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DOE/EIS-0069/V1

Final Environmental Impact Statement
Volume 1



Solvent Refined Coal—II
Demonstration Project

Fort Martin
Monongalia County
West Virginia

U.S. Department of Energy

January 1981

DEPARTMENT OF ENERGY

Enclosed is a copy of the Department of Energy (DOE) Final Environmental Impact Statement (FEIS) for the proposed Solvent Refined Coal - II Demonstration Project at Fort Martin, West Virginia.

DOE conducted a scoping process in 1979 to obtain input for the preparation of the Draft Environmental Impact Statement (DEIS). To obtain public input on the scope of the EIS, DOE held public meetings in Morgantown, West Virginia on June 26 and October 22, 1979, and in Pittsburgh, Pennsylvania on October 23, 1979 to identify key issues for detailed analysis.

The Draft Environmental Impact Statement (DOE/EIS-0069-D) was filed with the Environmental Protection Agency on May 23, 1980, and a notice of availability was published in the Federal Register on June 2, 1980. Federal, State, and local agencies were supplied copies of the draft statement and were requested to comment on its contents. In response to requests, copies of the statement were also provided to interested groups and individuals.

Following the Council on Environmental Quality regulations, a 45-day comment period was provided for submitting written comments. The comment period was subsequently extended to 60 days (from May 30 to July 31) by DOE. Additionally the opportunity to comment on the draft statement was provided at public hearings conducted in Morgantown, West Virginia, on June 30 and July 1, 1980. Written comments and oral comments from the public hearings were given equal consideration in preparing this FEIS.

A Record of Decision will be prepared and published in the Federal Register in connection with this proposed action. In considering the comments received on the DEIS in preparation of this FEIS, the Department has been particularly cognizant of the complexity of issues raised in connection with this project. Accordingly, the Department will consider any written comments on the FEIS received on or before March 15, 1981, in preparation of the Record of Decision. Any comments should be sent to Martin L. Rogowsky, Chairman, Fossil Energy Environmental Task Force, Room 5A-061, Forrestal Building, 1000 Independence Avenue, Washington, DC 20585.

Cover Sheet
Final Environmental Impact Statement
Solvent Refined Coal-II Demonstration Project
Fort Martin, West Virginia
DOE/EIS-0069

(a) Lead Agency: U.S. Department of Energy (DOE)

(b) Proposed Action: The cost sharing by DOE (45%), the Federal Republic of Germany (25%), Japan (25%), and SRC International, Inc. [composed of The Pittsburg & Midway Coal Mining Co., a wholly owned subsidiary of Gulf Oil Corporation (50%), and the West German (25%) and Japanese (25%) industrial participants] in the construction and operation of a 6000 tons per stream day (tpsd) solvent refined coal (SRC-II) demonstration plant with the potential for ultimate development of a 30,000-tpsd commercial facility at Fort Martin, Monongalia County, West Virginia.

(c) For further information, contact (1) Mr. James A. Reafsnyder, Research and Development Manager, SRC Projects Office, U.S. Department of Energy, P.O. Box E, Oak Ridge, TN 37830 [phone (615) 576-1055]; (2) Dr. Robert J. Stern, Acting Director, NEPA Affairs Division, Office of the Assistant Secretary for the Environment, Room 4G-064, Forrestal Building, 1000 Independence Avenue SW, Washington, DC 20585 [phone (202) 252-4600]; or (3) Mr. Stephen H. Greenleigh, Esq., Assistant General Counsel for Environment, Room 6D-033, Forrestal Building, 1000 Independence Avenue SW, Washington, DC 20585 [phone (202) 252-6947].

For copies of the EIS, contact James A. Reafsnyder at the address noted above.

(d) Designation: Final EIS (FEIS).

(e) Abstract: The statement assesses the potential environmental impacts associated with the construction and short-term operation of a 6000-tpsd-capacity facility that will demonstrate the technical operability, economic viability, and environmental acceptability of the solvent refined coal (SRC-II) process at Fort Martin, West Virginia. Impacts assessed include effects of the project on occupational and public health resulting from the production and use of SRC products; potential impacts on terrestrial and aquatic ecology; potential and expected impacts on land use; projected effects on floodplains and wetland areas; potential contamination of surface and groundwater quality; water use and effects on water availability; potential effects on State and Federal ambient air quality standards; potential change of the cultural landscape, including structures eligible for or listed on the National Register of Historic Places; effects on sites of archaeological significance; and changes to existing economic and social characteristics of the site area. Additionally, the statement presents an assessment of potential long-range and cumulative impacts of a future commercial expansion of the proposed facility to achieve an approximate 30,000-tpsd capacity. The effects of continued operation of the demonstration plant, mothballing, conversion to another government use, and decommissioning are also considered as alternative fates of the facility after the demonstration. A mitigation plan and the construction and operational monitoring plans for assessing the effectiveness of mitigation measures for the duration of the demonstration phase are also presented.

(f) In assessing the potential environmental impacts of the proposed action, several programmatic and design alternatives are considered and evaluated. The range of alternatives assessed includes proceeding with the action as proposed, modification of the action and subsequent continuation of the project, and no further action. The modification section includes evaluation of alternative plant designs and alternative plant sites.

(g) The proposed action is intended to demonstrate the feasibility of a solvent refined coal process. As a result, it is possible that design changes or other similar actions may occur. If such changes or actions are determined to produce significant adverse environmental impacts beyond those described in this FEIS, appropriate NEPA (National Environmental Policy Act) documentation will be provided.

(h) A Record of Decision will be prepared and published in the *Federal Register* in connection with this proposed action. In considering the comments received on the DEIS in preparation of this FEIS, the Department has been particularly cognizant of the complexity of issues raised in connection with this project. Accordingly, the Department will consider any written comments on the FEIS received on or before March 15, 1981, in preparation of the Record of Decision. Any comments should be sent to Martin L. Rogowsky, Chairman, Fossil Energy Environmental Task Force, Room 5A-061, Forrestal Building, 1000 Independence Avenue, Washington, DC 20585.



Final Environmental Impact Statement
Volume 1



Solvent Refined Coal—II
Demonstration Project

Fort Martin
Monongalia County
West Virginia

U.S. Department of Energy

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FOREWORD

This Final Environmental Impact Statement (FEIS) is issued by the U.S. Department of Energy regarding the Department's proposal to build and operate a solvent refined coal (SRC-II) demonstration plant at Fort Martin, West Virginia, on a cost-shared basis with the Federal Republic of Germany, Japan, and SRC International, Inc. [composed of The Pittsburg & Midway Coal Mining Co., a wholly owned subsidiary of Gulf Oil Corporation (50%), and the West German (25%) and Japanese (25%) industrial participants] in order to demonstrate the technical operability, economic viability, and environmental acceptability of the SRC-II process. The project is designed with the potential for the ultimate development of a 30,000-tpsd commercial facility. This document has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969 as implemented by regulations promulgated by the Council on Environmental Quality (CEQ) (40 CFR Parts 1500-1508, November 1978) and DOE implementing guidelines (45 FR 20694, Mar. 28, 1980).

The proposed action will not require the opening of a dedicated coal mine or significant expansion of existing mines to supply the necessary feed coal. Therefore, impacts at specific mines are not addressed in this statement. However, because regional mining impacts will increase incrementally as a result of this project, these are discussed generically and on a regional basis in Sect. 1.4.3.5.

One of the primary objectives of the demonstration plant program is to obtain an environmental data base. The data will be used by regulatory agencies to establish requirements for maintaining acceptable environmental quality and by industry to evaluate the economics of a commercial facility including required environmental controls. It is assumed that the decision to construct a commercial-scale facility at the demonstration plant site will be made in consideration of information obtained by construction and operation of the demonstration facility. The analysis that follows focuses on environmental issues that can be identified at this time as potential impacts of or limitations to commercial development at the proposed site. Although the analysis of commercial-scale impacts is limited in this statement, it should be noted that DOE has signed a cost-shared agreement with the industrial partner that now ensures that DOE will prepare appropriate NEPA documentation before any transfer of the demonstration facility to the industrial partner for use as a commercial facility (see Appendix X).

To comply with the requirements of NEPA, DOE is issuing this FEIS based on the best available information before any decision is made to proceed with major detailed design efforts and to commence construction of the SRC facility. Utilizing a tiering approach, DOE will perform supplementary NEPA reviews as necessary to address significant environmental impacts not within the scope of this FEIS. For example, further NEPA review would be required if environmentally significant new information relevant to the selection of environmental control equipment arises as a result of further design efforts. This approach has been coordinated with the Environmental Protection Agency (EPA). (See Appendix X for letter from John C. Sawhill, DOE Deputy Secretary of Energy, to Douglas M. Costle, Administrator of U.S. EPA, Sept. 17, 1980, and Memorandum of Agreement between DOE and EPA, Sept. 15, 1980.)

The Draft Environmental Impact Statement (DOE/EIS-0069-D) was filed with the EPA on May 23, 1980, and a notice of availability was published in the *Federal Register* on June 2, 1980. Federal, State, and local agencies were supplied copies of the draft statement and were requested to comment on its contents. Copies of the statement were also provided to interested groups and individuals. Additionally, the opportunity to comment on the draft statement was provided at public hearings conducted in Morgantown, West Virginia, on June 30 and July 1, 1980. The comment period was originally scheduled to end on July 15, 1980, but was extended to July 31, 1980.

The format of this Environmental Impact Statement follows the suggested format in the CEQ regulations. Additional appendixes are included to provide detailed documentation of the analyses. Section 1 documents the purpose of the proposed demonstration plant, the need for it, and its current status and gives a programmatic overview of commercial deployment. Section 2 describes the proposed action and alternatives to it; the focus is on possible plant designs, sites, and future fates of the project following the demonstration. It also summarizes the impacts of the project on the environment and compares these impacts at each of the alternative sites.

Section 3 details the critical features of the potentially affected environment at each of the alternative sites. Section 4 analyzes the environmental consequences of the proposed action and alternatives to it during both the construction and operational phases of the project and identifies potentially significant issues that could arise during decommissioning or expansion to commercial scale. Section 5 presents the names and professional qualifications of the persons responsible for preparing the statement. Appendix A presents comments received on the Draft Environmental Impact Statement and DOE's responses.

SUMMARY

1. INTRODUCTION

This Final Environmental Impact Statement (FEIS) is issued by the U.S. Department of Energy regarding the Department's proposal to build and operate a Solvent Refined Coal (SRC-II) plant at Fort Martin, West Virginia, on a cost-shared basis with the Federal Republic of Germany, Japan, and SRC International, Inc., to demonstrate the technical operability, economical viability, and environmental acceptability of the SRC-II process. The plant will have the potential to be scaled up to a 30,000 tons per stream day (tpsd) commercial facility. This document has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969 as implemented by regulations promulgated by the Council on Environmental Quality (40 CFR Parts 1500-1508, November 1978) and DOE implementing guidelines (45 FR 20694, Mar. 28, 1980).

The proposed action will not require the opening of a dedicated coal mine or significant expansion of existing mines to supply the necessary feed coal. Therefore, impacts at specific mines are not addressed in this statement. However, because regional mining impacts will increase incrementally as a result of this project, these are discussed generically and on a regional basis in Sect. 4.1.3.5.

To obtain a meaningful environmental data base, Stearns-Roger, Inc., a subcontractor to SRC International, Inc., conducted a one-year baseline monitoring program at the proposed site and prepared and submitted an Environmental Report (ER). This report provided DOE with detailed information on the proposed project and the environment in which it would be placed. Information from the ER was used in preparing this FEIS.

2. DESCRIPTION OF THE PROPOSED ACTION

The proposed action is the construction and short-term operation of a facility to demonstrate the technical feasibility, economic viability, and environmental acceptability of the SRC-II solvent-refined-coal process at near-commercial scale. Following an approximate two-year operating period, the industrial partner may purchase the facility from the government. Any such transfer would be supported by appropriate NEPA documentation (Appendix X). Should the demonstration plant prove successful, it is anticipated that the first commercial SRC-II plant of about 30,000-tpsd capacity would be constructed at the demonstration plant site by the industrial partner.

SRC International, Inc., has estimated that for the first year, one dissolver (50% of the plant) will operate 50% of the time, but at 70% of rated throughput, leading to a capacity utilization of 18%. Values are higher in the second, third, and later years of operation (see Appendix C, Table C.2, for details). These factors affect rate of coal transport and delivery, rate of brine generation, yearly rate of emissions, etc. Because the impact analyses in this FEIS are based on the plant operating continuously at 100% of capacity, these analyses are believed to be conservative.

2.1 Plant description

The demonstration plant will use the noncatalytic, direct-hydrogenation SRC-II process to liquefy up to 6000 tpsd of bituminous coal. The pulverized feed coal will be mixed with a recycled hydrocarbon-mineral-residue slurry stream from the process and pumped together with hydrogen-rich gases through a preheater to the dissolver. In the dissolver, hydrogenation and liquefaction reactions will convert the coal into liquid and gaseous products. Flue gases from the fuel-fired preheater will constitute the only source of air emissions from this area of the plant under normal operating conditions.

The stream leaving the dissolver will undergo a series of separations that produce a heavy-liquid stream containing the mineral ash, a lighter liquid stream, and a vapor stream. A portion of the heavy-liquid stream will be recycled to the slurry mix tank, and the remainder will be sent to a vacuum-distillation tower. The distillation will produce a mineral-residue

slurry, which will be gasified to produce the hydrogen required by the process, and an overhead stream, which will be combined with the light liquid from the liquefaction separators and fed to a fractionator (distillation tower). The fractionator will separate this stream into naphtha plus light and heavy fuel oils. The vapor stream from the first separator will be treated to remove hydrogen sulfide and carbon dioxide and then cryogenically separated to produce a high-purity hydrogen stream that will be recycled to the dissolver, a methane-rich stream that will be upgraded to produce a pipeline-quality gas, and an ethane-rich stream, from which propane and butane will be recovered as products. Part of the residual stream will be used as plant fuel and the rest will be converted to substitute natural gas in the methanation step.

The SRC process requires a number of supporting facilities to (1) provide required materials and utilities such as steam, electricity, process water, air, and nitrogen; (2) treat products to market specifications; (3) recover by-products; (4) treat waste streams to remove pollutants and produce effluents suitable for in-plant reuse, emission, or discharge; and (5) provide for the safe disposal of solid wastes.

The proposed plant design is discussed in Sect. 2.2.1 and Appendix C.

2.2 Site description

The proposed site consists of about 983 ha (2430 acres) surrounding the unincorporated community of Fort Martin, West Virginia. About 151 ha (373 acres) will be required for demonstration plant facilities. The site will be acquired through a combination of purchase and long-term lease arrangements. All areas required for process facilities have either been purchased by the industrial partner or are under purchase option to the Monongalia County Development Authority. Negotiations are in progress for acquisition of the remaining portions of the proposed site.

The proposed site is bounded on the southeast by the Monongahela River, on the east by the Fort Martin Power Plant (Monongahela Power Company), on the north by the West Virginia-Pennsylvania state line, and on the west and south by land in private or corporate ownership. Except for a narrow floodplain with small wetlands along the river, the site is hilly terrain at an elevation of about 1108 ft mean sea level (MSL), or 95 m (311 ft) above the river. The western portion of the site has been both deep- and strip-mined with strip-mining in progress, and this area consists primarily of reclaimed lands in various stages of recovery (Sect. 3.2.1.2). The central portion of the site along State Highway 53 consists primarily of pasture and grassland (some of it reclaimed surface-mined areas), whereas the eastern portion, including the steep slopes along the river, is primarily forestland. No critical habitat for any threatened or endangered species is located on the site (Sect. 3.2.1.3). Seismic risks are low (Sect. 3.2.1.2).

Water quality in the Monongahela River has improved significantly in the last ten years and, although the river is still subject to acid mine drainage and municipal and industrial discharges, the water is considered adequate for plant use (Sect. 3.2.2.3). Previous studies have identified the Monongahela Basin as an area having limited water supplies for energy development (Sect. 3.2.2.1). The Water Resources Council has conducted a study on the influence of the plant on water resources. The results of this study indicate water availability concerns for the demonstration plant during low-flow conditions and for the commercial plant (Sect. 4.2.2.1). Use of shallow groundwater for domestic purposes is limited, and public water supplies are available; deeper aquifers are generally brackish (Sect. 3.2.2.2).

Ambient air quality monitoring conducted near the point of predicted maximum facility impact indicates current compliance with all National Ambient Air Quality Standards (NAAQS) and the availability of the full class II Prevention of Significant Deterioration (PSD) increments (Sect. 3.2.3.1).

About 65% of the required work force is expected to come from the site vicinity. The availability of single-family housing units and rental units in Monongalia County appears to be adequate to meet the demand exerted by in-migrating construction workers. However, demand for low-cost single-family units, however, may exceed the supply, and it is possible that a problem could arise from construction labor competing with university students for rental units. In addition, mobile home rental units and sites are in short supply in Monongalia County and the demand may exceed the supply (Sect. 4.2.4). Traffic congestion in the site vicinity has been identified as a potentially significant impact area and the State of West Virginia has committed to provide adequate access to the site (Sect. 3.2.4).

See Sect. 3.2 for a more complete description of the site.

3. PURPOSE OF THE PROPOSED ACTION

The purpose of the proposed action is to demonstrate that the SRC-II process is a viable and competitive solution to meeting the national need for alternative energy sources in order to reduce oil imports. Operation of the demonstration plant will provide the information required to minimize technical and economic risk, confirm the effectiveness of environmental control systems, and encourage the transition to commercialization. Without government support, private industry would scale up the SRC-II process plant in smaller steps, and commercial demonstration would be delayed for several years.

The technical feasibility of the SRC-II process has been proven by the operation of both bench- and pilot-scale facilities, including the 50-tpsd facility at Fort Lewis, Washington. Although this facility and the smaller test unit at Harmarville, Pennsylvania, have provided information necessary for the scale up of the SRC-II process equipment, there are still a number of areas of technical uncertainty associated with the construction and operation of a commercial facility with adequate capacity to be economically viable. These areas of uncertainty cannot be fully resolved by the operation of pilot-scale facilities. Since many of the equipment items of greatest concern would be replicated in a commercial-capacity facility, adequate information can be obtained from operation of a facility utilizing commercial-scale equipment but having an overall capacity significantly less than that required for economic viability. By providing for testing and production under commercial conditions, a demonstration plant can minimize the technical and economic risks associated with construction of the first commercial plant. Also, by providing an opportunity for design of the commercial-capacity facility based on monitoring and control equipment evaluation during its operation, the demonstration plant can significantly reduce the environmental risks associated with commercialization.

4. NEED FOR THE PROPOSED ACTION

The large size and diversity of U.S. demands for hydrocarbon fuels and uncertainty about product slate makes it prudent to demonstrate processes that are sufficiently flexible to shift with the market.

The SRC-II process provides the flexibility to vary product mix and the ability to efficiently convert a variety of coals, including some of the nation's worst ash and sulfur-laden coals. The products by themselves, or when subjected to further refining as with any coal liquid, are acceptable for a wide range of uses — from boiler fuels to fuels for transportation.

The flexibility of the product types, quantities, and quality combined with the process features of efficient use of hydrogen and high energy yield is an advantage of SRC-II that is extremely important to future investors in commercial plants who will represent a wide range of interests.

5. CURRENT STATUS OF THE PROPOSED ACTION

Conceptual design studies, designated as phase 0, were completed and delivered to DOE on July 31, 1979. Based on an evaluation of the phase 0 deliverables, DOE decided to proceed with the design phases.

The Draft Environmental Impact Statement (DOE/EIS-0069-D) was filed with the Environmental Protection Agency on May 23, 1980, and a notice of availability was published in the *Federal Register* on June 2, 1980. Federal, State, and local agencies were supplied copies of the draft statement and were requested to comment on its contents. In response to requests, copies of the statement were also provided to interested groups and individuals. Additionally, the opportunity to comment on the draft statement was provided at public hearings conducted in Morgantown, West Virginia, on June 30 and July 1, 1980.

Copies of phase 0 deliverables and the FEIS are available for inspection at the following locations:

West Virginia University Library
Downtown Campus
Morgantown, WV 26506

DOE Public Document Room
Room G208
Oak Ridge Federal Building
Oak Ridge, TN 37830

Morgantown Public Library
373 Spruce Street
Morgantown, WV 26505

DOE Public Reading Room
Room IE-180
Forrestal Building
1000 Independence Avenue SW
Washington, DC 20585

Copies of the phase 0 deliverables (document Nos. FE-3055-T1 through FE-3055-T16) are available on microfiche through the National Technical Information Service (NTIS), U.S. Department of Commerce, 5285 Port Royal Road, Springfield, VA 22161.

Based on the FEIS and the results of design studies, a decision as to whether to proceed with construction of the demonstration plant will be made. If the decision is to proceed, preliminary site preparation could begin in the spring of 1981. Land purchases have been initiated by the industrial partner through the Monongalia Development Authority. These land purchases have been made solely by the industrial participant and are not part of any agreement with DOE. If DOE decides to proceed with the project at the proposed site, title to the land will be transferred to DOE.

6. ALTERNATIVE ACTIONS AVAILABLE TO DOE

The proposed action is the construction and operation of a demonstration plant in accordance with the proposed process design evaluated in this FEIS. This design is described in the phase 0 conceptual design report, with the modifications indicated in Appendix C.

The environmental impacts of the proposed action must be evaluated in comparison with the impacts of the alternative actions that may be taken by DOE. These alternatives are to

- proceed with the proposed action
- select an alternative site, design, or plant layout to further reduce environmental impacts and proceed with construction, or
- determine not to proceed with construction at any site (no action).

The proposed action is described in detail in Sect. 2.2, and the resulting environmental impacts are summarized in Sect. 2.3.1 and discussed in detail in Sect. 4. The impacts of alternatives are compared with those of the proposed action in Sects. 2.3.2 and 2.3.3.

7. IMPACTS OF PROCEEDING WITH THE PROPOSED ACTION

7.1 Impacts during the demonstration phase

The environmental impacts resulting from construction and operation of the demonstration plant at the proposed Fort Martin site in accordance with the currently proposed design are described in Sects. 4.1 and 4.2.

In summary, construction and operation of the plant in accordance with the proposed design and site are expected to result in the following impacts:

- Through chemical reactions involving coal, the SRC process will produce a broad range of materials that contain carcinogenic and mutagenic organic compounds, including aromatic amines, aromatic and heterocyclic compounds, highly substituted phenols, and other compounds. The public could be exposed to these substances in fugitive emissions (leaks), emissions from the plant flare system, wastewater discharge to the Monongahela River, and SRC liquid spills during product transport. Point source air emissions, onsite spills, and solid waste disposal are not significant sources. Fugitive hydrocarbon emissions will be reduced through the use of special mechanical design and equipment selection for potential leak points and a "directed maintenance" program. The flare system serving the liquefaction and distillation equipment will be used to reduce emission of these hazardous substances through the use of a controlled combustor. Discharge of hazardous substances to the Monongahela River will be reduced through the use of an extensive wastewater treatment system with zero-discharge capability. Impacts from SRC liquid product spills will be reduced by careful selection of markets, routes, transportation equipment, a developed plan for spill cleanup and countermeasures, and cooperation with the EPA and the Coast Guard in the event of a spill (Sect. 4.1.3).

For workers involved in maintenance operations, skin contact and inhalation are of concern. For other categories of workers at the plant site, fugitive emissions to the atmosphere are expected to be the major exposure source and will be reduced by the measures discussed above. Highly detailed maintenance procedures will be developed based on experience at the SRC pilot plants and at other industries involved in handling materials that are hazardous if personal contamination occurs (Sect. 4.1.3.4).

The pilot plants at Fort Lewis, Washington, and Wilsonville, Alabama, have operated since 1974 without any overt health effects unique to their operation. However, the size of the work force and study times are not adequate to draw conclusions concerning potential long-term effects in an epidemiologically significant manner. DOE and other agencies are sponsoring programs for characterizing and assessing the health risks of SRC processes as soon as possible. Major long-term chemical, biological, and monitoring studies are under way to determine the specific characteristics of SRC materials and the effects of management and controls on them (Appendix Y). Results of programmatic efforts to date are encouraging. Industrial hygiene management within the Fort Lewis plant appears to be effective and to provide a sound basis for developing the program to be employed at the demonstration plant. Exposure monitoring for both the work force and the public will be a major feature of the health protection program (Sects. 4.1.3.5, 4.1.3.6, 4.5.3.1, and 4.6.9). Construction and operation of the plant in accordance with the proposed design and monitoring and mitigation measures will ensure low exposures and thus low risk to the public, the work force, and the environment (Sect. 4.1).

- Spills of SRC-II products have the potential for causing significant adverse impacts to surface waters and groundwaters. The SRC-II facility will be designed for maximum containment of any materials spilled on site. Areas susceptible to spills will be lined with impervious material to prevent infiltration of contaminants to groundwater and will be surrounded by dikes to prevent contamination of surface waters. Spilled material will be collected by the runoff containment system and routed to oil and water separators for recycle or treatment of spilled materials. These facility-design and spill-control measures will greatly reduce the consequences of onsite spills (Appendix C, Sect. C.3.5.3).

Spills of SRC-II products during transportation may at some time result in direct or indirect exposure of the public (Sect. 4.1.3.8 and Appendix Z). Spilled materials may enter surface water or groundwater supplies, be dispersed into the atmosphere, or cause exposure during cleanup operations. It is assumed that SRC-II liquid fuel products will be shipped by unit train to Baltimore, Maryland, and will cross numerous streams. Based on observed rail spill frequencies for similar products, spills of SRC-II liquids to water bodies can be expected to occur every 30 to 60 months (see Appendix Z, Sect. Z.4.1). The worst-case spill of SRC-II liquids in transit is considered to be a loss of 75,800 liters (20,000 gal) to the Potomac at the Harper's Ferry, West Virginia, crossing. Such a spill could cause a minor water supply emergency for Washington, D.C., whose water intake is 80 km (50 miles) downstream from that crossing. Such a worst-case spill is considered to be exceedingly unlikely (see Appendix Z, Sect. Z.5.2).

A worst-case spill to a stream could result in massive mortality of river biota for a distance of 5-15 km downstream from the spill site. Impacts would be due principally to the water-soluble compounds, specifically the phenolic and aniline compounds. Impacts on aquatic ecology and water quality would decline downstream as dilution, uptake by organisms, adsorption by sediments, photolysis, and volatilization occurred. Selective mortality of river biota would occur downstream from the zone of massive mortality (Appendix Z, Sect. Z.5.2.1).

- About 151 ha (373 acres) of land will be converted from rural agricultural and residential use to industrial use for the life of the plant. About 540 ha (1350 acres) of land (primarily pasture) will be removed from agricultural production (Sects. 4.2.1.1 and 4.2.1.3).
- About 60 people (24 residences) will be displaced from the unincorporated community of Fort Martin (Sect. 4.2.1.1).
- Increased erosion and resultant sediment loads to surface waters will occur during construction. These impacts may be reduced to low levels by implementation of control and mitigating measures (Sects. 4.2.1.2, 4.2.2.1, and 4.2.2.3).
- Vegetative communities and available wildlife habitat will be reduced. This will not affect any Federal- or State-listed endangered or threatened species. Breeding habitat will be reduced for several West Virginia Heritage Trust Program and Audubon Society *Blue List* species, and proportionate population reductions may occur (Sect. 4.2.1.3 and Appendix E).

- Several important factors suggest that groundwater impacts from slag disposal will be minimal: (1) the leachate generated in laboratory tests appears to be nonhazardous under proposed RCRA criteria; (2) soils are generally deep and of low permeability and high silt and clay contents (all favoring attenuation of contaminants); and (3) RCRA guidelines for construction of a secure landfill will be followed. A monitoring program will be implemented to identify potential failures in the containment system and resulting water quality impacts (Sects. 4.2.2.2, 4.5.3.1, and 4.5.3.2). As discussed in Sect. 2.3.2.1, disposal of several other solid wastes and soluble salt brines that may be hazardous is still under study.
- Destruction of shoreline habitat for construction of the barge dock, barge slip, water intake structure, and wastewater discharge structure will occur. Shoreline development will remove habitat that is valuable for spawning and feeding for some fish species. These habitat losses may be mitigated by preserving and enhancing habitat along the remaining undisturbed shoreline at the site (Sects. 4.2.2.4, 4.6.6, and 4.6.7).
- Operation of the demonstration plant will result in the consumptive use of 226 liters/s of water from the Monongahela River. Under normal flow conditions, water use by the SRC-II facility will have no significant impact. However, during low-flow conditions (the 7-d, 10-year low flow) the demonstration plant would consume 2.2% of the river's flow at the site. This water use would decrease water availability to downstream users and would reduce the downstream river flow that dilutes incoming pollutants, causing up to 2.3% greater concentrations of these pollutants. Barge traffic for SRC-II feed coal will also increase the streamflows required for lock operation. Under extreme drought conditions (recurrence of the drought of record), streamflow will be inadequate to maintain navigation. Under such conditions, reduced-rate operation or shutdown of the demonstration plant will probably be necessary. DOE recognizes that water availability problems of the Monongahela Basin require basin-wide comprehensive planning for water management (Sect. 4.2.2.1).
- When the Monongahela River's assimilative capacity is adequate, the plant will discharge treated wastewater. This discharge will create a mixing zone with degraded water quality, but only minor changes in water quality are expected outside this mixing zone. Significant water quality impacts will be avoided by operating the wastewater treatment plant in a zero-discharge mode during periods of low river flow or when high contaminant loading is found in either the discharge or the river (Sect. 4.2.2.3).
- Treated wastewater discharge will increase stress on aquatic ecosystems. The discharge of trace elements and organic compounds will create a mixing zone populated principally by pollution-tolerant organisms. In and near the discharge mixing zone, organisms will suffer chronic effects because of exposure to sublethal concentrations of toxicants. The SRC-II discharge, however, is not expected to substantially degrade water quality or ecosystem health outside this immediate discharge mixing zone (Sect. 4.2.2.4).
- The water intake structure will withdraw 304 liters of water per second from the Monongahela River. Planktonic organisms will be entrained in the intake flow, most notably ichthyoplankton (fish larvae). (Juvenile and adult fish are not expected to be entrained due to the low intake velocity.) The shoreline water intake structure may cause significantly more entrainment of aquatic organisms than would a submerged intake closer to midstream. The only ichthyoplankton data available are for midchannel; however, ichthyoplankton density may be greater at the shoreline based on observations of fish nests along the river's edge. For a worst-case analysis it was assumed that low river flow and peak ichthyoplankton density occur simultaneously, when actually several months typically separate these two occurrences. Under low-flow conditions the plant would withdraw 3.2% of the river's streamflow. The shoreline intake could therefore entrain more than 3.2% of the river's ichthyoplankton under these worst-case conditions. Although midchannel appears to be the environmentally preferable location for water intake, it is highlighted for further evaluation (Sect. 4.2.2.4). During detail design, DOE and the industrial partner will evaluate shoreline and submerged water intake structures near midstream and their environmental effects.
- Collectively, the multiple impacts on the aquatic environment (loss and disturbance of shoreline habitat during construction, wastewater discharge, occasional nonroutine discharges, and other minor impacts) have the potential to change the river's character near the facility and shift the composition of the biological community toward those species more tolerant of disturbance and elevated contaminant levels. Therefore, it is important that high priority be given to minimizing the facility's impacts during construction and operation, to employing suitable mitigating measures (Sect. 4.6.6), and to monitoring to determine which impacts actually occur and the success of the mitigating measures (Sect. 4.5.3.3).

- Air quality dispersion modeling indicates that plant operation will comply with the allowable PSD increment consumption (Sect. 4.2.3.1).
- Criteria air pollutants of greatest concern will be particulates and sulfur dioxide, which consume 34.9 and 13.3% of the 24-h PSD increment, respectively (Sect. 4.2.3.1).
- The release of fugitive hydrocarbons is expected to be about 95 tons per year, which produces a maximum ground-level concentration of about 0.2% of background concentration (Sect. 4.2.3.1).
- Ozone concentration is not expected to be affected locally because of the long-range transport nature of the photochemical reaction of ozone's precursors (Sect. 4.2.3.1).
- Reduced-sulfur-compound emissions will be controlled through recovery as elemental sulfur (Sect. 4.2.3.1 and Appendix C).
- Carbon monoxide emissions will be minor (Sect. 4.2.3.1).
- Cooling tower drift losses will be minimal, and nearly all the drift will be deposited within 1000 ft of the towers. Cooling towers will be sited to minimize visibility and icing effects. The heat rejection rate will be equal to 15% of the adjacent Fort Martin power plant when operated at its design capacity. Virtually all cooling tower impacts will occur on site. The two sensitive locations for cooling tower impacts are Highway 53 and the electrical substation, neither of which will be significantly affected (Sect. 4.2.3.1).
- Emissions during normal startup and shutdown operations will be less than emissions at design level (Sect. 4.2.3.1 and Appendix C, Sect. C.4.1).
- During emergency upsets gases will be vented to a controlled-combustion/flare system with high emissions of short duration (Sect. 4.2.3.1 and Appendix C).
- Construction of the plant will result in higher noise levels in the area. Most of the construction will take place far enough away from receptors that they will be exposed to no more than normally acceptable noise levels [not exceeding 74 dB(A) at 60 ft]; the exception would be when construction activity is within this distance of a sensitive receptor. Mitigating measures (temporary barriers) appear to be feasible in these areas (Sect. 4.2.3.2).
- Direct construction employment will peak between 3800 and 5000 in 1983. Between 1600 and 2700 indirect jobs will be created. Labor shortages expected in 6 key crafts (electricians, millwrights, ironworkers, boilermakers, pipefitters, insulators) will result in between 1400 and 1800 construction workers moving to the general site area. This is predicted to result in a population increase of between 2400 and 3100 people, including dependents, with about 67% (between 1600 and 1900 people) expected to move to Monongalia County. This population increase will probably cause a shortage in mobile home spaces unless mitigating actions (Sect. 4.6.2) are quickly taken. In the worst case, Monongalia County public schools will not be significantly affected, but greater stress will be placed on the high schools. There may be localized inadequacies in availability of water and sewer service (Sect. 4.2.4.1). DOE is working with the Department of Housing and Urban Development and State and local planning agencies to identify means for mitigating housing, sewer, and water shortages (Sect. 4.6.2).
- The best estimate of total population growth in the area of Monongalia County, West Virginia, because of peak demonstration-phase construction activity at SRC-II is 2.0 to 2.5% of the projected 1985 county population. This anticipated growth falls far short of the conventional criteria for an anticipated "boom-town" impact. Consequently, a boom-town effect is not expected to occur (Sect. 4.2.4.1).
- Five sites eligible for the National Register of Historic Places will be adversely affected by the proposed plant: Belldina's Bottom, Van Voorhis Farm, the Fort Martin archaeological site, the Gingrich House, and the Fort Martin School/Community Center. A Memorandum of Agreement is under negotiation with the Advisory Council on Historic Preservation. The memorandum will outline mitigation measures. Mitigation measures (Sects. 4.2.4.1 and 4.6.3 and Appendix U) under consideration include data recovery for three of the eligible archaeological sites and the use of Gingrich House and the Fort Martin School/Community Center as an information center for the project.
- The proposed site will be removed from the local tax base for the duration of the demonstration phase. As a result, there will be no direct tax payments. During the construction phase, however, about \$11 million in business and occupation tax revenue is expected to

accrue to the State of West Virginia indirectly from construction subcontractors (Sect. 4.2.4.1).

- Additional traffic will occur on local roads leading to the site. These roads are structurally inadequate to accommodate materials movement and inadequate in capacity to accommodate the work force commuting traffic. Substantial upgrading of roads and bridges will be necessary. Detailed planning for this road upgrading is under way by the State of West Virginia, and upgrading is expected to be completed in time to accommodate the peak demand (Sect. 4.2.4.1).
- Direct employment of about 460 people during the operation phase and an additional 465 people due to secondary employment. The Morgantown-Monongalia County area is expected to have the capacity to absorb all long-term project-related growth without major negative impact; the plant payroll will have a large, positive impact on the area (Sect. 4.2.4.2).
- River traffic will increase for coal delivery by barge. The U.S. Army Corps of Engineers has determined that the existing river navigation system is adequate to accommodate coal transportation needs for the demonstration plant (Appendix M).
- Rail traffic will increase for product shipment. An average of 1 unit train (74 cars) every other day will be required. The existing rail system is considered adequate to accommodate the added traffic without significant impact (Appendix Z, Sect. Z.2.1.1).
- Development of the proposed SRC-II demonstration plant at Fort Martin, West Virginia, will necessitate the use of the west bank floodplain of the Monongahela River between river miles 93.2 and 94.5. Facilities to be located in the floodplain below the 100-year flood elevation include a barge unloading slip, process water intake facility, the wastewater discharge, sections of a haul road and access road, and coal barge unloading and fleeting facilities. A limited area (about 1.2 ha) will be filled to support the product storage area and its associated spill containment facilities. Based on the analysis to date, no feasible alternatives exist to locating these facilities within the Monongahela River floodplain (Appendix D and Sects. 4.6.6, 4.6.7, and 4.8).
- Development in the floodplain and in upland areas will necessitate the elimination of several small areas of wetland habitat. Based on the analysis to date, no feasible alternatives are available to further reduce these impacts. Mitigating measures, including facility design modifications, have been incorporated into the overall site development plan, and the resultant floodplain/wetland impacts for the proposed SRC-II demonstration plant are considered to be minimal (Appendix D and Sects. 4.6.6, 4.6.7, and 4.8).

7.2 Cumulative effects

The five-state region surrounding the SRC-II site (West Virginia, Virginia, Ohio, Maryland, and Pennsylvania) was examined to determine existing or potential sources of competing labor demands that may influence the ability of the SRC-II contractors to obtain skilled craftsmen not available from within the specified commuting zones.

Extensive examination of current secondary data sources and interviews with local officials did not reveal any other major construction projects that are or would be likely to represent any significant competing demand for skilled construction labor in the five-state region. This examination considered refinery construction and/or major maintenance, the often proposed Lake-Front Steel Mill in Ohio, the retrofitting of various power plants for air pollution control, governmentally mandated conversion of oil- and gas-fired power plants to coal burning, the DOE Gas Centrifuge Plant, general power plant construction, and the Fairmont Energy Corporation coke plant near Morgantown.

Another procedure undertaken to ascertain labor demand in the five-state region was specifically in regard to power plant construction and involved projections made by the Construction Labor Demand System (CLDS) developed by the U.S. Departments of Energy and Labor. These projections are by craft and indicate that from 1979 to 1983 large numbers of skilled construction workers will become available for employment as the anticipated level of power plant construction declines in the five-state region. Barring a substantial, unanticipated increase in power plant construction, it appears that no critical skill shortages are likely, with the possible exception of boilermakers. Any decline in activity from that utilized for CLDS projections would only reinforce this finding. The most likely situation currently is that even a significant increase in labor requirements over current projections should not create insurmountable labor shortages.

in the five-state region (Sect. 4.2.4.1). It is known that four other potential coal conversion plants are being considered for West Virginia. However, it is not considered likely that construction scheduled for such plants would overlap SRC-II construction; thus, the construction-phase cumulative socioeconomic impact should be negligible (Sect. 4.2.4.3).

The additive air quality effects of the nearby Fort Martin steam plant as well as all existing sources are included as observed background (Sect. 3.2.3.1). The cumulative air quality effects of these plants are thus included in the dispersion modeling presented in Sect. 4.2.3.1. Analysis of the interaction of SRC-II with facilities such as the proposed Fairmont Energy Corporation coke plant and the asphalt plant in Morgantown indicates that because of their relative locations, the distance separating them, and the prevailing wind, the cumulative air quality impacts will be small (Sect. 4.2.3.1).

During extreme droughts, the Monongahela River Basin will face serious streamflow deficits with or without the SRC-II project. The demonstration project, however, will be a significant new water consumer and will require substantial streamflow to operate the navigation locks if coal is to be transported to the site by barge, as is currently proposed. To reduce or eliminate SRC-II's contribution to low streamflows; the demonstration project will develop alternative plans of operation that reduce or eliminate river water consumption. To resolve the Monongahela Basin's current and future water problems, the Water Resources Council and the Ohio River Basin Commission recommended development of basin-wide water management programs (see Sect. 4.2.2.1).

7.3 Impacts of alternative fates of the facility after the demonstration

One of the major objectives of the demonstration program is to expedite commercial application of the technology by providing a base for construction of the first commercial facility. If a decision is made to proceed with construction of the demonstration plant as proposed, the contract calls for a two-year demonstration period, at the conclusion of which the facility may be purchased by the industrial partner. If the demonstration plant is not sold, DOE may elect to continue operation under the existing contract for a period of up to nine months.

The following fates for the demonstration plant may result from a decision to proceed with construction:

- commercialization by the industrial partner at an expanded capacity,
- continued operation of the facility at demonstration plant capacity,
- conversion of the facility to another government use,
- mothballing of the facility, or
- decommissioning.

Because construction of a commercial facility at an expanded capacity is a major objective of the demonstration program, the suitability of the site for a commercial facility and the environmental impacts of its construction and operation are primary considerations in a decision to proceed with the project. However, it is possible that sale of the demonstration plant will not occur and that one of the alternative fates will result. The probable impacts associated with each of the possible alternative fates are identified below. Impacts of commercial operation at expanded capacity are also discussed throughout Sect. 4.2.

7.3.1 Commercialization

One of the primary objectives of the demonstration plant program is to obtain an environmental data base. This data base will be used by regulatory agencies to establish requirements for maintaining acceptable environmental quality and by industry to evaluate the economics of a commercial facility including required environmental controls. It is assumed that the decision to construct a commercial-scale facility at the demonstration plant site will be made in consideration of information that is currently unavailable and that will be obtained by construction and operation of the demonstration facility. The analysis that follows focuses on environmental issues that can be identified at this time as potential impacts or limitations to commercial development at the proposed site. Emission estimates used in the impact analyses of commercialization are conservative. It should be noted that DOE's NEPA strategy (Appendix X) and cost-sharing agreements provide that before any transfer of the demonstration plant to the industrial partner, DOE will prepare the appropriate NEPA documentation.

Air quality

Estimates have been made of the total suspended particulates (TSP), SO_2 , NO_x , CO, and nonmethane hydrocarbons (NMHC) for the 30,000-tpsd expanded commercial plant. Because the layout of the expanded commercial plant is still conceptual, the location of emission sources (e.g., heaters, boilers, sulfur-recovery plant, etc.) cannot be identified to the extent required for dispersion modeling. Emission estimates for the commercial-scale plant can only be considered as preliminary. During operation of the demonstration plant, extensive source testing and area monitoring will be conducted to determine the total emissions and resulting ambient concentrations and to provide appropriate emission factors for use in design of the commercial facility.

Estimates of the various contributions to TSP for the expanded commercial plant, compared with those for the demonstration plant, as well as the rationale used in their determination, are shown in Appendix C, Table C.31. The emission rate of fugitive dust from coal and slag handling is estimated to increase by a factor of 5 over that of the demonstration plant. The estimated increase in the rate of fugitive dust emissions from coal storage is a factor of 3. Point sources such as the coal dryer/pulverizer, pneumatic transfer, heaters, and boilers are expected to emit less than five times the amount of particulates emitted from the demonstration plant. Estimated total particulate emissions would increase from 18.0 g/s for the demonstration plant to 37.6 g/s for the expanded commercial plant, or a factor of 2.09.

A comparison of SO_2 emissions from the demonstration plant with those from the expanded commercial plant is shown in Table C.32. For the expanded commercial plant, it was assumed that the fuel for all heaters and boilers would be plant gas, with a sulfur content of 100 ppmv; for the demonstration plant, a mixed fuel of plant-produced hydrotreated naphtha with a sulfur content of 0.1 wt % and plant gas with a sulfur content of 100 ppmv, was used. Therefore, only about one-half as much SO_2 would be emitted per Btu of fuel burned in the expanded commercial plant as in the demonstration plant. Also, it was assumed that the expanded commercial plant would have a substantially higher thermal efficiency because of additional process and design information and because of such design features as increased waste-heat recovery, higher gasification pressure, and the use of combined-cycle gas turbine drives for large compressors, with the hot turbine exhaust gases used for steam generation. Fuel requirements for the expanded commercial plant are estimated to be 4.5 billion Btu/h, compared with 1.47 billion Btu/h for the demonstration plant. It further was assumed that the technical performance and reliability of some sulfur-recovery technologies would be improved and alternatives chosen so that the sulfur concentration in the H_2S -incinerator stack effluent would essentially be cut in half. For example, Selexol desulfurization (a commercially proven technology) could be used in place of Benfield and would reduce sulfur emissions by more than 50%. (For the demonstration case, Benfield was assumed in the estimate of emissions and air quality impact analyses to provide a worst case.) The ratio of SO_2 emissions from the expanded commercial plant to those from the demonstration plant is 2.21.

The major factors affecting increased emissions of NO_x and CO from the expanded commercial plant, as compared with those from the demonstration plant, are:

- The expanded commercial plant will have a fuel consumption rate about three times as large as that of the demonstration plant.
- Fuel used in the expanded commercial plant will consist entirely of plant gases (low nitrogen content) rather than a mixture of naphtha and plant gas.

Worst-case assumptions for NO_x and CO emissions from the commercial plant predict an increase over those for the demonstration plant of 2.5 for NO_x and 2.6 for CO.

The plot plan of the expanded commercial plant shows two commercial processing trains added onto the 6000-tpsd demonstration processing train. A 200% increase in piping and NMHC fugitive potential is probable. As a worst-case assumption, expanded commercial plant NMHC emissions of five times those of the demonstration plant are used in the air quality analysis.

The air quality impacts of operating an expanded commercial SRC facility were based on preliminary information on its emissions, which is contained in Appendix C (Sect. C.8). It was assumed that the contribution of each source to the increase in maximum ambient concentration above that produced by the demonstration plant would be in proportion to the increase in that source's emissions. Thus, the demonstration plant's impacts were scaled up to give projected commercial-scale impacts. It should be noted that this is an extremely conservative approach, which should lead to high-side estimates of maximum ambient concentrations. The assumption made is that all additional emissions occur at precisely the same locations as do the demonstration plant emissions and from the same release height. In all probability, the increased

emissions would occur over a larger physical area, which would tend to reduce concentrations in the atmosphere from those calculated by merely scaling up emissions.

The results of these calculations for the commercial-scale facility appear in Table 4.14. The consumption of PSD increments is highlighted in Table 4.15. Based on the concentrations predicted for the commercial plant given in Tables 4.14 and 4.15, it is expected that the expanded plant and other potential sources would consume 33.2% of the allowable 24-h PSD increment for SO₂ and 75.6% of the allowable 24-h PSD increment for particulates. It should be noted that the availability of PSD increments cannot be projected to the date of commercial plant operation.

Because the regionally available PSD increment is limited, a commercial plant would consume a portion of the PSD increment that could potentially be assigned to other industrial operations. Therefore, the permitting of the emissions from the plant could potentially result in constraining future industrial development opportunities in the region. However, it should be noted that consumption of the PSD increments, especially the short-term (3- and 24-h) increments, is extremely local in nature. It is highly unlikely that the short-term maximum impacts of two separate emitting facilities will occur in the same location unless they are almost adjacent to each other and meteorological conditions are favorable to such an occurrence. It is doubtful that the SRC-II plant will seriously constrain future industrial growth in the area.

See Sect. 4.2.3.1 and Appendix C, Sect. C.8.

Water use

The Monongahela River would be the primary source of water for a commercial plant. The U.S. Army Corps of Engineers currently regulates flow in the Monongahela River at the Tygart Lake Dam to maintain a minimum flow of about 9630 liters/s (340 cfs) between Tygart Dam and Lock and Dam 7.

Although the production capacity of the commercial plant is currently projected to be five times that of the demonstration plant, water consumption is not expected to increase in proportion to the increase in capacity. Estimated consumptive water use for the expanded commercial plant is 793 liters/s (28 cfs or 12,500 gpm), compared with 225 liters/s (8 cfs or 3588 gpm) for the demonstration plant. The reduction in water consumption per unit of capacity for the expanded commercial plant is due primarily to those design features discussed in Sect. C.8.2.2 that would result in increased thermal efficiency for the expanded commercial plant. The expanded commercial plant would consume 8.2% of the current minimum flow. Before commercialization, a Water Resources Council (WRC) water assessment would be made to more accurately assess water availability and related water impacts. Evolution of the design basis for the commercial plant has enabled this estimate of water consumption used in this FEIS, which is more accurate than the value used in the WRC report. In addition, if the commercial plant uses the same source of coal as the demonstration plant and if it uses barge transport, the flow required for lock operation with SRC-II feed coal could range from 736 liters/s (26 cfs) to 1700 liters/s (60 cfs), depending on whether existing lock capacity is increased.

During low-flow periods, consumptive water use by the commercial plant would contribute to significant streamflow deficits and would affect downstream water users. Under Pennsylvania's policy for consumptive use, the state could require municipal water suppliers to curtail their withdrawals or make compensatory releases from storage. Consumptive use by the SRC-II commercial plant could increase the frequency of this occurrence. In addition, streamflow deficits (due to the SRC-II commercial plant and other new water users) could affect navigation, contribute to water quality problems, and affect fish and wildlife.

It is anticipated that during the demonstration phase, comprehensive basin-wide planning will be undertaken, as suggested by the WRC. This, together with the experience gained in the demonstration phase, will provide a basis for developing a strategy to deal with water supply problems during low-flow events. Options for reducing streamflow deficits, which could be used under a coordinated basin plan, include basin-wide water conservation, additional storage and/or allocation of storage at existing basin reservoirs, additional water storage on site or off site, and development of supplemental groundwater resources.

See Sect. 4.2.2.1.

Water quality and aquatic ecology

The wastewater handling and monitoring system envisioned for the expanded commercial plant is similar to the one being planned for the demonstration plant. This system includes provision for

discharging treated wastewater to the Monongahela River when the river can assimilate it without violating in-stream water quality standards and for recycling treated wastewater within the process when river conditions do not allow discharge. Wastewater concentrations of contaminants will be similar to those for the demonstration plant, with reductions in specific contaminants depending on improvements in the state of the art. Due to the increased quantity of treated effluent water, the impact of the expanded commercial plant on the Monongahela River with regard to total dissolved solids could be greater than for the demonstration plant. Therefore, it is anticipated that the plant would operate in the zero-discharge mode more frequently, and proportionately less water and dissolved solids would be discharged to the river from the expanded commercial plant as compared with the demonstration plant. As a result, more soluble salts will be recovered on site, per ton of coal feed, for the expanded commercial plant than for the demonstration plant.

Salt production is basically proportional to coal input to the plant, so the expanded commercial plant would produce 120 tons of salts per day compared with 22 tons/d for the demonstration plant. If the demonstration plant produces 22 tons of TDS per day and is allowed 10% of the Monongahela River's assimilative capacity by the regulatory agency, the river's capacity to assimilate TDS would have to be 220 tons/d. The probability graph in Sect. C.4.2.2 indicates that the river would have this assimilative capacity 95% of the time. If salt production for the expanded commercial plant is 120 tons/d and 10% of the river's capacity to assimilate TDS is allowed for the plant, the river's capacity to assimilate TDS would have to be 1200 tons/d. The probability graph indicates that the river would have this assimilative capacity 60% of the time. It is therefore estimated that the expanded commercial plant would be allowed to discharge treated wastewater 60% of the time without violating in-stream water quality standards and would operate in the zero-discharge mode 40% of the time. This estimate assumes that TDS are the governing discharge limitation. In actuality, the decision to operate in either the discharge or recycle mode will be made by monitoring both the treated wastewater and the river for many chemical constituents. It is anticipated that EPA will develop effluent limitations during preparation of the National Pollutant Discharge Elimination System (NPDES) permit application.

If the water intake structure withdraws water from near the shoreline (as is currently planned), the potential exists for losses of more than 10% of the river's ichthyoplankton during extreme low flows. The impacts of raw water withdrawal on ichthyoplankton are uncertain, and additional monitoring is needed. Further baseline and/or operational monitoring may indicate the need for placement of the intake structure in an area of minimum ichthyoplankton density (Sect. 4.2.2.4).

Under worst-case assumptions, wastewater discharge from the commercial SRC-II plant would cause significant additional stress to the aquatic ecosystem compared with that produced by the demonstration plant. The commercial plant, however, is expected to operate in the zero-discharge mode for a greater part of the time. In addition, design of the commercial plant will take advantage of the knowledge and experience gained from demonstration plant operation. The reliability of wastewater treatment systems will be better understood. If operation of the demonstration plant has revealed problems caused by a particular contaminant (e.g., bioaccumulation of heavy metals), specific treatment processes for control can be incorporated in the commercial plant's design.

See Sects. 4.2.2.1, 4.2.2.3, and 4.2.2.4.

Impacts on floodplain and wetlands

Rail service is provided at the base of the hillside, out of the 500-year floodplain. Therefore, the storage and loading facilities on the upper terrace of the Belldina property will not be enlarged during commercial expansion. The barge and water intake facilities for the demonstration plant will be sized to accommodate the commercial plant. Therefore, no new encroachment will occur; thus, no adverse impacts on either wetlands or floodplain will result from the expanded commercial plant (Appendix D).

Socioeconomic

The construction labor force for commercialization would rise to a peak of about 5000 to 10,000. Due to regional competition for labor, careful planning would be necessary to ensure availability of an adequate labor force. A shortage of labor would not prevent the plant from being built but would tend to lengthen the construction schedule. The size of the in-migrating labor force and their families during construction of the commercial plant would be much larger than during construction of the demonstration facility. Experience gained by the local area in accommodating demonstration plant construction may help in planning for growth during commercial plant construction. The result should be a net benefit to the area. Plant construction would create between

2500 and 5000 secondary jobs, 90% of which are projected to be filled by people living in the area.

Commercialization would provide a significant economic benefit to the area in the form of an increase to the local tax base, because ownership of the facility would be transferred from the Federal government to private industry at the end of the demonstration phase. Commercialization would also result in an increased strain on community services and resources. All problems associated with the demonstration plant would be magnified.

Secondary commercial development is expected to support the demonstration plant. This development would probably expand to provide the required support for the expanded commercial plant. This would represent a net benefit to the area in the form of jobs and tax revenue. A work force of about 900 would be required to operate an expanded commercial facility (about double the size of the demonstration plant's operation work force). It is expected that most of the work force would be made up of local residents. About 465 secondary jobs would be created by commercial plant operation, of which 90% is projected to be filled by people living in the area.

See Sect. 4.2.2.3.

Solid waste

The expanded commercial plant will produce about 4000 tpsd of slag plus increased quantities of other solid wastes, some of which may be hazardous. The demonstration plant will have an extensive monitoring program to determine the long-term fate of the contaminants in solid waste materials (Sects. 4.5.3.1 and 4.5.3.2). Runoff and leachate will routinely be analyzed. Such data will determine more definitively if a waste is hazardous. Current research indicates that the slag will be nonhazardous (Appendix K). The requirements for brine disposal during zero-discharge operation will increase due to the greater quantity of soluble salts being processed in the expanded commercial plant and the increased frequency of operating in the zero-discharge mode to avoid exceeding the assimilative capacity of the Monongahela River. Disposal plans for brine and other solid wastes are now being developed for the demonstration plant (Appendix C, Sect. C.3.7.2). Knowledge gained from the demonstration plant's operation will aid in identifying disposal requirements for the expanded commercial plant.

7.3.2 Continued operation of the demonstration plant

It is possible that the proposed two-year operation of the demonstration plant will not provide the data base desired for commercialization. A probable result would be an extension of the demonstration program and continued operation of the plant.

Changes in the design and operation of the plant will undoubtedly occur during the operating phase, but the environmental effects of continued operation are likely to be essentially the same as those described in Sect. 4. Process and environmental monitoring during operation will be used to identify the significant environmental impacts, their sources within the plant, and the available methods for mitigating them (Sect. 4.5). Consumption of available water and PSD air quality increments would continue, limiting other potential users.

If the Federal government continued to own the site, the area would continue to experience a loss of tax revenue. However, this loss of tax revenue would be somewhat offset by the continued employment of about 460 people, along with the additional secondary jobs created through the growth of support industries and services during construction and initial operation of the demonstration plant.

7.3.3 Conversion to another government use

If, at the conclusion of demonstration plant operation, private industry is not interested in constructing a commercial plant, DOE may elect to convert the facility to another use or to offer it to other Federal agencies.

The potential environmental impacts of an alternative use of the site would depend on the intended use and cannot be evaluated at this time. In view of the availability of facilities for the receipt, transport, storage, and preparation of coal, it is likely that an alternative use would be related to coal use and that impacts associated with coal receipt and handling would continue.

Continued Federal ownership of the site would result in continued loss of tax revenue and, more significantly, would prevent an increase in revenue that would result from transfer of the improved site to private ownership. The significance of this loss of anticipated revenue would depend on the degree to which local financial plans had been developed in anticipation of such revenues. This reduction in revenue would be partially offset by continued employment resulting from the alternative use of the site.

Conversion of the facilities to an alternative use would probably require some construction work and associated work force. Impacts resulting from construction would probably be relatively minor because most of the disturbance would have occurred during construction of the demonstration plant, and construction activities would probably be limited primarily to the process area. The work force required for conversion would probably be smaller than that required for construction, and in the absence of a major competing project, significant impacts would not be anticipated.

7.3.4 Mothballing

If there is no interest in constructing a commercial facility or in converting the site to an alternative use, DOE may elect to discontinue operation of the demonstration plant for an indefinite period, with the intention of resuming operation at some time in the future. In this alternative it is assumed that all process operations would cease and that equipment would be drained, cleaned as necessary, and prepared for extended shutdown. There would be minimal dismantling or removal of process equipment. Coal and product would be removed from the site. The slag disposal area and any other solid waste disposal areas would be closed and revegetated; leachate monitoring and treatment, if required, would be continued in accordance with RCRA requirements.

Mothballing of the demonstration facility would result in elimination of air emissions, consumptive water use, and slag production. Solid waste production would be reduced to that resulting from treatment of leachates from solid waste disposal areas and surface runoff. Elimination of evaporative cooling and its associated consumptive water use would result in the discharge of treated effluent. The facility would probably be maintained on the state emission inventory for a period of 18 months, temporarily limiting siting options for other emission sources. Location of other industries in the area could result in reduced availability of PSD increments and water resources for resumed operation.

Continued Federal ownership of the site would result in continued loss of property tax revenue and would prevent an increase that would result from transfer of the improved site to private ownership. This loss of revenue would not be offset by continued employment. It is anticipated that mothballing of the facility would result in layoff of most of the demonstration plant's work force of about 460 and in the elimination of essentially all secondary employment.

7.3.5 Decommissioning

If there is no interest in constructing a commercial facility, converting the site to another government use, or resuming operation of the demonstration plant, DOE may elect to decommission the facility and declare it excess property for disposal by the General Services Administration.

If decommissioning occurs, it is probable that the significant value of the improvements and the short operating history would make the site desirable as an industrial facility and that it would be sold for this purpose. Impacts resulting from conversion to an industrial use other than an SRC commercial facility would result in impacts that cannot be fully evaluated at this time. As in the case of conversion to another government use, it is probable that an alternative use would involve coal use and that the impacts of coal receipt, handling, and preparation would continue. Also, impacts of construction required for conversion to another use would probably be relatively minor. Sale of the facility for an industrial use would result in a tax benefit because the site and improvements would be placed on the tax rolls. Continued employment would also be a positive benefit.

Should there be no interest in purchase of the site for alternative use or should the government elect not to sell, the impacts would be essentially equivalent to those resulting from mothballing.

It is probable that major vessels and equipment would be removed. However, complete restoration of the site to its original condition would not be undertaken, and the site would be available for future redevelopment for industrial use.

8. IMPACTS OF SELECTING AN ALTERNATIVE PLANT DESIGN OR SITE

One of the three fundamental alternatives available to DOE is to modify the currently proposed action. From an environmental standpoint, such modifications could be used to lessen the environmental impact of the proposal. The following section evaluates the feasibility of using alternative plant designs to lessen the environmental impacts of plant operation (Sect. 2.3.2.1) and compares the impacts of locating the proposed facility at the proposed site with the impacts of locating it at two alternative sites (Sect. 2.3.2.2).

8.1 Alternative plant designs

8.1.1 Introduction

Analysis of plant design began with screening of the major process areas to identify (1) effluents and emissions under normal and upset conditions, (2) potential for adverse environmental impacts, and (3) control requirements. The following major process areas and control options, identified as having potential for causing significant adverse impacts, were evaluated to determine whether the proposed design was complete and whether alternative plant designs exist that could achieve superior environmental performance. The following areas and options were evaluated and are discussed below and in Sect. 2.3.2.1 and Appendix C:

- sulfur recovery and emission control,
- water consumption, treatment, and cooling,
- wastewater treatment,
- wastewater treatment under abnormal conditions,
- desalination of treated wastewater for recycle,
- brine disposal during zero-discharge operation,
- waste heat rejection,
- process hydrocarbon emission control,
- reduction of fugitive emissions by double piping and enclosures,
- disposal of process sludges,
- particulate emission control,
- plant fuels,
- electric power supply,
- plant layout (including floodplain/wetlands considerations),
- separation and disposition of mineral residue,
- hydrogen production, and
- gasification processes.

8.1.2 Incomplete design requiring further evaluation

As described in Appendix X, DOE will complete an FEIS before a decision is made to proceed with major detailed design of the plant. Important quantitative information such as material and energy balances around all process components is therefore missing at this time. A strategy is therefore required where assessment of adverse impacts for this document is based on conceptual design and worst-case estimates of effluents. DOE will integrate appropriate environmental controls as final design proceeds.

A tiered approach to NEPA compliance will be followed, in which final design data as they become available are given in interim reports to EPA and made publicly available and in which the impact analysis is compared with the worst-case impact analysis given in this FEIS. Based on design or operating information, DOE will make a determination as to whether supplemental NEPA review is required.

(Appendix C includes a more complete discussion of plant design alternatives.)

The environmental impacts of the designs of the following plant features have been evaluated in this FEIS. However, the specific designs will be the subjects of additional design work.

Sulfur recovery

The sulfur-recovery operation will make up about 65% of the plant's overall atmospheric emission rate. The air quality analysis is based on the Benfield-Claus/SCOT system (proposed in the DEIS), which has a higher emission rate than the currently proposed Selexol-Claus/SCOT system. This provides a worst-case impact analysis. Each of these alternatives, and others that offer the potential for lower emissions, is discussed in Appendix C, Sect. C.3.2.1.

Capacity of wastewater treatment system

A number of circumstances will cause a substantial deviation from the normal operating mode of the wastewater treatment system. The occurrences that are expected to tax the wastewater treatment system include shutdown and startup, extended shutdown, abnormally low river flow, and abnormally high rainfall. These occurrences will be used in the design basis of the wastewater treatment system (Appendix C, Sects. C.2.11, C.3.6, and C.4.2).

Desalination

The need exists for wastewater reclamation facilities to eliminate or reduce the treated wastewater discharge to the Monongahela River. This system will separate a salt-free water stream for use within the utilities section and will, when required, concentrate the effluent brine for storage or alternative disposal. The processes considered for this service were the common desalination processes of evaporation, reverse osmosis, electrodialysis, and ion exchange; currently, evaporation is preferred. This evaluation is continuing and will receive priority consideration during detailed design (Appendix C, Sect. C.3.6.2.2).

Controlled combustor/elevated flare system

Although the main processing units will normally not emit hydrocarbons, process upsets and emergencies may occur that require immediate disposal of combustible vapors and gases to relieve internal pressures. Some of these combustible materials may contain complex organic compounds, including carcinogenic substances, and flaring (a conventional refinery and chemical industry practice) may not adequately destroy these compounds. The proposed design incorporates a controlled-combustor/elevated flare system that would significantly reduce this problem in all but the most severe emergency events. The design of this system, which is incomplete, is under evaluation by DOE and the industrial partner and represents one of the major environmental control decisions to be made during the detailed design phase (Appendix C, Sect. C.3.5.4).

Location of water intake

The analysis of impacts on aquatic ecology has revealed that the shoreline water intake structure may cause considerably more entrainment of aquatic organisms than would a submerged intake closer to midstream. DOE and the industrial partner will evaluate these alternatives and their environmental effects during the detailed design phase (Sect. 4.2.2.4).

Design of coal conveyors

Fugitive dust from coal conveying will be reduced by using covered conveyors. Fully enclosed conveyors would virtually eliminate coal conveying as a source of fugitive dust but may pose unacceptable safety hazards. DOE and the industrial partner will evaluate the viability of this alternative during the detailed design phase (Appendix C, Sect. C.3.1.1).

Coal pile dust control

As currently proposed, the plant will use a conventional coal dryer and a wet dust suppression system for the coal piles. A polymer coating that would reduce fugitive dust emissions for one of the two active piles is also being evaluated (Appendix C, Sect. C.3.1.1).

In addition to the above plant features, this list identifies those aspects of plant design for which the environmental impacts have not been evaluated in this FEIS due to a lack of detailed design information.

Methods of brine disposal

The proposed system of treated wastewater discharge cannot operate during periods of low river flow and high dissolved solids loading in the river without producing violations of in-stream water quality standards. The secondary operating mode of reduced or zero liquid discharge will produce a brine that will probably be considered a hazardous material under RCRA criteria. The ultimate disposal method for this brine waste is under continuing evaluation by DOE and the industrial partner and represents one of the major environmental control decisions to be made during the detailed design phase (Appendix C, Sects. C.3.6, C.3.7.2, and C.4.2).

Water storage

The analysis of water use and water availability in the Monongahela River Basin has revealed possible water availability problems during periods of low flow. Off-stream water storage on site is a possible mitigating measure. In the unlikely event that this alternative is chosen, the size, design, and location of such storage facilities have not yet been specified and will receive priority consideration during the detailed design phase (Sect. 4.2.2.1).

Cooling system

The proposed design calls for the combined use of several types of cooling on selected streams in the plant. For selected hot streams expected to be free of carcinogens, aerial coolers will be used. To prevent process materials from leaking into the cooling water and then being discharged to the atmosphere through the cooling tower, moderate temperature streams containing hydrocarbons likely to be carcinogenic will be cooled by an indirect cooling system. The bulk of the process cooling on streams other than the above will be by conventional wet evaporation methods. Final design selection of which streams to cool by each method will be based on an integration of additional toxicity testing on representative process materials, safety analysis, cooling needs, and selection of wastewater treatment strategy, because the ability to achieve zero discharge requires substantial evaporative cooling capacity for disposal of treated wastewater (Appendix C, Sects. C.2.11 and C.3.5.5).

Location of hazardous waste landfill

As currently envisioned, solid wastes will be stored in two landfills designed for storage of RCRA hazardous wastes — one for gasifier slag only and the other for several process sludges. The location of the second landfill, which will contain hazardous wastes, has not yet been proposed, and the chemical composition of the sludges will probably remain unknown until the plant is operating. These uncertainties will also be among those to receive priority consideration during the detailed design phase (Appendix C, Sect. C.3.7, and Sect. 4.2.2.2).

8.1.3 Plant layout

The currently proposed site plan was reviewed to determine whether an alternative site arrangement could significantly reduce the impact resulting from construction and operation of the demonstration plant. The currently proposed site plan was presented as an alternative in the phase 0 deliverables and was subsequently selected to avoid the possibility of subsidence of mined areas initially proposed for disposal of slag produced by future commercial operations. The revised site plan appears to avoid geologically unsuitable areas (especially undermined areas for solid waste disposal) and to utilize areas of low environmental significance to the maximum extent possible (Sect. 2.3.2.1).

The proposed location of the cooling towers should reduce the significance of the visible plume and the increased fogging, icing, and salt deposition resulting from their operation. Areas sensitive to cooling tower operation, Highway 53 and the electrical substation, should not be significantly affected.

Throughout the development of the SRC-II facility, layout and design alternatives that could reduce floodplain/wetlands impacts of the proposed facility were considered. Major design alternatives affecting floodplain/wetlands that were considered (Appendix D) include (1) alternative design of the barge slip, (2) alternative layout of the product storage area, and (3) elimination of the coal barge dock facility (i.e., the exclusive use of railroads for coal shipments).

8.2 Alternative sites

Emissions and discharges from the demonstration plant are determined primarily by the design of process and support facilities and may be reduced through application of the various design alternatives discussed above. Assuming that the design of the demonstration plant is unchanged, the significance of the impacts produced by construction and operation is determined to a large extent by the physical characteristics and quality of the environment of the site at which the plant is located.

The contract awarded for the phase 0 design study required that the industrial participant submit a site-specific proposal. In 1975, Gulf Oil Corporation undertook an alternative site analysis for selection of a site for a 6000-tpsd SRC-II plant capable of accommodating an expansion in the plant capacity to 30,000 tpsd. Although environmental factors were considered, the siting criteria used in the Gulf study were primarily physical, engineering, and economic factors that were judged to be important for construction and operation of the SRC-II plant. Fort Martin, West Virginia, was proposed as the site. At that time, DOE was not a participant in the project.

After Gulf completed its site selection study for the SRC-II project, two important events transpired: DOE became a participant in the project and Executive Orders 11988 and 11990 pertaining to floodplain/wetlands encroachment were issued (May 24, 1977).

Although a proposed site had already been chosen for the project (as specified in DOE's Request for Proposal and contract with its industrial partner), it was recognized that an evaluation of the reasonable alternatives to the proposed action, including alternative sites, was necessary.

To evaluate the impacts of construction and operation at alternative sites, an independent analysis of available sites was conducted. Based on this analysis, which is described in detail in Appendix B, two sites were identified as reasonable alternatives to the proposed site: one on the Green River near Equality, Kentucky, and one on the Ohio River near Ravenswood, West Virginia. Appendix B (Sect. B.2) describes the site selection process conducted by Gulf in 1975, which includes the proposed site. Section B.3 describes the Oak Ridge National Laboratory analysis, which evaluates sites other than Fort Martin (Sects. 2.3.2, 4.3, and 4.4).

A definitive analysis of the environmental acceptability of alternative sites is severely constrained not only by the degree to which judgmental factors enter into the analysis but also by the availability of consistent and detailed information on each site. In this case, detailed information exists for the proposed site from a one-year baseline monitoring program, whereas only reconnaissance-level information is available for the alternative sites. The purpose of this alternative site comparison is not to select the environmentally preferable site but rather, in response to NEPA, to evaluate reasonable alternatives to the proposed action. Even though environmental comparisons such as these are based on dissimilar levels of baseline data, sufficient information is available to enable a reasoned choice among alternatives.

In summary, the proposed site was selected by the industrial partner using the procedures and criteria described in Appendix B (Sect. B.2). The proposed site will experience environmental impacts as would any alternative site. Based on available information, none of the alternative sites are obviously environmentally superior to the proposed site.

9. IMPACTS OF DETERMINING NOT TO PROCEED WITH CONSTRUCTION AT ANY SITE — NO ACTION

If the decision is made to choose the alternative of not proceeding with the demonstration project, the opportunity to obtain the intended environmental, technical, and economic data on the SRC-II process at near-commercial-scale would be greatly reduced. Provided that the proposed SRC-I demonstration program is carried out, it could provide information of a generic nature on hydrogen production via gasification, ash and slag disposal, pressure letdown, large-scale oxygen production, wastewater treatment, solid-liquid separation, and high-temperature and pressure handling of hydrocarbon, hydrogen, and oxygen mixtures. However, the conceptual designs for each of the two SRC demonstration plants have unique features such as solid-liquid separation and

wastewater treatment. Demonstrating both technologies would provide a valuable diversity of information and operating experience about alternative designs. The Exxon Donor Solvent and H-Coal pilot plants have been constructed and are currently in the mechanical shakedown and testing phase. These plants could also contribute generic information that would advance SRC-II technology.

Demonstration plants are a key factor in reducing scale-up risks (technical, financial, and environmental) from pilot plant to commercial facilities to a reasonable level. A decision not to build SRC-II would delay commercialization of this technology for direct coal liquefaction.

Concerning the development of the proposed plant site, the adverse impacts on the physical and biological environment and the socioeconomic conditions in the region would not occur if the no-action alternative is chosen. Also, the region would not receive the economic benefits of increased employment and revenue associated with the construction and potential continued operation of the SRC-II demonstration plant.

10. MONITORING AND MITIGATION

An extensive environmental monitoring program will take place during construction and operation of the proposed SRC-II demonstration plant (Sect. 4.5). A substantial portion of the monitoring program is designed, as it would be for any large energy demonstration facility, to demonstrate that the plant can be constructed and operated in compliance with existing environmental requirements. These requirements for construction (Table 4.27) and operation (Table 4.28) include consideration of occupational safety and health, air quality, water quality, solid waste disposal, spill prevention and cleanup, noise, endangered species, proper management of floodplains and wetlands, and preservation of national historic landmarks. A portion of the monitoring program will focus on early detection of pollutants or contaminants in ambient and work place environments so that adverse effects can be avoided or mitigated. The remainder of the monitoring program will be used to acquire an understanding of environmental and health effects caused by the presence or release of chemical substances from SRC technology for which no legislated standards exist. Obtaining these data is one of the fundamental purposes of the SRC-II demonstration project.

To establish a thorough baseline and then to determine the environmental effects of construction and operation, monitoring programs will include the study of (1) air quality and meteorology; (2) surface water quality and hydrology; (3) groundwater quality, soils, geology, and geo-hydrology; (4) aquatic and terrestrial ecology; and (5) socioeconomics. In addition, operational monitoring will include monitoring the actual emission sources, monitoring occupational environments, and conducting medical surveillance of the work force.

EPA, the Corps of Engineers, and other Federal, State, and local agencies require DOE to obtain a variety of permits and licenses to construct and operate the facility. The status of the major permits and licenses can be found in Appendix R of this FEIS. In many cases, these permits serve as action-forcing documents in that they require monitoring. Citizens have the opportunity to participate in the permit process.

One purpose of the SRC-II demonstration program is to identify any serious health and environmental risks associated with the demonstration plant itself and a future commercial SRC industry and to minimize these risks before the onset of adverse effects. To understand these risks, it is necessary to look beyond current and projected environmental requirements (Sect. 4.1). This is true, in part, because current and projected standards do not yet exist for all the possible chemical compounds that could be generated by such a facility.

To understand these risks, DOE will develop a program to (1) monitor routine, fugitive, and emergency emissions from the plant to characterize the actual contaminants leaving the plant; (2) monitor the ambient environment to carefully study impacts predicted in this FEIS and the effectiveness of measures to mitigate them, detect impacts that were not predicted, and generally identify how contaminants are transported through the environment and where they appear or accumulate; (3) monitor occupational environments to determine worker exposure to routine, toxic, and biologically active chemical compounds so that they may be controlled to within recommended limits; (4) conduct medical surveillance of the work force to enable early detection of any signs of stress or adverse effects related to occupational exposures; and (5) conduct research studies to help develop a fundamental understanding of how the physical and the biological environment respond to the unique chemical contaminants that appear in and around the plant as a result of the project. Clearly, the emphasis of the monitoring program is on prevention of adverse impacts through early detection and mitigation.

DOE shall (1) maintain records of such adverse impacts and provide for prompt reporting to appropriate regulatory agencies and the public and (2) take the necessary mitigating actions during construction and operation of the plant to comply with all existing environmental requirements. Mitigating measures to be implemented include those summarized in Sect. 4.6 of this FEIS. The DOE/EPA agreement presented in Appendix X identifies DOE's commitment to consult with EPA and make available to the public design study reports related to the environment and monitoring program data that measure the effectiveness of mitigating measures initiated by DOE.

The mitigation measures discussed in Sect. 4.6 include the following:

- a tertiary wastewater treatment facility with zero-wastewater-discharge capability;
- a controlled combustor as part of the flare system to enhance destruction of organic compounds;
- a liner and leachate collection system for the coal pile;
- a cooling system that would reduce the release of process materials in the event of a heat exchanger leak;
- a spill prevention, containment, and treatment system for the plant;
- a directed-maintenance program to reduce fugitive emissions from process equipment;
- a formal Hazards Evaluation Program;
- coordination with EPA, the Coast Guard, and State and local agencies to develop strategies for preventing and/or mitigating spills that occur during product transit;
- hazardous waste landfill designs for all solid wastes;
- coordination with HUD and other State and local agencies to aid in mitigating potential adverse socioeconomic impacts;
- mitigation plans for important historic and archaeological sites;
- mitigation plans to reduce erosion and sedimentation during construction;
- collection and treatment of process area runoff;
- primary and secondary containment for storage vessels and major process units;
- coordination with the U.S. Fish and Wildlife Service and other agencies to mitigate the loss of shoreline habitat and wetland areas;
- use of dust suppression techniques during construction and operation;
- reduction of air emissions through equipment design, selection of plant fuels, and pollution control devices; and
- an industrial hygiene program including training, protective equipment, specific work practices, medical monitoring, and exposure monitoring.

DOE recognizes the health risk of operating a plant of this nature and has therefore taken the following actions: (1) the contract between DOE and the industrial partner states that the two highest design priorities are safety and the environment (Appendix C, Sect. C.9); (2) engineering controls are being incorporated in the design with the philosophy that the risk should first be reduced by minimizing the exposure of workers, the public, and the environment (Sect. 4.1.3); (3) the design and implementation of mitigating measures will be responsive to exposure data from a monitoring program that will include point and fugitive emission sources, the site and surrounding environment, in-plant area monitors, and personnel monitors (Sect. 4.1.3.5); (4) an industrial hygiene program will be instituted to further reduce worker risk through identification of hazardous materials and areas, a worker education program, protective clothing and equipment, carefully developed work practices and personal hygiene procedures, and medical monitoring (Sect. 4.1.3.6); and (5) the ongoing research program sponsored by DOE will continue and will be responsive to the information needs of the demonstration program and data retrieved from operating the demonstration plant (Appendix Y).

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1. PURPOSE, NEED, STATUS, AND PROGRAMMATIC OVERVIEW

1.1 INTRODUCTION

The proposed action evaluated by this Statement is the construction and short-term operation of a facility to demonstrate the technical feasibility, economic viability, and environmental acceptability of the Solvent Refined Coal-II (SRC-II) process. The proposed SRC-II project will be funded on a cost-shared basis by the Department of Energy (DOE), SRC International, Inc., and the governments of the Federal Republic of Germany and Japan. Following approximately two years of operation, the industrial participant may purchase the facility from the government. Should the demonstration plant prove to be successful, it is anticipated that it will be expanded to become the first commercial SRC-II plant, processing about 30,000 tons per stream day (tpsd). Aspects of the SRC-II demonstration project are described in Sects. 1.1 and 1.3, and programmatic-related matters concerning direct liquefaction are discussed in Sects. 1.2 and 1.4.

1.1.1 Description of the proposed action

The proposed SRC-II facility will convert high-sulfur coal into a low-sulfur, low-ash primary liquid fuel product; secondary gaseous and liquid fuel products; and by-product sulfur, ammonia, and tar acids. In the process, pulverized coal is mixed with a recycled hydrocarbon/mineral residue slurry produced in the process and is reacted with hydrogen at high temperature and pressure. After separation of gaseous products and unreacted hydrogen, the liquid products are processed to separate the mineral residue (ash and unreacted coal) from the primary and secondary products. A portion of the mineral residue is recycled to the process, and the remainder is processed in a gasifier to produce a synthesis gas, primarily carbon monoxide, which is reacted with steam to produce the hydrogen required by the process. The slag residue remaining after gasification is the principal solid waste produced by the process. Most of the sulfur and part of the nitrogen present in the coal react with hydrogen to form hydrogen sulfide and ammonia which must be removed from the gaseous products and are recovered as by-product elemental sulfur and ammonia.

During the startup and initial operating periods of the demonstration phase, coal will be purchased from two existing mines in the northern panhandle area of West Virginia—Ohio, Powhatan No. 6, North American Coal Company, and/or Ireland coal, Consolidated Coal Company. These Pittsburgh seam coals have been extensively evaluated in pilot plant operations at Fort Lewis, Washington, and the Harmarville Process Development Unit. Following the startup and initial operating period, high-sulfur bituminous coal(s) from other seams may be run in the plant to demonstrate that the process can be applicable to a variety of coals. Coal will be delivered to the plant by barge. Products will be shipped by rail and truck. If the facility is expanded to commercial capacity, it is probable that coal will be received by both barge and rail and that some products may be shipped by barge and pipeline.

1.1.2 Location of the proposed facility

The proposed plant site is located in Monongalia County, West Virginia, at about mile 94 of the Monongahela River in the unincorporated community of Fort Martin. The site is about 11.3 km (7 miles) north of the city of Morgantown; the West Virginia-Pennsylvania state line forms the northern boundary of the site. The demonstration plant and support facilities will occupy about 115 ha (285 acres) of the 983-ha (2430-acre) site. If a commercial facility is constructed, the additional facilities will require about 160 ha (395 acres). Based on the preliminary site layout, it appears that the proposed site has adequate area to accommodate the planned expansion.

1.1.3 Status of the proposed action

On July 10, 1978, a multiphased contract for the SRC-II demonstration plant was signed by the Secretary of DOE and representatives of The Pittsburgh & Midway Coal Mining Co. (P&M). The contract provided for all phases of the demonstration project: conceptual design, process and detailed design, construction, and operation; however, initially only the provisions for conceptual design were defined. The contract provided for DOE funding of the conceptual design

phases and allowed for the option of cost-shared funding of process and detailed design, construction, and operation.

On July 31, 1980, a modification to the initial contract was executed, wherein the provisions for process and detailed design were defined. This contract modification provides for DOE funding of the process and detailed design phase and allows the option of cost-shared funding of construction and operation. The contract has been novated to SRC International, Inc., a joint-venture company comprised of P&M and the West German (25%) and Japanese (25%) industrial participants.

Current plans call for operation of the plant for an initial demonstration period of two years. At the conclusion of this demonstration period, the industrial participants will have the option to complete negotiations for purchasing the facility. Should the industrial participants decline to purchase the plant, DOE may elect to continue operations under the existing contract for up to nine months or to discontinue operations and mothball, decommission, or dispose of the facility. The Government of the Federal Republic of Germany and the Government of Japan are participating with the United States in the SRC-II demonstration project. Each country has agreed to contribute 25% of the total project cost. DOE's contribution will be about 45%. A central body called the Steering Committee, chaired by an American committee member, has been formed as a part of the three-country agreement to implement joint participation in the SRC-II demonstration project. The Steering Committee fulfills its responsibilities by meeting at least twice a year. The Steering Committee is assisted by a full-time staff, called the Joint Project Management Team, located in Washington.

Conceptual design studies, designated as Phase Zero, were completed and delivered to DOE on July 31, 1979. Based on an evaluation of the Phase Zero deliverables, DOE decided to proceed with the design phases. Copies of Phase Zero deliverables are available for inspection at the following locations:

West Virginia University Library
Downtown Campus
Morgantown, West Virginia 26506

DOE Public Document Room
Room G208
Oak Ridge Federal Building
Oak Ridge, Tennessee 37830

Morgantown Public Library
373 Spruce Street
Morgantown, West Virginia 26505

DOE Public Reading Room
Room GA-142
Forrestal Building
1000 Independence Ave., SW
Washington, D.C. 20585

Copies of the Phase Zero deliverables are available on microfiche through National Technical Information Service (NTIS), U.S. Department of Commerce, 5285 Port Royal Road, Springfield, Virginia, 22161, Document Nos. FE-3055-T1 through FE-3055-T16.

A Record of Decision will be prepared and published in the *Federal Register* in connection with this proposed action [see part (h) of the Cover Sheet of this document].

1.2 PURPOSE AND NEED FOR THE COAL LIQUEFACTION PROGRAM

1.2.1 National policy

The United States' dependence on foreign sources for almost 50% of its petroleum requirements has been a matter of grave concern for some time. To help relieve this serious energy and economic situation and to improve our strategic position, the United States will limit its imports of petroleum to the 1977 levels and develop, as a part of the overall national energy plan, a domestic synthetic fuels industry.

In April 1977, the Administration submitted to Congress the National Energy Plan (NEP) and accompanying legislative proposals designed to produce a coherent energy policy for the United States. The National Energy Act, passed by Congress in mid-October 1978, provides for implementation of vital parts of the NEP. The NEP-II was submitted in May 1979, and further defined energy policy by emphasizing the development of oil substitutes. On July 15, 1979, the President

presented his Imports Reduction Program to the nation, further emphasizing in detail the development of oil substitutes. The Energy Security Act of 1980 signifies the commitment of the United States to a national energy program for reducing its dependence on imported oil. Its major provisions are

- a Synthetic Fuels Corporation with the potential for \$88 billion in resources to stimulate the production of 2 million barrels per day of synthetic fuels by 1992,
- a Solar Energy and Energy Conservation Bank with \$3 billion authorized to spur energy conservation and renewable energy investments,
- biomass financial assistance programs designed to assist the production of alcohol fuels and fuel from biomass and municipal waste, authorized at \$1.45 billion over two years,
- a policy of 100,000 bbl/d minimum fill rate for the Strategic Petroleum Reserve, and
- statutory support for electric and gas utility investments in energy conservation.

1.2.2 Need for additional domestic energy resources

The United States is at a pivotal point in its energy and economic development. In the past, economic growth has been fueled by abundant supplies of inexpensive, readily available domestic and foreign fossil energy. The United States currently competes in an international marketplace to purchase the supplies of oil and gas on which the domestic economy has become dependent. In the past, economic planners could assume an uninterrupted supply of energy from a variety of sources. Now, the United States must search for new supplies of energy needed for economic expansion. The high cost and uncertain availability of energy have become major obstacles to the continued growth of the U.S. economy.

In 1978, the United States consumed about 78.4 quads* of energy in the residential, commercial, industrial, and transportation end-use sectors. Almost 50% (38.0 quads) of 1978 energy demand was supplied by petroleum, while natural gas supplied 25% (20.0 quads), coal supplied 19% (14.2 quads), and nuclear/hydropower/geothermal supplied over 7% (6.1 quads).¹

In formulating its programs for meeting the nation's broad-based energy goals, DOE must consider a wide range of program options. Although it is desirable to develop the broadest possible range of technologies, the available economic and personnel resources are limited, and each technology must be evaluated on the basis of its potential for energy production or reduction in consumption, the current status of the technology, the resources required for further development, and the economic and environmental risks associated with commercial application.

1.2.3 Energy options

The program options available to DOE are discussed briefly in the following sections.

1.2.3.1 Contribution of nonfossil energy sources

Conservation

Conservation is an immediate and cost-effective way to deal with the energy problem. There have been many recent government and private studies on the long-term energy demand in the United States. Using these studies, projections of consumption by end use in 1990 were made to assess the possible results of a Federal conservation program. For a real gross national product growth rate of 3.1%, Table 1.1 shows the possible energy savings in 1990 compared with actual consumption in 1978 and a projection of "business as usual" practices.²

These savings look attainable, especially since they do not entail major technological breakthroughs. Although conservation offers great potential for near-term reduction in energy consumption and associated dependence on foreign resources, it alone cannot provide a long-term solution.

* 1 quad = 10^{15} Btu.

Table 1.1. U.S. energy consumption (quads)

	Residential/ commercial	Industrial	Transportation	Total
Consumption, 1978	28	30	21	78
No-change path, 1990	43	47	24	114
Possible, 1990	30	38	18	86
Savings, %	30	20	25	25

Source: U.S. Department of Energy, "Policy, Programming, and Fiscal Guidance, FY 1982-1986," Jan. 30, 1980.

Solar

Solar and other renewable energy resources offer the nation some of its best opportunities to become self-sufficient in energy over the long-term. These technologies are already playing a small but significant role.

As oil prices continue to rise and conventional energy resources face constraints, solar energy use can be expected to continue to increase.

Biomass

"Biomass fuels include wood and wood residues, agricultural materials and refuse, various high-energy-yield crops, and municipal refuse."³ Generally, these are low-density and low-heating-value materials having moderate to high moisture content. Techniques are under development to use biomass as feedstock for gas and liquid synthetic fuels (similar to those derived from coal) to produce alcohol and to pyrolyze or burn for heat recovery. Production of alcohol and direct combustion of wood are the near-term uses of biomass for energy.

Alcohol. Both ethanol and methanol can be produced from biomass. Ethanol is produced from the carbohydrates in biomass. Corn, cornstalks, other vegetation-derived materials, and municipal refuse can be fermented to yield ethanol. Present plans are to blend this with gasoline, but use of ethanol fuel alone also has been proposed. Methanol can be produced by converting the organic content of biomass to synthesis gas and catalytically converting that to alcohol. Methanol also can be blended with gasoline, but at concentrations above a few percent it tends to chemically attack various components of storage tanks, pumps, and fuel systems. It is expected to have significant application in stationary equipment such as turbines.^{3,4}

Wood. Currently about 2% of U.S. energy comes from wood. The major users of wood fuel are the forest industries. Wood use is increasing; however, constraints include variability, transportation and availability, and the high capital cost of wood-fired systems. Wood contains significantly less sulfur and nitrogen than most fossil fuels but particulates loadings may be high.³ Its heating value is approximately half that of coal.

Hydroelectric

Development of hydroelectric generating capacity is limited to specific geographic areas and, to a large extent, most of the favorable sites have already been developed. In view of growing public opposition to the commitment of additional land resources for reservoir development, significant increases in hydroelectric power generation capacity are not anticipated.

Nuclear

Development of nuclear power represents a significant potential for additional energy. The nation's mid-term (i.e., 1990-2010) energy situation would benefit from successfully maintaining and expanding the use of nuclear power. However, due to the long lead time required for bringing a nuclear power plant on-line, and other issues relating to nuclear waste management, safety, and cost of nuclear power, acceleration of nuclear energy beyond that already planned could not be a viable alternative to synthetic fuels development in the near term.

Geothermal

Geothermal energy resources are also limited by geographical scope and by their low-level energy concentration. Development of the available resources is limited in many cases by environmental considerations associated with control of hydrogen sulfide and disposal of brines.

1.2.3.2 Contribution of fossil energy sources

The DOE Fossil Energy Program is structured to develop appropriate technologies to help meet future U.S. energy needs. The technology base effort develops basic information and advanced concepts with potential applications in providing energy from coal, oil, gas, and other fossil resources. The technology base elements are basic research, applied research, and exploratory development of the extraction, conversion, and utilization of fossil energy resources. The technology base focuses on better scientific and engineering data for research and development programs and on basic improvements to process efficiencies and/or use of lower cost technology that can operate in an environmentally acceptable manner. The DOE is also heavily involved in direct technical support of the Federal government's actions to stimulate near-term use of alternative fuels technologies. Implementation of improved environmental controls will also be needed to ensure acceptability of the new technologies for use of fossil fuels.

In addition to the energy sources mentioned above (Sect. 1.2.3.1), the following fossil energy sources are also available as energy options. They are divided between nonliquid and liquid options.

Nonliquid fuels

Increased production of domestic gas. Natural gas plays an important role in domestic energy markets for two reasons: (1) natural gas currently provides a quarter of total U.S. energy supply, and (2) natural gas can, as a technical matter, easily displace oil in large portions of the industrial and electric utility sectors. Uncertainties exist about the size of the future contribution of domestic, imported, and synthetic/substitute natural gas to total U.S. energy needs. Estimates range from 22 to 24% of total U.S. energy needs in 1985 and from 15 to 20% in 2000.

Natural gas, despite a 15% decline in production in the past five years, remains the largest contributor to domestic energy supply. Continued decline in gas production will increase reliance on imported oil and gas. If more of this fuel becomes available, the decline could be offset and gas could be diverted to industrial users of oil, thus reducing oil imports.

Domestic production of natural gas may be increased (1) through additional exploration and development of new fields and (2) by enhanced recovery of existing resources.

1. Exploration and development of new fields. Domestic production and reserves, dominated by conventional gas resources, have declined steadily. Annual production in 1978 was 19.3 trillion cubic feet (Tcf), down from the 1973 peak of 22.6 Tcf. Proven reserves have dropped below 200 Tcf from their 1967 peak of 293 Tcf. In only one year since 1967 have additions to reserves kept pace with depletion of reserves through production. (That year was 1970, when the associated gas reserves of Prudhoe Bay, Alaska, were "booked.") The ratio of reserves to production for the lower 48 states at the end of 1978 was an all-time low of 8.8 to 1, compared to almost 15 to 1 only a decade earlier. Reserve additions (excepting Prudhoe Bay) have replaced only 46% of withdrawals during the 1970s.

This serious decline in production, reserves, and reserve-production ratios has continued despite a near tripling of average natural gas price (in real terms) since 1973, the emergence of still higher price intrastate markets, and a corresponding doubling of exploratory effort. Additions to reserves per successful exploratory well drilled since 1970 have decreased from 10.7 to 2.3 billion cubic feet (Bcf) per well. Estimates of conventional gas resources in two areas for which a reevaluation is complete resulted in a 60% decrease in the estimated recoverable resource. The prior estimate was in 1974. Similar downward revisions have been made in estimates of inferred reserves for these areas.

These data point to sharply declining availability and rapidly increasing costs of conventional gas production from the contiguous United States. The phased decontrol and special provisions of the Natural Gas Policy Act of 1978 provide incentives for accelerated exploration, but the apparent decline in the number and quality of conventional gas prospects suggests that numerous supplementary gas sources will be required to meet the demand for gas.

2. Enhanced gas recovery. National energy policy identifies unconventional gas resources as potential supply targets. As a result, the DOE Unconventional Gas Recovery Research, Development, and Demonstration Program was established. Four large, unconventional gas resources have been identified as having significant potential for development and positive impact on future supplies. These are

- low-permeability (tight) lenticular and blanket-type gas sandstones of the western United States,
- gas-bearing Devonian and Mississippian shales of the eastern United States in Appalachia and the Midwest,
- natural gas present within coal seams and associated strata, and
- high-temperature, high-pressure (geopressured) aquifers of the Gulf Coast.

Direct coal utilization. Coal constitutes about 77% of the U.S. conventional energy reserves but currently supplies less than 20% of energy consumption. The increased utilization of domestic coal reserves appears to offer the greatest near-term potential for increased domestic energy production. Available technology for utilization of coal is currently limited primarily to direct combustion in conventional boilers. Intensive efforts are underway to develop improved combustion techniques.²

1. Conventional direct combustion. Although direct combustion of coal with required controls on particulate and sulfur dioxide emissions currently appears to be the most cost-effective method for the large-scale utilization of coal (particularly for electric power generation), the cost of required pollution control equipment limits the utilization of coal in small- and moderate-size plants. Requirements for the disposal of large quantities of ash and flue gas desulfurization residues also limit the applicability of direct combustion. In addition, many applications require either gaseous or liquid fuels and are unsuited for direct coal utilization.

2. Fluidized bed combustion. Fluidized bed combustion is currently under development as a direct combustion alternative to conventional combustion of coal. In this technology, coal is burned in a fluidized bed of an inert material, usually dolomite. During combustion, the sulfur content of the coal is oxidized to SO_2 which then chemically combines with the dolomite, eliminating the need for further SO_2 control systems. While solid waste, which includes ash and spent dolomite, is the major discharge for disposal from fluidized bed combustion, it is less of a problem than scrubber sludges. Combustion occurs at a lower temperature in the fluidized bed than in conventional fireboxes, thereby reducing the amount of NO_x produced. Both pressurized and atmospheric systems are under development for use in steam generation. The pressurized systems may offer a slightly higher efficiency than atmospheric; however, environmental effects will be similar.

3. Magnetohydrodynamics. When a hot, ionized gas is passed through a magnetic field, an induced potential is developed and can be used to generate an electrical current. Magnetohydrodynamics (MHD) is the application of this phenomenon. The hot gas can be produced by burning coal and ionization can be improved by "seeding" the gas with an alkali metal salt. This is another form of direct combustion of coal currently under development. The high temperatures required will favor NO_x formation; however, the process is expected to yield higher thermal efficiencies than most other direct combustion alternatives. Control of SO_2 can be achieved by proper choice of the seed material.

4. Fuel cells. The fuel cell represents another approach to direct coal utilization. Fuel cells operate by injecting an oxidizer and a fuel separately into an electrolyte at separated points. Electrochemical reactions occurring during the oxidation cause a potential difference between two electrodes, which yields an electrical current in an external circuit. With some fuels (e.g., hydrogen), a solid electrolyte can be used; however, with coal the electrolyte is commonly a molten salt. In the latter case, the impurities and unreactive components of the coal are left in the salt, which is continuously removed and regenerated. During this regeneration, the potential pollutants are recovered in various forms for disposal.

5. Combined-cycle power generation. Combined-cycle power generation makes use of high-temperature gas turbines and conventional steam turbines to generate electricity. Using coal as the fuel, the coal is initially converted to a low- or medium-Btu fuel gas in a pressurized gasifier. The fuel gas is cleaned to remove particles and to remove sulfur and nitrogen compounds as elemental sulfur and ammonia, respectively. The coal mineral matter is removed from the gasifier as ash or slag. The gas is then burned in a combustor to drive a high-temperature turbine. Exhaust from this turbine is still hot enough to generate steam to drive a steam turbine. Since the high-temperature gas turbine requires a highly pure fuel to preclude blade damage, the only potential atmospheric discharge of any significance is NO_x formed from the air nitrogen in the combustor.

Coal gasification. Coal gasification is the chemical reaction of coal with oxygen or air and steam to produce carbon monoxide and hydrogen. Other gases produced include smaller amounts of carbon dioxide, methane, and sulfur compounds such as hydrogen sulfide and carbonyl sulfide. If air is used directly in the reaction as the source of oxygen, nitrogen will also be present in the gas.

1. Surface gasification. There are several approaches for the government to take regarding synthetic gas development. First, there are existing synthetic coal gas technologies that are used commercially outside of the United States. However, uncertainties involving cost and environmental performance must be resolved for these technologies to operate in the United States. To obtain a near-term contribution to the energy supply from synthetic fuels, the government can provide incentives (e.g., tax credits, price supports, and exemptions from excise taxes) that will encourage the construction and operation of these first-generation synthetic fuel technologies in the United States.

Another approach the government may take is to conduct long-range planning activities to remove uncertainties and to reduce lead times for the development of second-generation synthetic fuels technologies. The second-generation gasification technologies could use a wide range of U.S. coals, particularly caking coals, which would offer higher environmental performance and efficiency and increased reliability. The coal gasification technologies in the DOE Fossil Energy Program fall into the category of second-generation technologies and are expected to be both economically and environmentally superior to current gasification technologies upon successful completion of demonstration plant programs.

2. Underground gasification. Underground coal gasification (UCG) is the technology now under development to convert coal to a combustible gas while still in place underground. The gas product is conveyed to the surface and, after cleanup, can be used as a low- or medium-Btu gas, upgraded to pipeline-quality gas, or used to produce liquid fuels through indirect liquefaction. The development of UCG could greatly expand the usable reserves of the United States by utilizing coal currently considered unmineable by conventional means because it is uneconomical. Underground coal gasification processes will therefore complement surface-based processes that require mined coal.

Current estimates of the most suitable UCG resources include low-volatile bituminous and lower-rank coal seams at least 5 ft thick that lie at depths between 200 and 3000 ft.

The four major program elements of DOE's UCG technology development program are

- western low-Btu gas,
- western medium-Btu gas,
- eastern coal technology, and
- steeply dipping beds.

The overall program goal of UCG is to demonstrate in situ gasification schemes to produce low- and medium-Btu gas from coals of different ranks and from different geographical areas in an environmentally safe manner.

At the present time, a multimodule Western low-Btu test is planned for 1984 to 1985. The successful completion of this test (Hanna 5) could make low-Btu gas produced from UCG a commercial reality by 1987 or 1988. A planned pilot test will include the production of electricity from a 60-MW(e) generating facility. Because of the modular nature of UCG (i.e., commercial configuration would comprise a multiple array of systems of a type similar to those in pilot tests), demonstration before commercialization does not appear to be warranted at this time.

The Western medium-Btu gas project is expected to provide a medium-Btu gas for chemical feedstocks or as an upgraded gas, a source of synthetic pipeline gas for use in the national pipeline network. The encouraging test results from this past year and the increasing demand for synthetic pipeline gas projected over the next few years could lead to the commercialization of this technology in the late 1980s.

The commercial application of UCG technology to Eastern coal and steeply dipping beds is not expected until the late 1980s or early 1990s, assuming that the technological uncertainties and environmental concerns associated with these options are adequately resolved.

Liquid fuels

Increased production of domestic oil. The phased decontrol of domestic crude oil prices is expected to reduce petroleum imports by increasing the incentive for domestic production of oil and reducing consumer demand for petroleum products. By 1990, the increase in domestic production is expected to be 0.4 to 0.7 million bbl/d. The reduction in domestic consumption attributable to decontrol will also be substantial. By 1985, decontrol will reduce domestic petroleum consumption by 0.3 to 0.5 million bbl/d. By 1990, the reduction is estimated at 0.4 to 0.7 million bbl/d.

Coal-oil mixtures. Pulverized coal mixed with No. 6 fuel oil appears to be a viable near-term alternative fuel for oil-fired systems. With proper suspension additives, mixtures containing up to about 30% coal can be fired in industrial and utility boilers and furnaces with little or no derating. Generally, burner modification is required to maintain stabilized combustion. This technology is not new and has always suffered from the corrosive and erosive nature of the coal components during combustion. However, it appears that burner nozzle metallurgy and design is approaching the stage where coal-oil mixtures can become an article of commerce.

Enhanced oil recovery. Enhanced oil recovery (EOR)⁵ involves in situ modification of the reservoir conditions or oil resource characteristics to improve the recovery of oil. Because primary recovery (from reservoir pressure) and secondary recovery (from water injection) can only capture about one-third of the oil in place, enhanced oil recovery has the potential to greatly expand the size of the nation's recoverable domestic reserves. In the United States alone, some 300 billion barrels will remain in place after past and current production of known resources.

Enhanced oil recovery is a viable, near-term option to increase recovery and production of domestic petroleum products. Actions to decontrol domestic crude oil prices will offer greater incentives for enhanced oil recovery. New production from certain enhanced recovery techniques (such as tertiary recovery) are entitled to the world oil price.

The objective of the DOE enhanced oil recovery projects is to reduce uncertainty in the selection and operation of the appropriate technology/site combinations, to expand the application of the methods, and to improve the productivity of the technology. These objectives are to be accomplished in an environmentally acceptable manner.

One or more of the enhanced recovery technologies is generally applicable to most of the nation's existing oil fields. DOE's objective is to promote wider application of the basic technologies by reducing project risk, while improving resource productivity. These enhanced oil recovery projects will increase the output of domestic reserves, thus reducing our reliance on imported oil.

Based on the July 1979 report from the DOE Working Group on Enhanced Oil Recovery, Unconventional Gas, and Oil Shale, and reinforced by industry estimates, it is believed only two EOR processes will produce significant quantities of oil by 1990. They are steam injection and CO₂ flooding. Currently, about 373,000 bbl/d of oil are produced by EOR: 250,000 by steam injection, about 100,000 by CO₂ injection, and the remainder by chemical and polymer flooding. Steam injection accounts for 99 of 196 EOR projects, 72 of which are in Kern County, California. By 1990, steam injection is expected to produce 450,000 bbl/d, and CO₂ injection, 400,000 bbl/d. Although CO₂ will have the greater rate of increase, steam injection provides greater data availability and concentration of projects, and a longer period of operation.

Both steam-soak and steam-drive processes are widely used. In the steam-soak process, large quantities of steam are injected into a producing well and allowed to soak into the formation. The heated oil, having more mobility, is then allowed to flow into the well. In the steam-drive process, separate wells are used for steam injection and oil production.

Tar sands and heavy oil. Heavy oil is defined as any oil having an API gravity of less than 20°, and these sour bitumen materials are found in tar sands. The United States appears to have about 30 billion barrels of heavy oil reserves, although estimates range from 10 to 175 billion barrels. These reserves have been found mainly in California and Utah. The Energy Security Act calls for accelerated production of heavy oil through the Synthetic Fuels Corporation to about 500,000 bbl/d (crude oil equivalent) by 1992.

Oil shale. Oil shale is fine-grained marlstone sediment rich in hydrocarbon derivatives. This hydrocarbon material, kerogen, produces a synthetic oil or gas upon pyrolysis.

The richest oil shale reserves in the United States are located in the Green River formation of Colorado, Utah, and Wyoming. The U.S. Geological Survey has identified shale oil resources at over 2×10^{12} bbl, of which 90% is in the Green River formation.

The current DOE program includes shale oil production research on true in situ methods, modified in situ methods, above-ground methods, and supporting research for oil shale processing and control technology. The DOE policy is that the technology for surface retorting is ready for commercialization. An assessment of information available to date on all methods has, however, identified specific uncertainties and concerns that affect the future environmental acceptability of commercial development. These concerns deal with air quality, water availability and quality, land disturbance, ecological effects, human health, occupational health and safety, transport and end use, socioeconomic, and compliance with applicable emission limitations.⁶

1.2.4 Coal liquefaction

The development of environmentally acceptable commercial coal liquefaction processes will provide a route to increased domestic production of fossil fuels and feedstocks. Synthetic fuels derived from coal liquefaction processes can replace refined petroleum products most effectively in two distinct markets. One market uses low-ash, low-sulfur boiler fuels suitable for clean generation of electric power and industrial steam. The other market uses high-grade fuels such as jet and diesel fuel, gasoline, heating oil, and chemical feedstocks.

1.2.4.1 Goals and objectives of the coal liquefaction program

The overall goal of DOE's coal liquefaction program is the initiation of an environmentally acceptable synthetic liquid fuel industry. The specific objectives of the program are to

- demonstrate the technical capability to commercially produce liquid and solid fuels from coal by at least four direct liquefaction processes (SRC-I, SRC-II, H-Coal, EDS*) by the mid 1980s,
- develop improved indirect liquefaction processes to produce liquid fuels from synthesis gas made from coal by the late 1980s,
- promote government incentives for commercialization of those technologies that are currently ready for development such as indirect liquefaction, and
- promote the development of more advanced third-generation coal liquefaction processes that can be demonstrated to be commercially viable in the 1990-2000 time frame.

To meet the above objectives, a coal liquefaction program has been developed which will reduce technical and economic uncertainties and allow the private sector to increase fossil energy supplies with minimum negative environmental impacts. The program will be implemented by supporting

- those technologies ready for commercial demonstration and
- longer-range, advanced research and development, novel concepts, and high-technical-risk projects.

The overall program involves a strong integrated effort including government, industry, national laboratory, and university projects.

1.2.4.2 Indirect liquefaction alternative

In indirect liquefaction, the coal is initially gasified to produce a synthesis gas (hydrogen and carbon monoxide) which is then catalytically converted to liquid fuels. There are commercially available technologies for converting synthesis gas to methanol and Fischer-Tropsch liquids. Currently, methanol is synthesized by steam reforming of methane. The other commercially available technology, Fischer-Tropsch, converts synthesis gas to a variety of hydrocarbon and oxygenated products. This process has been used commercially for over 25 years in South Africa for liquid fuel production. Because the indirect liquefaction technology already has reached a commercial stage, there are no planned demonstration programs in this area. This technology has been demonstrated outside the United States. In addition, domestically, Mobil Oil Co. has developed a coal-to-gasoline process which may be commercially viable. In fact, the U.S. General Accounting Office has stated that indirect liquefaction may be a near-term assist to the nation's energy goals largely because Lurgi gasification, the gasification step currently used in indirect liquefaction, is commercially available.

*EDS = Exxon Donor Solvent.

The thermal efficiency is approximately 45 to 55%. Liquid yields are in the range of 1.6 to 1.7 bbl of fuel oil equivalent per ton of coal for Fischer-Tropsch and 2.2 to 2.5 for methanol.

Some of the environmental impacts associated with commercial indirect liquefaction plants will be similar to those of direct liquefaction while others will not. Land disturbed for the plant, coal mining, solid waste disposal, socioeconomic effects, air and water quality, and water availability impacts will be for the most part similar. If high temperature gasification processes are used, wastewater treatment will be less extensive because the organic loading will be significantly reduced. As a result of the indirect process, converting coal first to synthesis gas and then catalytically producing the liquid fuel product, few if any potentially biologically active hydrocarbons are produced and potential health impacts are correspondingly reduced.

Government support will be provided for preconstruction activities of a limited number of commercial indirect liquefaction facilities and will include site selection, environmental licensing, and preliminary and detailed design. The objective of this program is to assure the earliest possible construction and operation of coal liquefaction plants and to obtain sufficient technical, environmental, and economic information to provide a foundation for future decisions by both the private sector and the government. These preconstruction activities are being accomplished through feasibility studies and cooperative agreements with industry.^{7,8}

1.2.4.3 Direct liquefaction alternative

In direct liquefaction, coal is slurried in a process-derived solvent and reacted in a hydrogen atmosphere under high temperature and pressure. A feature of this method is a necessary solid-liquid separation step after the hydrogenation reactor to remove unreacted coal and ash. The unreacted coal is gasified in a manner similar to the indirect liquefaction route to provide the required hydrogen. Direct liquefaction processes typically have thermal efficiencies of 65 to 75% and yields of 2.5 to 3.0 bbl of product per ton of coal.

The primary emphasis of the direct liquefaction program is to further the development of improved coal liquefaction processes that appear to be closest to commercial readiness. The selection of a particular process is based upon its economics, product slate value and potential applications, process efficiency, environmental impacts, and its amenability to accept a broad range of U.S. coals. Emphasis is placed on processes capable of producing liquids and solids for applications unsuitable for direct coal combustion. These applications include transportation, commercial/residential heating, and industrial and utility boilers.

In direct liquefaction processes, sulfur and nitrogen removal are not as thorough as in the indirect liquefaction route. At this stage of development, the greater thermal efficiencies and yields of the direct hydrogenation processes are expected to generate products that are less expensive than those from indirect processes.

To cover the goals and objectives adequately, to minimize risks, and to provide the private sector with sufficient options for commercialization, four processes — SRC-I, SRC-II, H-Coal, and EDS — have been chosen for primary emphasis. All four of these processes appear to be commercially viable and represent the most advanced processes under study. For these reasons, DOE is supporting them in the current program, rather than foreclosing its options prematurely. One other process, Char Oil Energy Development, a pyrolysis process capable of producing liquids as well as gas and solid fuel from coal, is being examined in the high-Btu gasification program as part of the proposed Illinois Coal Gasification Group demonstration project. The strategic objective is to develop the capability for commercial deployment of plants producing the most economic clean synthetic liquid and solid fuels by the late 1980s.

SRC-I and SRC-II

Two demonstration plants based upon differing versions of solvent refined coal direct liquefaction technology are proposed for design, construction, and operation. Each plant will consist of one module of a full-sized commercial plant and will produce fuels suitable for use in boilers or as feedstocks for refineries. Two pilot plants are initiating operations for the other direct liquefaction technologies, EDS and H-Coal. The SRC-I and SRC-II processes have been selected for demonstration because they are in a more advanced stage of development than EDS and H-Coal. The SRC-I process yields both liquid and solid products. The SRC-II process yields no solid products and a significantly larger fraction of liquid products.

The SRC demonstration plants will

- provide an accurate basis for determining investment and operational costs for commercial-sized applications of the technology,
- demonstrate the environmental acceptability of the fuel product and allow assessment of the marketability of a range of fuel products obtainable from the process,
- demonstrate the technical viability of the process steps, as well as increase industry's confidence in the improved materials, design, and fabrication technologies that are needed for commercial-scale applications,
- provide technical and economic data that can be transferred to other coal liquefaction technologies, and
- provide the environmental, health, and safety data base necessary to permit commercialization of the processes.

These demonstration plants will also support the H-Coal and EDS processes by providing data on those operations common to all processes. Such operations include coal handling, gasification of the unreacted coal matter, and product fractionation. The environmental, health, and safety aspects of these two processes are similar to those of the SRC processes and information in these areas also will be applicable.

H-Coal

The H-Coal process is a catalytic hydroliquefaction process that converts high-sulfur coal to either a boiler fuel that will meet sulfur emission regulations or to a refinery synthetic crude oil. The process is based on a unique reactor concept which has substantial scale-up background in commercial petroleum processing. Construction of the 600-tons/d pilot plant at Catlettsburg, Kentucky, started in January 1977. Construction has been completed, and the plant is in the initial stage of operation.

An industry consortium sponsoring the H-Coal project is presently composed of the Electric Power Research Institute, Ashland Oil, Standard Oil of Indiana, Conoco Coal Development Co., Mobil Oil, and the Commonwealth of Kentucky. This project is co-funded with industry, with 87% of the current estimated total cost provided by DOE. The H-Coal plant will be operated in two modes to produce either synthetic crude oil or heavy fuel oil. Successful plant operation will accelerate commercial development of this technology by providing data for the design of a commercial-scale facility. Supporting laboratory-scale and process development with experimentation will continue.

EDS

The EDS process liquefies coal through the use of a recycled hydrogen donor solvent obtained from a coal-derived distillate. The donor solvent process transfers hydrogen to the coal, thus promoting liquefaction of the coal. Following solid-liquid product separation by distillation, the solid residue (bottoms) can be sent to a flexicoker to produce additional liquids and low-Btu gas for in-plant fuel. Hydrogen is provided by steam reforming of gases and recycled to the liquefaction and solvent hydrogenation sections. Another design option is to gasify the solid residue to produce hydrogen. The process is sufficiently flexible to allow for different coal feed and to produce a variety of liquid products to meet market demand. A 250-ton/d pilot plant is being operated by Exxon at Baytown, Texas.

1.2.4.4 Advanced liquefaction development research

In the United States, government involvement in research and development has generally been justified when one of the following criteria apply:

- the costs and benefits to individual elements of the private sector are not commensurate with the costs and benefits to the nation as a whole,
- the funds required to bring research and development to a successful conclusion are too great or the risks so high that only the largest firms are capable of undertaking the task and, as a result, the competitive position of smaller firms within an industry may be damaged and adoption of the technology retarded, and

- information is required for such government functions as planning, formulating policy, and establishing regulations and incentives.

Following these criteria, a Federal role in synthetic fuels research has been developed. The uncertain nature of future energy prices, high development costs, and technical risks associated with the development of new synthetic fuel technologies has justified Federal support. Finally, research, development, and demonstration of environmental control technology have been supported since such activities provide information needed to formulate environmental regulations.

Significant effort is devoted to engineering studies and analyses that are required to guide and evaluate process development work. Two major problem areas, common to most liquefaction processes, are under study: utilization of bottoms containing ash and unreacted coal for hydrogen production and durability of auxiliary equipment. Other supporting research consists of developing improved catalysts and techniques for refining of coal liquids.

1.2.5 Need for environmental, health, and safety information

The development of environmental, health, and safety information is one of the objectives of DOE's coal liquefaction program. Process development priorities are safety, environment, operability, flexibility, yields and efficiencies, reduction of technical risk, schedule, cost, and economics.⁹

The Fort Lewis SRC pilot plant operation includes both onsite and offsite environmental monitoring programs to document the quality of the working and neighboring plant environment. In addition, the toxicology characteristics of process liquids and solids are being studied, as discussed in Sect. 4.1. A coordinated SRC biomedical testing program has been initiated. Similar studies are under way for upgraded coal liquids in support of commercialization plans. Environmental studies are under way to assess state-of-the-art and advanced environmental control technologies for liquefaction process applications. DOE and the Environmental Protection Agency, through the use of Environmental Control Assessment Plans and Pollution Control Guidance Documents, are involved with this effort.

A similar toxicology program is being prepared for H-Coal and EDS products and for upgraded coal liquids in support of commercialization plans. Environmental studies also are under way to assess state-of-the-art and advanced environmental control technologies for these liquefaction process applications.

Handling and transportation of vast quantities of petroleum products is practiced daily by the petroleum industry. While there are hazards associated with these activities, when the quantities of materials involved are considered, the accidents that do occur are infrequent. In physical characteristics relevant to handling and transporting, coal-derived liquids appear to be no different from petroleum products. However, the toxicological properties are expected to be different from petroleum (Sect. 4.1).

Congress has passed many environmental laws in the past several years. Coal liquefaction processes with their concomitant gaseous, liquid, and solid discharges must meet the requirements, of, among others, the Clean Air Act, the Clean Water Act, the Resource Conservation and Recovery Act, and the Toxic Substances Control Act. Many emissions from coal liquefaction plants are identical to those from gasification and, to a large extent, combustion systems. However, DOE has identified three issues unique to liquefaction.⁵

- development of particular industrial hygiene programs to ensure worker safety in liquefaction plants,
- identification of the sources of potentially carcinogenic, mutagenic, and toxic compounds in order to control normal operational emissions as well as accidental leaks and spills, and
- treatment of wastewater containing phenols and final disposal of sludges and solid wastes.

1.2.5.1 Health risk assessment methodology

The major components of a technology health risk analysis are represented schematically in Fig. 1.1. Risk assessments may be discussed using the generic framework of Fig. 1.1 with the components defined as follows.

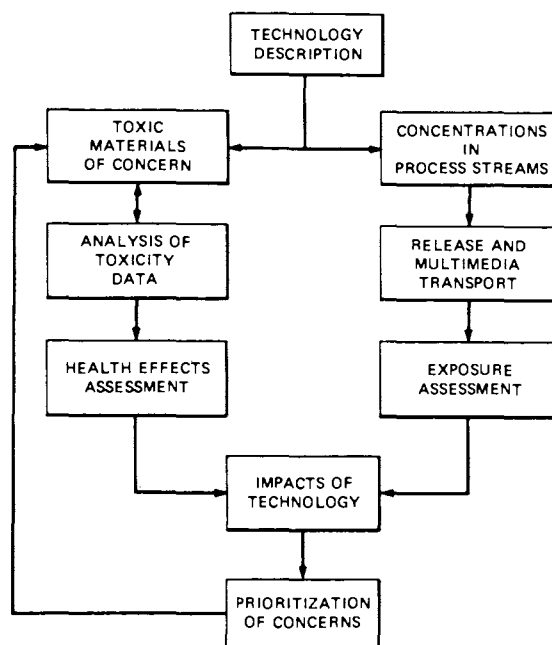


Fig. 1.1. Scheme for technology assessment.

Technology description

Technology descriptions are process designs for fuel cycles or components of fuel cycles, including input, intermediate, and product streams and environmental control technology. Process descriptions include sufficient detail to identify potential releases that may affect occupational or public health. During development of the technology description, a list of materials of potential concern must be developed. The list of materials of concern for synfuel technologies is based on information from related processes and on biological, chemical, and physical measurements for bench-, pilot-, or demonstration-scale experiments in support of the development of commercial-scale synfuel facilities. The biological data base for selection of materials of concern is discussed further under health effects assessments.

Exposure assessment

Exposure assessment is defined as assessing the concentrations of toxic materials in space and time at their interface with target populations. Referring to Fig. 1.1, the inputs to an exposure assessment are

Source term. Concentrations of toxic materials in process streams, including chemical and physical characterization and profiles of classes of compounds. Process streams include effluent, emission, and product streams. Mass flow rates of toxic material will be essential.

Multimedia transport. Atmospheric and aquatic transformation and/or transport resulting in dermal absorption or food chain contamination. Outputs of multimedia transport models would have to include consideration of soil and sediment fate. Multimedia transport includes consideration of media interaction and direct exposure.

Chemical and physical properties. Chemical and physical characterization of toxic materials in air, food, and water at their interface with target populations.

Population exposure assessment. Identification of populations at risk. Life style, demographic patterns, and living habits can dramatically influence populations at risk.

Health effects assessment

Ideally, the output of a health effects assessment shows risk as related to exposure or dose. Risk refers to mortality or morbidity in humans. Health effects assessment involves extrapolation of toxicity data from every level of biological organization to provide human health risk data. The process is represented schematically in Fig. 1.2. Generically, the process involves identification of concerns, data procurement, information retrieval, and analysis. The major types of currently available biological data at the various levels of biological organization are as follows:

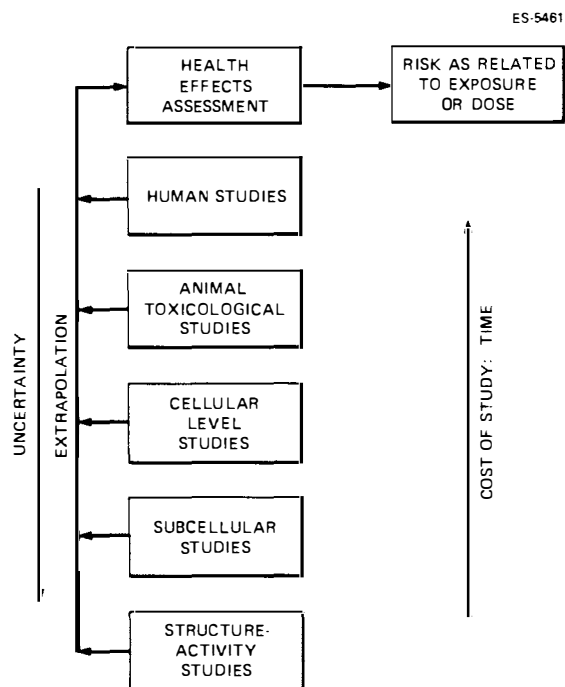


Fig. 1.2. Health risk analysis.

Human studies. Medical surveillance and epidemiological studies on occupational or public groups exposed to materials of concern for coal liquefaction technologies under consideration.

Animal toxicological studies. Dose-response relationships for carcinogenicity, life-span, reproduction, teratogenicity, and mutagenicity for materials of concern. Major parameters to be considered are exposure route, exposure rate, interspecies comparisons, mechanistic and metabolic factors, dose distribution, and predictive value for organ damage or neurotoxicity. Mathematical/theoretical models of dose-response and relevant extrapolations will be useful in descriptive applications.

Cellular-level studies. Existing data from cellular-level studies will be useful for comparing mutagenesis/toxicology of synfuels versus that of natural petroleum. These data can also be useful for screening complex mixtures as well as pure compounds in elucidating in vitro/in vivo cytogenetics and in elucidating somatic cell transformation; the data are also useful as potential bioassay systems for human exposure. Further discussion of the predictive power of cellular-level studies is given under major data needs.

Subcellular studies. Studies at the subcellular level provide information on metabolism, repair processes, complex mixture synergisms or antagonisms, and laboratory data on chemical, physical, or biological modifications that may occur between source and receiver.

Structure activity studies. The chemical structure and physical properties of a material can cause it to be suspect because of similarities to known toxic materials. As indicated in Fig. 1.2, the amount of uncertainty would be large in extrapolating such information to provide a human health effects assessment.

Health risk assessment

Health risk assessment consists of two main components: exposure assessment and health effects assessment (as described above). These compounds are combined to describe the estimated impacts on human health of the materials of concern that are associated with the given technology. Initially, the list of materials of concern may be a long one and may necessitate several successively more rigorous applications of the entire risk assessment process in order to rank the materials of concern on the basis of potential human health impacts. Worst-case assumptions regarding multimedia transport leading to exposure assessments and extrapolation of toxicity data leading to health effects assessment can be used in first application. Materials judged to be of minimal impact under such assumptions can be eliminated from further consideration. The remaining materials of concern can then be evaluated under more realistic assumptions, and data needs can be identified both for more quantitative exposure assessments and health effects assessments. The setting of priorities for data needs with respect to reduction of uncertainties can be attempted. Feedback of concerns will allow for more effective technology control modifications focused on occupational and public health concerns.

Health risk assessment is a complex activity that involves (1) extrapolation of toxicity data from high-level exposures or doses and (2) extrapolation from one biological system to another. Controversy still exists among scientists about how to extrapolate this knowledge to estimate the dose-response rate for humans. Health effects assessment must consider biological mechanisms and effects data at every level of biological organization and several dose levels in attempting to arrive at best possible estimates of human health risk as a function of exposure or dose. For example, certain trace elements are essential to the metabolic processes but at very high doses become toxic, and the dose response becomes "U-shaped" as is found with ordinary table salt (NaCl). Generally, ideal estimates are not achievable because of the lack of knowledge of the biological, chemical, and physical mechanisms of disease processes. Risk is discussed in relative or comparative terms, and dose-response models are wholly descriptive. Modelers in the descriptive sense and those who have attempted mechanistic models find that available biological effects data are not collected to test any particular holistic model, and furthermore, available data can be "fitted" by using several models. Often, experiments become "servants" of other experiments, and not enough attention is given to the hybridization of biological experimentation and model or concept-hypothesis testing. If "fitted" models diverge by orders of magnitude at low-level doses, little will be learned from their use. Clearly, health effects assessment requires a strong element of professional judgment across many disciplines, and mechanistic models should apply reasonably well at low rates provided all appropriate mechanisms have been considered.

The assessment methodology illustrated in Figs. 1.1 and 1.2 provides the framework for coal conversion assessments. Several areas needing study are already apparent, especially as they relate to guidance for the estimation of health risks. Guidance must be derived on the basis of existing epidemiological, toxicological, and theoretical data, supplemented by short-term toxicity testing data. Such supplemental data are of particular importance for the coal conversion program because, in many cases, process samples will be complex mixtures of compounds for which little or no toxicological data will be available. Currently we can state only that toxicological data should be obtained in such a way that toxicity of a complex mixture can be bracketed by the better known toxicities of individual compounds.

1.2.6 Alternatives

Of the alternatives to coal liquefaction, no single technology is expected to be capable of making up the amount of oil projected from coal-derived liquids. It is possible, however, that a combination of alternative sources could produce fuel equal in amount to that expected from liquefaction.

The alternatives include

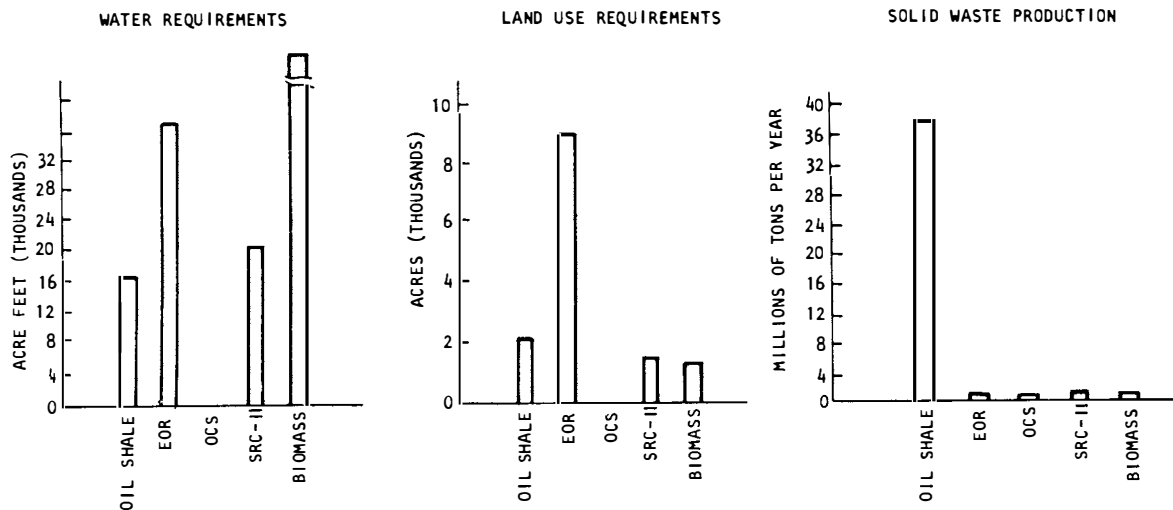
- increased domestic oil production,
- oil shale development,
- enhanced oil recovery,
- outer continental shelf petroleum,
- tar sands and heavy oil,
- biomass/alcohol,
- imported oil,
- coal-oil mixture, and
- no action.

Several alternative liquid fuels and their associated impacts are discussed in ref. 6 and are briefly described in the following sections.

1.2.7 Environmental impacts of liquid fuels alternatives

Developing any of the liquid alternatives listed in Sect. 1.2.6 will have adverse effects on the local environment where such development occurs. The degree of impact will depend on factors such as emission rates, water requirements, successful use of mitigating measures, and on the ability of the environment to accommodate the residual factors. In the following discussion, an overview of the major potential environmental impacts of the liquid fuels alternatives is presented. In addition, the environmental impacts of selected liquid alternatives are graphically compared in Figs. 1.3 and 1.4. The potential for water quality degradation and health and safety hazards for several liquid technologies are compared in Fig. 1.5.

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*Data from Chapters 2, 4 and Appendix C; data for other energy alternatives from Reference 11.

Figure 1-3. Water Requirements, Land Use and Solid Waste Production Comparisons for 100,000 BPD Energy Alternatives

Fig. 1.3. Water requirements, land use, and solid waste production comparisons for 100,000 bbl/d energy alternatives. Sources: SRC-II values from Sects. 2 and 4 and Appendix C; other data from *Draft Environmental Impact Statement, Development Policy Options for the Naval Oil Shale Reserves in Colorado*, vol. 1, August 1980.

1.2.7.1 Increased domestic oil production

Increased oil production would likely occur both onshore and offshore in Alaska and the continental 48 states. The environmental impacts resulting from refining and consumption of petroleum would be similar for both synthetic and natural fuels; however, the refining technology would be more extensive for synthetic fuels. Similar to increased production of syncrudes, increased production of petroleum would result in conjunctive developments, such as construction of pipelines and roads, and transportation of crude oil by tanker. Reference 6 discusses these environmental impacts more fully.

1.2.7.2 Oil shale development

Air quality concerns associated with oil shale relate to (1) the production of both criteria pollutants (e.g., carbon monoxide, sulfur dioxide, nitrogen oxides) and noncriteria pollutants from surface and in situ retorting, and (2) particulate matter and noncriteria pollutants associated with dusts from mining and crushing of raw shale and resuspension of disposed spent shale.

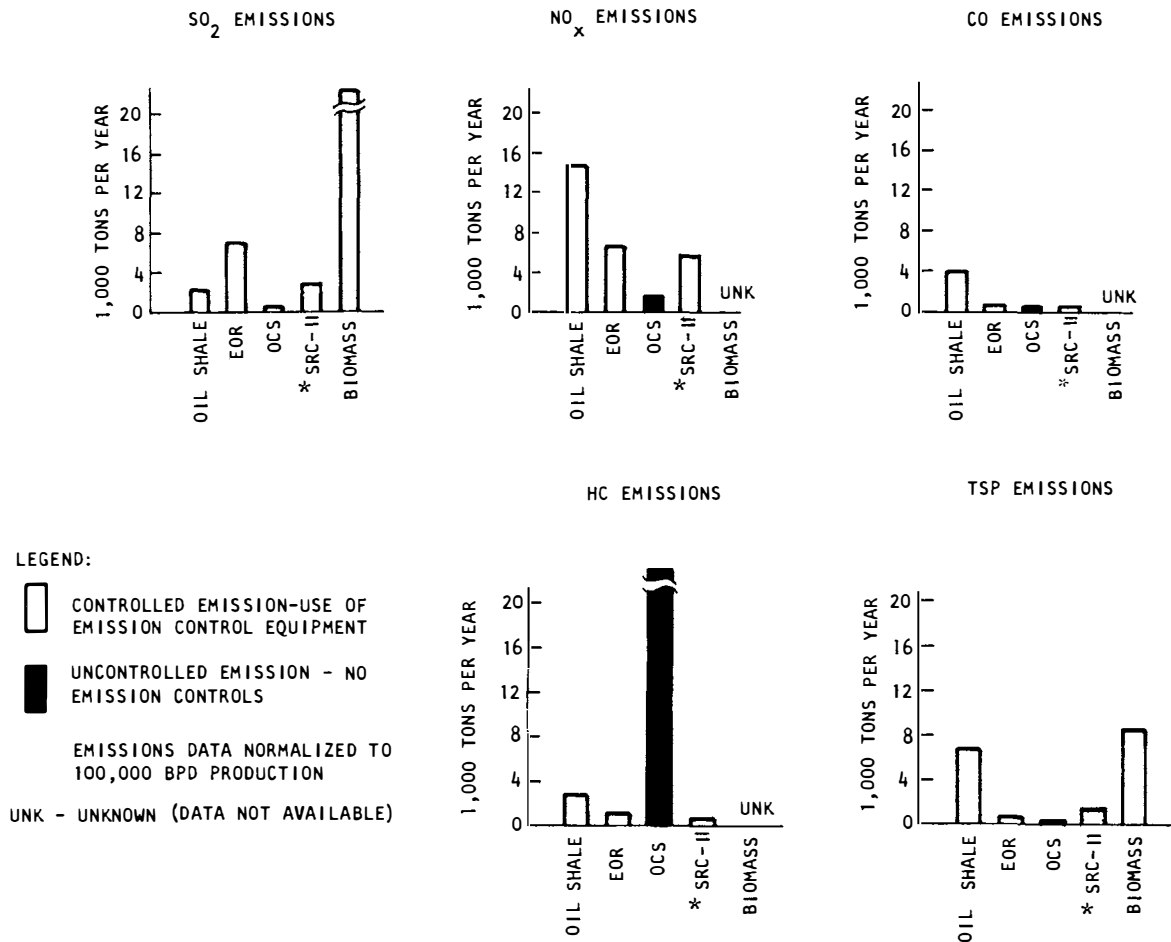


Fig. 1.4. Air pollutant emissions normalized to 100,000 bbl/d production level. Sources: SRC-II values from Sect. 2 and Appendix C; other data from *Draft Environmental Impact Statement, Development Policy Options for the Naval Oil Shale Reserves in Colorado*, vol. 1, August 1980.

Water resource impacts encompass effluent control and water supply. In the semiarid Piceance and Uinta geological basins in Colorado and Utah, where most of the high-quality oil shale is found, water pumped from mines or drawn for process use is expected to be recycled or consumed. Effluent problems are focused on potential contamination of aquifers and surface waters by leaching from spent shale piles, by evaporative and lagoon concentrates, or from burned-out in situ retorts, rather than direct emissions. Problems with in situ processes caused by backflood water and fugitive gas emissions may result in contamination of groundwater aquifers. Groundwater supplies and surface water supplies fed by groundwater aquifers might be affected for very long periods of time, thereby creating difficulties in securing adequate water supplies for retort operations.

Stabilization and management of spent shale and other wastes from surface retorting processes will require additional research, development, and demonstration before the leaching concerns are resolved. For surface operations, long-term information is lacking on stabilization of shale piles, leachate rates, and retort and other wastewaters as they may affect surface water and groundwater. There is a lack of knowledge about the changes in form and toxicity of inorganic and organic residuals that may occur by microbial or chemical reaction.

The effects of in situ processes on groundwater and the relationships between groundwater and surface water impacts are poorly understood. The variables that affect the quantity and quality of retort water are also poorly understood. Means have not been developed for preventing contamination of groundwater aquifers by backflood water for in situ operations.

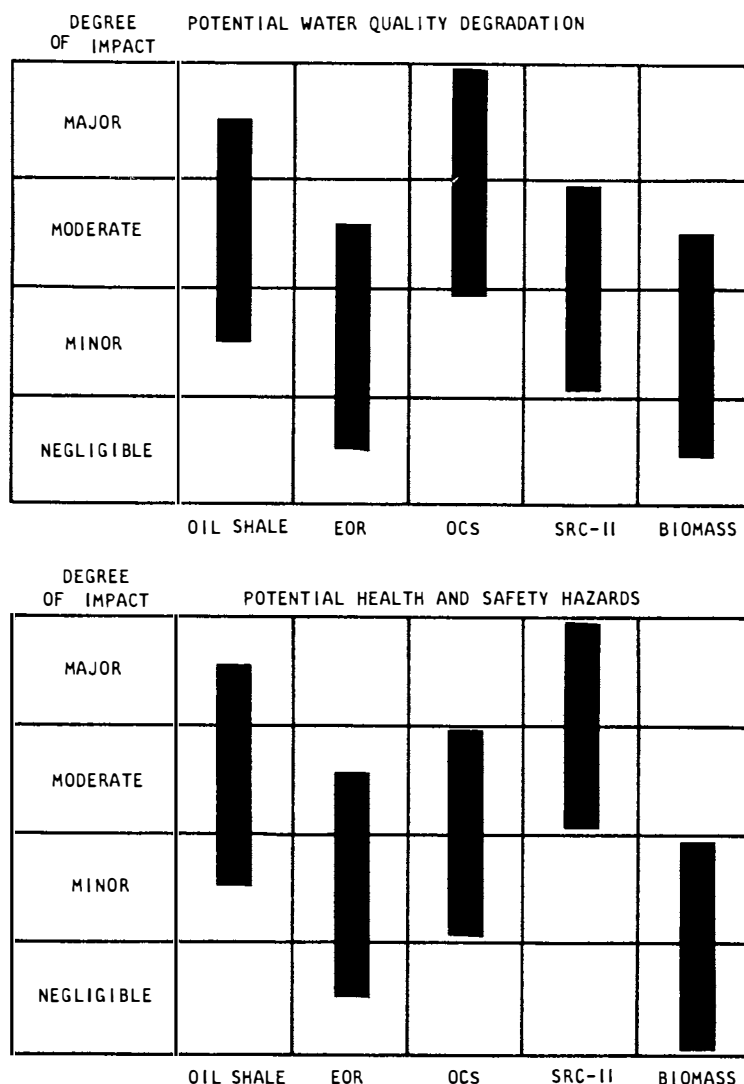


Fig. 1.5. Qualitative and subjective comparative assessment of the potential for water quality degradation (based on worst case, not assuming zero discharge) and health safety hazards.

Major uncertainties exist with surface retorting concerning the large volumes of spent shale for disposal. Disposal of spent shale and storage of raw shale could create land disturbances of large magnitude, potential accumulation of toxic substances in vegetation, and contamination of groundwaters and surface waters from runoff.¹⁰

1.2.7.3 Enhanced oil recovery

Steam flooding, the thermal method selected for the reference case, utilizes separate injection and production wells. Injecting steam enhances the recovery of heavy oils by expanding the oil and reducing its viscosity, by pushing the oil toward the recovery well, and by steam distillation.

Air emissions from the steam injection process result chiefly from the coal- or oil-fired boilers necessary for steam production. Hydrocarbon emissions may be released if the storage tanks and production wells are not equipped with vapor recovery systems or during oil spills or other accidents.

Steam flooding is a water-consumptive process. The production of 100,000 bbl of oil per day would require approximately 38,000 acre-ft of water per year.

Contamination of groundwater sources through leaks in well casings generally is a concern in pressurized injection operations and in oil production in general. Spills of oil or produced brine could occur as the result of accidents at the wellhead, storage facilities, or along the transportation route.

Because oil produced by steam flooding does not require upgrading before transportation, the most significant source of solid waste is the sludge resulting from pollution control equipment necessary for controlling emissions from boilers. Other solid wastes generated by steam flooding operations include drilling muds and fines, and wastes from site preparation. Drilling muds and scrubber sludge may contain toxic substances which could potentially degrade water quality. However, solid wastes generated by this alternative are generally less hazardous and of much smaller volume than those produced by the oil-shale alternative.¹¹

1.2.7.4 Outer continental shelf petroleum

Air emissions result primarily from fuel combustion for power generation and from oil storage and processing. Additional emissions may result from well fires or oil spills. If a gas blowout were to occur, methane and other light hydrocarbons would be released, as well as hydrogen sulfide.

Water impacts may result from oil spills, which can introduce large quantities of organic compounds into the water column. If the oil is spilled beneath the surface from a ruptured pipeline, much of the oil would be taken into the water column. If oil is spilled at the surface, it may form slicks that cover a considerable surface area. The rate of discharge and duration of the spill also determine the types of effects the spill will have. Spill transport depends upon such factors as location, meteorological conditions, currents, and tides. These factors, as well as the location of vulnerable resources, will determine how much damage is caused by the spill.

Water quality will be affected by increased turbidity resulting from the disposal of solid wastes such as drilling muds and cuttings. Large quantities of sediment also are suspended during pipeline placement and burial.¹¹

1.2.7.5 Tar sands and heavy oil

The environmental effects and resulting problems associated with the development of a tar sand production industry are expected to be generally similar to those of other extractive industries, especially oil-shale operations using open pit mining and above-ground or in situ retorting. These impacts are discussed under Oil Shale.

1.2.7.6 Biomass/alcohol

When corn starch is converted to alcohol by means of hydrolysis and fermentation, approximately equal weights of ethanol and carbon dioxide are formed in the processes. This CO₂ is usually vented to the atmosphere. Little information exists regarding the specific nature of the hydrocarbons associated with this exit gas. Some writers have suggested an arbitrary 1% loss of product (ethanol). Odor is occasionally mentioned as an environmental problem in residential areas but can be avoided by use of modern closed fermenters with well-designed and properly maintained equipment.

Aside from the studied emissions of any power plant used to supply process heat, the largest emission of particulates from ethanol production occurs in the front and back end of the plant, that is, from grain elevators, screening and grinding of corn in the beginning, and during the drying and handling of spent distillers' grains in the by-product area. Emissions are generally controlled by gas cyclones followed by fabric-bag filters.

Estimates of residuals have been made for a 20-million-gallon-per-year ethanol plant. The amount of raw waste might range from approximately 12 to 55 gal per gallon of product. The waste may contain contaminants equivalent to 0.12 to 0.17 lb of BOD₅ (five-day biological oxygen demand) per gallon of ethanol product.

The main source of solid waste is biological growth associated with secondary treatment of the liquid waste previously mentioned. Approximately 0.5 lb of excess activated sludge can be expected for each pound of BOD₅ removed. Assuming that the raw waste contains 0.17 lb of BOD₅ per gallon of product ethanol, 95% removal corresponds to 961 tons of BOD₅ removed per 10¹² Btu produced. Excess waste, then, will amount to 480 tons per 10¹² Btu.

Solid wastes from biomass farms for methanol production should be minimal, because optimum use of the yield should be the prime goal of biomass technology. However, sediment loading of waterways will result from conventional logging techniques. For a 170,000 gal/d methanol plant with activated sludge treatment, it has been estimated that 0.64 ton/d of BOD₅ would be produced along with six tons/d of waste activated solids and 25 tons/d of ash and unburned carbon.¹⁰

1.2.7.7 Coal-oil mixture technology

Increased environmental effects resulting from converting from oil to coal-oil mixture (COM) boiler and furnace firing would be caused mainly by combustion differences. Environmental impacts expected in COM preparation operations parallel those experienced with coal-fired power plants. The mixing would occur in a closed system and requires no water, and land use would consist of the standard coal-fired power plant coal storage pile, plus a relatively small area for COM mixing and short-term storage.

The combustion efficiency of COM firing — about 98% — approaches that of oil firing, and the environmental impacts lie between coal- and oil-fired systems.

Sulfur, nitrogen, and mineral matter content all will be increased over that of oil alone. Typically, fuel oils contain mineral matter at levels ranging from trace quantities to not over 0.1% although some coals have over 30% mineral matter. Thus, at a 30% coal loading in COM the mineral matter could be increased to 9% from 0.1%. Emissions of sulfur dioxide, nitrogen oxides, and particulates will be increased, perhaps to the point of requiring control system modification or retrofit. In addition, unburned hydrocarbon emissions including polynuclear aromatics may occur. Thus, the environmental controls required for combustion would consist of those, albeit to a lesser degree, which are employed in coal-fired power plants.

Likewise, wastewater streams and treatment (boiler and cooling tower blowdown, floor and equipment drains, etc.) would be similar to those in coal-fired power plants. Due to the inherently erosive nature of COM mixing and pumping operations, pump and valve leaks and spills could be expected. This is the single operation that may set COM technology apart from coal- and oil-fired systems. Thus, backup systems, soil-surface treatment, and component location should be considered in developing COM technology.

1.2.7.8 Imported oil

Increasing imports of petroleum create significant problems, most importantly, the question of national security and the effect on the nation's balance of payments. The potential environmental impacts resulting from increased oil imports would result from tanker operations, oil handling and transfer operations, refining operations, and construction activities, such as deep-water ports. The major impact to the human environment from increased imports is economic. In addition, an increased dependence on foreign sources for oil supplies would increase the potential impacts associated with a disruption of these imports. Consequently, this option is counter to the objective of the proposed action and is not analyzed in detail. Discussion of the impacts resulting from increased imports is presented in ref. 6.

1.2.7.9 No action

The government could elect to take no action regarding synthetic fuels development. Under this alternative, development of direct liquefaction technology would be left entirely to the private sector of the economy. Since there are technical and economic risks associated with any new venture, technology development would occur later in time, further delaying the deployment of commercial facilities. This in turn would continue our heavy dependence on imported oil. In addition, private sector development without DOE involvement probably would not emphasize environmental research at an early date. It is possible that environmental impacts could be more severe under the no-action alternative than with government support or that more delay in commercialization would be experienced in order to develop the necessary environmental technology.

1.3 PURPOSE AND NEED FOR THE PROPOSED ACTION

1.3.1 Summary

The SRC-II demonstration plant will produce, in addition to pipeline gas, a variety of liquid products that fit directly into existing energy consumption markets substituting for liquid petroleum products. The primary product, a low-sulfur distillate fuel oil, has applications in the utility and industrial markets where it may be substituted directly for No. 2 and No. 6 fuel oil.

Demonstration of the SRC-II process will enable design and construction of multiple commercial plants from the basis of a single demonstrated design. The basic SRC-II liquefaction step uses no catalyst and consequently does not carry the operational uncertainties associated with catalytic systems. The SRC-II process is not as sensitive to coal source as other direct liquefaction processes.

1.3.2 Purpose

The purpose of the proposed action is to demonstrate that the SRC-II process is a viable and competitive option for meeting the national need for alternative energy sources to reduce oil imports. Operation of the demonstration plant will provide the information required to minimize technical and economic risk, confirm the effectiveness of environmental control systems, and encourage the transition to commercialization. Without government support, private industry would scale-up the SRC-II process plant in smaller steps, and commercial demonstration would be delayed for several years.

The technical feasibility of the SRC-II process has been proven by the operation of both bench and pilot-scale facilities including the 50-tpsd facility at Fort Lewis, Washington. Although this facility and the smaller test unit at Harmarville, Pennsylvania, have provided information necessary for the scale-up of the SRC-II process equipment, there are still a number of areas of technical uncertainty associated with the construction and operation of a commercial facility with adequate capacity to be economically viable. These areas of uncertainty cannot be fully resolved by the operation of pilot-scale facilities. Because many of the equipment items of greatest concern would be replicated in a commercial-capacity facility, adequate information can be obtained from operation of a facility utilizing commercial-scale equipment but having an overall capacity significantly less than that required for economic viability. By providing for testing and production under near-commercial conditions, a demonstration plant can minimize the technical and economic risks associated with construction of the first commercial plant. Also, by providing an opportunity for design of the commercial-capacity facility based on monitoring and control equipment evaluation during its operation, the demonstration plant can significantly reduce the environmental risks associated with commercialization.

The DOE program strategy is to concentrate resources and effort in the direct liquefaction area where economic payoff is potentially greatest but where technology has not advanced sufficiently to result in private sector movement to build commercial plants. Furthermore, the strategy is to provide industry with enough processing flexibility and options to respond to a wide and shifting fuel market. Support of the H-Coal, EDS, SRC-I, and SRC-II projects provides that flexibility. The SRC-I and SRC-II processes have been determined to be ready for demonstration. Of the two processes, SRC-II produces a significantly larger fraction of liquid products that could substitute for liquid petroleum products. The underlying strategy in the SRC-I and SRC-II demonstrations is to design the plants as first modules of commercial plants and to develop plant sites that would permit expansion to full commercial plants.

Products anticipated from a future SRC-II commercial plant (30,000 tpsd coal feed) are:

Methane	129 million scf/d
Ethane	1,100 tpd
Propane	12,000 bbl/d
Butanes	8,000 bbl/d
Naphtha (C ₅ -350°F)	13,200 bbl/d
Fuel oil (350-900°F)	57,500 bbl/d
Sulfur	800 tpd
Ammonia	150 tpd
Phenols	35 tpd

The liquid products from the SRC-II process are different from those normally derived from petroleum. They contain less hydrogen (are more aromatic) and contain more oxygen and nitrogen than petroleum fuels. They are, however, lower in sulfur than most crude petroleum.

The naphtha fraction from the demonstration plant will be hydrotreated to remove the nitrogen, sulfur, and oxygen and then reformed to make an excellent gasoline blending stock. This is also the expected disposition of naphtha from the future commercial plant.

The proposed markets for the SRC-II fuel oil (middle and heavy distillates) are the electric utility and industrial markets which traditionally have used petroleum fuels. In this way, petroleum fuels may be displaced by the coal-derived fuel oil product obtained from the SRC-II process. Substantial research and development suggests that this can be done with relatively minor boiler modifications. A full-scale test in a Consolidated Edison steam boiler burned some 4,500 bbl of SRC-II fuel oil while meeting all emissions regulations with fuel boiler modifications.

SRC-II fuel oil could be upgraded to liquid products that are completely interchangeable with those derived from petroleum. DOE-sponsored research at Chevron Research Company and other laboratories has indicated that this is feasible. SRC-II fuel oil could be treated to manufacture gasoline, home heating oil, and commercial jet fuel. The additional cost is comparable to the cost of refining crude petroleum and is expected to range from \$10 to \$14 per barrel (1980 dollars). However, because the purpose of the demonstration plant is to demonstrate the feasibility of producing boiler fuel for the utility and industrial markets, hydrotreating of the fuel oil, which may have environmental benefits, is not contemplated for the demonstration plant products.

SRC-II demonstration plant project objectives that serve the purpose of the proposed action are to

- provide an accurate basis for determining investment and operating costs for commercial application of this technology, including required environmental control equipment and operating procedures,
- demonstrate the technical feasibility of certain process steps at commercial capacity, and provide other technical information on process integration, materials of construction, equipment design, and fabrication techniques needed for commercial operation,
- provide adequate supplies of SRC-II fuel products for long-term commercial-scale combustion tests necessary to demonstrate product use in existing and new electric utility and industrial applications,
- provide adequate supplies of SRC-II fuel products for long-term emission testing necessary to demonstrate the environmental acceptability of the fuels for direct use, and to characterize the control equipment or modifications necessary for compliance with applicable emission limitations,
- monitor plant emissions and evaluate environmental control and mitigation measures,
- allow assessment of the marketability of the range of products obtainable from a given coal,
- expedite commercial application of the SRC-II process by providing a site for the demonstration plant that is suitable for expansion to the first commercial facility,
- provide, through successful operation, significant technology advances that would not otherwise occur, which will also be used to optimize the use of other coal liquefaction technologies in such areas as hydrogen generation.

Typical liquefaction products and markets are shown in Table 1.2.

Table 1.2. SRC-II petroleum product markets

SRC-II process streams	SRC-II-derived products	Petroleum products	
		Displaced	Made available
Methane-ethane	Pipeline gas	Home heating oil	Home heating oil
Propane-butane	Propane, butane	Liquefied petroleum gas	Liquefied petroleum gas
Naphtha	Gasoline feedstock		
Middle/heavy distillate blend	High-quality boiler fuel	No. 2 and No. 6 fuel oil	Refinery feedstock for all products

1.3.3 Need

With the passing of the Energy Security Act by Congress in 1980, the reduction of oil imports became a matter of national policy. That Act established production goals of 2×10^6 bbl/d by 1992 for synthetic fuels. Although every viable technology will be needed to achieve these goals, direct liquefaction promises to be a major component of the needed facilities.

Primarily as a result of the extended pilot plant operation at Fort Lewis, the SRC process for direct liquefaction is considered to be more nearly ready for commercial operation than either the H-Coal or EDS processes and is being considered for demonstration at commercial scale. The

H-Coal and EDS processes are being further developed through the operation of large pilot plants (250 to 600 tpsd) which began operation in 1980. In combination with the information obtained from the SRC demonstration plants, the experience gained from the operation of these pilot plants is expected to allow construction of commercial capacity plants without intermediate demonstration plants. Information gained from the initial operation of the H-Coal and EDS pilot plants will be used in the final design of the SRC demonstration plants.

The SRC-II demonstration will determine the extent to which SRC-II fuel oil can displace petroleum in a variety of electric utility and industrial equipment applications. A group of electric utilities in the northeastern United States has indicated its interest in purchasing the SRC-II product and demonstrate its use in utility steam boilers and stationary combustion turbines. It is expected that industry will be involved in demonstrating SRC-II fuel oil usage, both in boilers and direct heat applications. Those applications represent a very large petroleum fuel market.

According to the recently published DOE study entitled "Reducing Oil Vulnerability" (DOE/PE-0021, dated November 10, 1980), the expected 1990 oil consumption in utility and large industrial plants is 3.0 quads. This study takes into account the potential reduction in oil consumption due to the Fuel Use Act requirements. The vulnerability study also projects 5.3 quads of 1990 natural gas use in utility and large industrial boilers. Although the exact number is not available, some portion of the boiler capacity using gas will also have the capability to use residual oil.

Thus, there appears to be a market of well over 3 quads for residual oil in 1990, which would mean more than 50 SRC-II commercial-sized plants, so market size does not seem to be a constraining factor.

The projected market opportunity for SRC-II fuel oil in the East Coast area of the United States is presented in Table 1.3.

Table 1.3. Potential SRC-II fuel oil demand
(selected East Coast U.S. areas, 10^3 bbl/d)

Year	Total fuel oil	Utility boilers ^a	Utility combustion turbines ^a	Industrial boilers ^b
1990	995	440	270	285
2000	800	130	360	310
2010	870	20	510	340

^aPotential demand from 11 large East Coast electric utilities.

^bPotential demand in Region 2 states: New York, Pennsylvania, Virginia, West Virginia, Delaware, and New Jersey.

This projection of market opportunity is conservative because of the limited regional scope.

The method of generating base load and intermediate load electric power is expected to change in the future, with baseload generated increasingly from nuclear and coal units and use of petroleum and natural gas decreasing. Direct firing of coal will be used heavily in the near-term, but eventually, new coal-related technologies such as high efficiency combined-cycle units fueled with coal-derived liquid or gas fuels will be utilized.

Technologies involving the use of coal or the conversion of coal to another fuel at the generating station site have a number of disadvantages from the electric utilities' point of view. In comparison with coal-derived liquid fuels such as SRC-II fuel oil, in which the coal and all process wastes can be handled elsewhere, the above technologies involve (1) the complexity and associated unreliability of handling solid fuel and solid waste, (2) space requirements for the handling and disposal of solid waste, and (3) the various environmental problems that complicate site selection and involve long lead times for obtaining permits and licenses. For some urban areas with severe environmental problems and limited space at the generating station, these problems may rule out or severely limit consideration of any direct coal utilization technologies.

Recent studies on expected changes in the electric utility industry indicate that some utilities in large eastern urban areas (i.e., New York City, Connecticut, and Boston) may use advanced technology, combined-cycle units which could be fueled with SRC-II fuel oil for most of the part of their baseload not supplied by nuclear units and for almost all of their new intermediate load and peaking requirements. Most other utilities will use other coal technologies for non-nuclear baseload but will use combined-cycle units for most of their intermediate load and peaking.

The availability of SRC-II fuel oil at an acceptable supply and price level would prolong the useful economic life of most existing liquid-fuel-fired boilers. There may also be some further installation of liquid-fueled steam boiler units in urbanized areas by utilities that wish to take a conservative approach to new or developing technologies and that find it impractical to use direct firing of coal for various reasons. However, such installations might require exemptions from existing Federal law.

1.3.3.1 Process features

In the SRC-II process, feed coal is crushed, dried, and mixed with solvent to form a slurry. It is then heated, pressurized, and hydrogenated (i.e., the coal undergoes a chemical reaction with hydrogen). As the mixture is heated, the coal begins to dissolve in the solvent, becoming a liquid. Hydrocracking reactions occur, reducing the size of the molecules, and lighter hydrocarbons are produced that range from fuel oil to methane. Organic sulfur is removed by hydrogenation, becoming hydrogen sulfide. The reactions raise the temperature even higher and the hot effluent is taken through a series of high-pressure vapor-liquid separators in which the gases and light hydrocarbons are removed, leaving a heavy slurry.

Part of this heavy slurry is recycled as solvent for the coal slurry mixing, and the remainder is separated (by fractionating) into the primary products of the process (naphtha, fuel oil, and mineral residue).

The gases from the vapor-liquid separators are treated to remove hydrogen sulfide and carbon dioxide, then cooled and separated in a cryogenic unit. Pipeline gas and liquified petroleum gas (LPG) are recovered for sale, and the unreacted hydrogen is recycled. The hydrogen sulfide is converted into elemental sulfur for sale.

The mineral residue from the process is sent to the gasifier to produce hydrogen to be recycled back to the process. Inorganic material is removed from the gasifier as an inert slag, suitable for disposal or possibly for use as a fill material.

Some of the most significant features of the SRC-II process are:

- recycling of the catalytically active mineral residue to achieve extensive hydrocracking of the dissolved coal to produce liquid and hydrocarbon gases;
- gasification of any dissolved coal which remains unconverted in the hydrocracking step to provide hydrogen for the process;
- burning as plant fuel any synthesis gas in excess of that required for making the necessary hydrogen; and
- the production of substantial amounts of pipeline gas as well as low-sulfur fuel oil.

Recycling the mineral residue increases the concentration of catalytically active iron-sulfur compounds in the reactor to the point at which extensive hydrocracking of the dissolved coal can be achieved. Although the catalytic activity of the mineral residue varies somewhat with the type of feed coal, the mineral residue from essentially all bituminous coals has sufficient activity to make SRC-II a viable process. This is generally applicable to the bituminous coal deposits of the United States and especially suitable for eastern high-sulfur bituminous coals.

In general, future commercial plants using coals having a very catalytically active mineral residue will be designed for a higher level of hydrocracking and a relatively moderate quantity of mineral residue to the gasifier. The amount of mineral residue to the gasifier will be at least as high as required to produce hydrogen for the process and will, in general, be somewhat in excess of this quantity. The excess synthesis gas can be converted into additional liquid products or used as plant fuel.

For coals having a mineral residue of lower activity, the plant will be designed for a lower level of hydrocracking and a higher level of residue to the gasifier. In this case, a greater excess of synthesis gas will be produced. As an alternative procedure, active inorganic material could be added to the feed coal to achieve optimum yields.

1.4 POTENTIAL FOR COMMERCIALIZATION AND PROGRAMMATIC IMPACTS

Expansion of the coal liquefaction program to the level of a mature commercial industry will result in regional impacts on air quality, water quality and availability, solid waste disposal, socioeconomic, and land use. These regional impacts were examined generically to provide programmatic estimates of the cumulative effect of commercialization that could be attributed to the DOE coal liquefaction program. To aid in this examination, a hypothetical scenario was developed, which postulates the number of plants and general candidate locations for the plants in the 1992 time frame.

Commercialization will most likely occur in regions having access to coal fields and an adequate water supply. Once the hypothetical locations were selected, the aggregate regional environmental impacts were estimated, based on algorithms that translated the input and output characteristics of a unit liquefaction plant into characteristics of the regionally located plants.

The analysis indicated that plants similar in design and size to the unit liquefaction plant could be located in the regions considered with limited environmental degradation occurring if certain siting precepts were considered. With reasonable care in selecting sites for commercial facilities and with proper engineering design, cumulative impacts from a mature industry would not create significant changes in regional environmental conditions such as air and water quality, solid waste disposal, land use, or in community facilities and services. The exact magnitude of such impacts would depend on the eventual site selection process and on the specific location of individual liquefaction plants.

1.4.1 Unit plant emissions

For purposes of this analysis, the unit plant emissions have been estimated for an SRC-II commercial plant. In the absence of final plant designs, it is difficult to estimate accurately the total emissions arising from a commercial coal liquefaction facility. Existing emissions data are highly conceptual. Atmospheric emissions and wastewater effluents for the unit plant are presented in Tables 1.4 and 1.5, respectively.

Table 1.4. Atmospheric emissions, direct coal liquefaction processes, SRC-II unit plant for point sources

(100,000 bbl/d oil equivalent)

Emissions	Average tons/year
Particulates	1304
SO ₂	2650
NO _x	5030
CO	354
Hydrocarbons	212

Table 1.5. Treated wastewater discharges from SRC-II coal liquefaction plant^a

(100,000 bbl/d oil equivalent)

Parameters	Average concentrations (mg/liter)	Average discharge rate (tons per year)
BOD	10.0	96.0
COD	100.0	960.0
TSS	10.0	96.0
Oil and grease	5.0	48.0
NH ₃ (as N)	5.0	48.0
Phenols	0.1	0.96
Sulfate	1000.0	9581.0

^aWastewater treatment system includes a zero discharge mode during low flow conditions in the Monongahela River.
Source: Appendix C.

Potential environmental impacts due to commercialization will originate principally from four major areas of plant operation: by-products and solid wastes, environmental control technology limitations, wastewater discharges, and fugitive emissions.

A scenario involving six liquefaction plants has been used to illustrate a coal liquefaction industry. Six plants have been chosen as a reasonable estimate of the number of commercial direct liquefaction plants that may be operating in 1992. These are plants having a product output of 100,000 bbl/d (oil equivalent). Each of these consumes 30,000 tons/d of coal. Location, coal type, and relevant coal analysis are shown in Table 1.6. Of the four major

Table 1.6. Coal liquefaction commercialization scenario

State	Illinois	Kentucky	West Virginia
No. of plants	Two	Two	Two
Coal	Illinois No. 6	Kentucky No. 9	Pittsburgh No. 8
Nitrogen, %	1.3	1.4	1.2
Sulfur, %	3.4	3.4	3.6
Mineral matter, %	10.8	10.4	8.9

Sources:

1. *Process Engineering Evaluation of Alternative Coal Liquefaction Concepts*, Vol. 1, Final Report, EPRI AF-741, Project 411-1, April 1978.

2. *SRC-I: Summary of Preliminary Demonstration Plant Design Cost Estimates and Long Lead Procurement Plan* (Draft), Vol. 1, Air Products & Chemicals, Inc., and Wheelabrator-Frye, Inc.

3. *Assessment, Selection and Development of Procedures for Determining the Environmental Acceptability of Synthetic Fuel Plants Based on Coal*, Basic Report and Appendix 1, FE-1795-3 (Pt. 1), May 1977.

areas of plant operation which produce discharges, estimates of fugitive emissions present the greatest uncertainty, while by-products and certain solid wastes can be estimated on the basis of the coal analyses.

1.4.2 Description of existing environment

The coal conversion facilities under consideration are proposed to be sited in Illinois, Kentucky, and West Virginia. Since the coal type to be used at each facility can be estimated, it is possible to broadly describe the existing environment based on coal seam locations. For example, Pittsburgh coal may be used to fuel the West Virginia facilities. However, since details of the environment will depend upon the specific sites selected, the following description of water availability, socioeconomics, air quality, coal supplies, and transportation systems is very general in nature.

1.4.2.1 Water availability

The six coal conversion facilities being proposed will each require substantial amounts of water, thus it is imperative that they be located in areas where there is a dependable supply of water. If the facilities should be constructed in the Ohio River Basin, the water supply should be adequate. An extensive network of tributaries exists in this basin which can supply a substantial volume of water. The region also has a mean annual precipitation of over 40 in. of rain. Average annual runoff ranges from over 10 in. in Illinois to more than 25 in. in West Virginia. Consequently, for these facilities, there should be adequate surface water. However, should this area receive more coal conversion facilities in the future, water availability could become a possible constraint.

Because of the large water requirements of each facility, and the existing water requirements, competition for water use may develop. The navigable waterways cannot afford to have their flow significantly reduced if this would affect navigation.

1.4.2.2 Socioeconomics

The six coal conversion facilities are assumed to be located in rural areas. Nearest urban centers, the primary sources of construction and operation labor forces, are a distance from the proposed sites. The labor force may have to be imported to the sites, thereby creating socioeconomic impacts related to population dislocations. Several western coal mining areas are already experiencing "boomtown" effects of rapid growth and cyclical boom and bust cycles leading to high unemployment.

In potential areas for SRC-II facilities, unemployment in July 1980 ranged from 6 to 12% in Kentucky, 12 to 18% in Illinois, and 5 to 12% in West Virginia. Since construction of commercial facilities will not begin for several years, no firm prediction can be made as to the level of unemployment which will exist at that time. Many of the unemployed are miners, and, according to the Bureau of Labor statistics, coal mining employment has declined sharply in areas where the coal contains a high sulfur content. However, since the coal conversion facilities may be located in high sulfur content coal regions, mines will be reopened to supply feed coal to the facilities. There may be an available labor force for construction of the facilities, but

because many of the unemployed workers may be skilled coal miners, many unemployed coal miners will be reemployed as the mines open. It is likely that some of the remaining unemployed will be hired to work on the construction of the facilities. The labor force at the peak of construction of a unit plant will be about 10,000.

1.4.2.3 Coal supplies

Bituminous coals with high volatile matter and sulfur contents, suitable for utilization in liquefaction facilities, are abundant in the proposed areas. The large Pittsburgh coal seam in West Virginia and Pennsylvania is the most important of all West Virginia coals. The Kentucky coals are generally ranked as high-volatile B to high-volatile A bituminous coals. Most of these coals are below 3% sulfur. The Illinois No. 6 coal, which would probably be used at the Illinois facilities, constitutes over 40% of the total coal resources in the state. The sulfur content is relatively low for Illinois, ranging from 0.5% to 2.5% and averaging around 1.5%. The volatile matter of this No. 6 coal is high, averaging over 30%.

1.4.2.4 Air quality

Air pollution legislation is based on the goal of protecting and enhancing public health and welfare. The Clean Air Act of 1970 and its 1977 amendments authorize two programs to meet this goal.

In highly polluted areas, regulations have been set to improve air quality through the National Ambient Air Quality Standards (NAAQS). In order for a coal conversion facility to locate in an area which is nonattainment, several stringent requirements have to be met. These include emission offsets and lowest achievable emission rates.

Kentucky has several primary nonattainment areas for SO₂ and TSP. Facilities locating in these areas would have to meet more stringent requirements than if they located elsewhere in Kentucky. Small portions of the upper neck of West Virginia are primary nonattainment areas for SO₂, and the entire area is primary nonattainment for TSP. Illinois similarly has primary nonattainment areas for SO₂ and TSP.¹⁰

In relatively clean air areas, a program has been established to prevent significant air quality deterioration. All other areas in these three regions are classified as Prevention of Significant Deterioration (PSD) Class II areas. The PSD program is aimed at preserving clean air resources and preventing the development of new air quality problem areas. PSD class II areas are those areas which are in attainment, but which allow for increments of air degradation. National parks, wildernesses, etc., are classified as PSD Class I areas. In these areas, only small amounts of degradation of ambient air quality are allowable. Any facility locating in a Class II area, adjacent to a Class I area would have to ensure that ambient air quality in the nearby Class I area is not degraded by more than the allowable amount. Evaluation of the impact of SRC-II commercialization on Class I areas in the three states will require site-specific studies prior to final site selection.

1.4.2.5 Transportation systems

The coal conversion facilities are expected to be located close to existing highways, railroads, and navigable waterways. Accessibility to these transportation networks will be advantageous during the construction phase for moving materials to the facility site and for transporting product fuels from the site.

Coal transport to the facility will be by rail, truck, or barge, depending upon the specific locations of the mine and the plant. The transportation of solid fuels from the facilities to the markets also will be via rail, truck, or barge. Illinois is much less mountainous than Kentucky and West Virginia and has the most extensive rail and highway network. Although the other regions are characterized by a more rugged terrain, they also have highways, railroads, and rivers which pass through the coal regions.

Although oil and natural gas pipelines pass through each of the regions, the liquid fuel produced at the conversion facilities may be too viscous, corrosive, or otherwise incompatible for injection into these existing systems. Insulated pipelines (similar to the Alaska Pipeline) may be constructed to transport the fuel to refineries, utilities, and/or other markets, or heatable tank cars may be used to transport the liquid product by rail.

Further assessment is needed to determine the compatibility of syncrude with materials used for petroleum transportation.¹⁵ Railroads, trucks, and tankers are more hazardous modes of transportation than pipelines.¹⁶ Due to their poor condition, the nation's railroads may transport the

least amount of synfuels products. In addition to transportation risks, exposure to the synfuels products may occur in loading and unloading trucks at storage terminals and service stations.

Equally important with the environmental advantages of using pipelines are the economic considerations. It is expected that it will be cheaper to transport coal liquids to existing refineries through a pipeline than to build new refineries. Pipelines are expected to be the most efficient and economic transporters of coal liquefaction and gasification products from synfuels plants to users in large cities across the country.⁵

1.4.3 Cumulative environmental consequences

1.4.3.1 Approach

In Sect. 1.4.1, six liquefaction plants were hypothetically sited in Illinois, Kentucky, and West Virginia. While it can generally be assumed that liquefaction plants would be located with respect to mine-mouth locations, it is not practical at this time to select specific sites for analyses. Consequently, a regionalized or state-level environmental assessment has been developed in the following section based upon two unit liquefaction plants located within each state and the coal mining requirements necessary to supply these plants when intrastate coal is available for use. As the synthetic fuels program evolves and grows, specific sites would be chosen by industry and NEPA reviews would be conducted where DOE or other Federal agencies are participants.

State-level environmental loadings associated with coal mining requirements and the construction and operation of plants located within a state are estimated on the basis of algorithms presented in Appendix BB. Where possible, the relative importance of these loadings is established by comparison with projected state-level loadings (i.e., net residuals) for energy production, processing, and end use as reported in runs of the Strategic Environmental Assessment System (SEAS).

A macroeconomic simulation model, SEAS calculates pollutant loads based on economic growth and energy supply patterns. The national energy production and consumption levels used as inputs to the SEAS model were projected by the FOSSIL2 model and reflect the president's energy initiatives as incorporated in the Second National Energy Plan. The estimates of the aggregated regional loadings from the commercial liquefaction plants and those state-level loadings projected by the SEAS model are not precise enough to represent anything more than a framework for a general comparison and to put the comparison in the proper context.

The cumulative loadings from the liquefaction plants should not be considered increases over those estimated by the SEAS model. Since the energy being produced by the liquefaction plants is already being produced in some form and way in the SEAS model, the net increase or decrease cannot be estimated.

1.4.3.2 Air quality

The U.S. Environmental Protection Agency (EPA) has promulgated Primary NAAQS (health-based) and Secondary NAAQS (welfare-based) for seven criteria air pollutants. Table 1.7 displays the current standards. Areas having air quality exceeding these levels are termed nonattainment areas. A clean air area is one whose air quality is purer than that required by an NAAQS. Significant deterioration is said to occur when the amount of new air pollution exceeds a fixed maximum allowable increase. The reference point for determining air quality deterioration is the baseline concentration, which is the ambient concentration existing at the time of the first PSD permit application submittal in the area. To date, only PSD increments for SO₂ and TSP have been established. Increments are currently under investigation for the other five criteria air pollutants. Table 1.8 provides the current increments for SO₂ and TSP.

States are required to develop State Implementation Plans (SIPs) to properly develop or implement air pollution control plans. One principal regulatory mechanism of an SIP is the New Source Review (NSR) process. Among other things, NSR requires that major emitting sources be examined by a reviewing authority to assure that they incorporate prescribed emission limitations [i.e., New Source Performance Standards (NSPS)]. A major emitting source is one that has the potential to emit, after control, 100 to 250 tons per year (the amount depending on the source category) of any criteria air pollutant. There are 28 source categories (including steam generators and coal preparation plants) currently having an NSPS and affected by the 100 ton-per-year rule. Liquefaction plants include both steam generators (boilers) and coal preparation plants which will be subject to NSPS review. The 1977 Amendments to the CAA directed EPA to accelerate the NSPS program so that standards will be periodically issued for most other major source categories (possibly synthetic fuel production plants).

Table 1.7. The national ambient air quality standards

	Time period	Units	Primary	Secondary
SO ₂	3 h ^a	μg/m ³		1300
	24 h ^a	μg/m ³	365	
	Annual	μg/m ³	80	
NO ₂	Annual	μg/m ³	100	100
TSP	24 h ^a	μg/m ³	260	150
	Annual	μg/m ³	75	60
CO	1 h ^a	mg/m ³	40	40
	8 h ^a	mg/m ³	10	10
Pb	3-month average	μg/m ³	1.5	1.5
Hydrocarbons (nonmethane) ^b	3 h ^a	μg/m ³	160	160
Ozone	1 h ^a	ppm	0.12	0.12

^a Levels not to be exceeded more than once per year. Annual standards are not to be exceeded.

^b For use as a guide in devising plans to achieve the ozone standard.

Source: U.S. Environmental Protection Agency, "National Primary and Secondary Ambient Air Quality Standards," 40 CFR Part 50.4 et seq. (1980).

Table 1.8. PSD increments (μg/m³)^a

	Class I	Class II	Class III
Total suspended particulates			
Annual geometric means	5	19	37
24-h maximum	10	37	75
Sulfur dioxide			
Annual arithmetic mean	2	20	40
24-h maximum	5	19	182
3-h maximum	25	512	700

^a EPA established an area classification scheme to be applied in all PSD areas. The basic idea was to allow a moderate amount of industrial development but not enough to degrade air quality to the point at which it barely complied with standards. In addition, states were allowed to designate certain areas where pristine air quality was especially desirable. PSD areas can be categorized as Class I, Class II, or Class III. Class I represents pristine areas subject to tightest control; Class II, areas of moderate industrial growth; and Class III, areas of major industrialization. Under EPA regulations, all areas were initially categorized as Class II. States were authorized to reclassify specified areas as Class I or Class III. There are 58 mandatory Federal Class I areas that include major national preserves.

Source: U.S. Environmental Protection Agency, "Requirements for Preparation, Adoption, and Submittal of Implementation Plans," 40 CFR Part 51.24 (1980).

The emissions of the major criteria air pollutants from plant operation and coal mining have been estimated for the liquefaction scenario. It is not possible, however, to estimate the effects that these emissions may have on air quality for every plant and mine since predicting air quality requires knowledge of local meteorological conditions. Table 1.9 provides the projected state emission inventory for plant operation and mining in 1995. (See Table 1.9 provides the projected state emission inventory for plant operation and mining in 1995. (See Table 1.4 in Sect. 1.4.1 for atmospheric emissions in tons per year per unit plant). Table 1.10 compares these emissions with those from the energy production, processing, and end-use sectors in each state, and the total emissions in each state. In all states, the emissions from the liquefaction plants will be a minor component of the total emissions from industrial combustion. Nevertheless, plants sited in all states will be required to undergo NSR for NA and PSD permit rules because their air emissions for sulfur oxides and nitrogen oxides would exceed 250 tons per year.

Table 1.9. Air pollutant emission inventory from coal liquefaction^a

State	Particulates			Sulfur oxides			Nitrogen oxides			Carbon monoxide			Hydrocarbons		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
Illinois	2,608	70	2,678	5,300	63	5,363	10,060	869	10,929	708	528	1,236	424	97	521
Kentucky	2,608	73	2,681	5,300	65	5,365	10,060	908	10,968	708	552	1,260	424	102	526
West Virginia	2,608	8	2,616	5,300	17	5,317	10,060	252	10,312	708	155	863	424	22	446

^aNumbers represent net emissions, in tons per year, by state, assuming two plants in each state: A = plant operation, B = mining, and C = total.

Table 1.10. Air emissions from liquefaction commercialization compared with energy sector and state total^a

State	Particulates			Sulfur dioxides			Nitrogen oxides			Carbon monoxide			Hydrocarbons		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
Illinois	2,678	2.0	0.8	5,363	0.5	0.5	10,929	1.4	1.4	1,236	0.1	0.05	521	0.2	0.2
Kentucky	2,681	2.0	0.8	5,365	0.5	0.5	10,968	1.9	1.9	1,260	0.2	0.1	526	0.6	0.6
West Virginia	2,616	2.9	2.1	5,317	1.1	1.1	10,312	2.4	2.4	863	0.3	0.1	446	1.0	1.0

^aState net emission figures for energy sector and total are from the NEI 80 High Scenario and are based on 1995 projected emissions; A = emissions (tons/year), B = percent of state energy sector, and C = percent of state total.

1.4.3.3 Water availability

It is estimated that about 16,500 gal/min of water will be withdrawn* to operate the unit plant. (Actual consumption is 12,500 gal/min.) This results in water requirements in each of the three states exceeding 24,000 acre-ft per year, as is shown in Table 1.11.

Table 1.11. Aggregate water use requirements

State	Water withdrawal (acre-ft/year)			Water consumption (%)	
	Liquefaction plants	Coal mining	Total	Energy sector (1990)	Total state (1975)
Illinois	40,000	1,607	41,607	18.1	20.5
Kentucky	40,000	1,350	41,350	20.3	22.6
West Virginia	40,000	1,388	41,388	19.2	61.6

In addition to the water needs of the liquefaction facilities, water will be required for the supporting coal mine operation. Principal categories that consume water in coal mining are dust control for roads, mines, and embankments, and revegetation of reclaimed areas. However, the mine location and type of mine will strongly influence the quantity of water consumed. Water sprayed for dust control in the mine and on the road is based on the area disturbed, evaporation rate, rainfall rate, and wetted area rate. The derivation of water use requirements is presented in Appendix BB. Total water requirements amount to almost 26,000 acre-ft per year in each of the three states when mining use is added to that required for facility operation as shown in Table 1.11.

*The reader should distinguish between the concepts of withdrawal and consumption. Water consumed is that which is chemically or physically altered during the process and is not released in the liquid phase. Water withdrawn is the total volume associated with the process. All consumed water is withdrawn, but not all withdrawn water is consumed. SRC-II figures represent withdrawn water, and SEAS figures represent consumed water. Thus, comparative impacts have been maximized.

To provide some perspective on the impact of water requirements values, Table 1.11 also shows the combined water requirements of liquefaction facilities and associated coal mining as a percentage of water requirement by the energy sector in 1990. The energy sector is defined here to include all activities associated with the production, processing, and end use of energy. The relationship between project-related water withdrawal and energy sector water consumption is relatively constant in the three stages, ranging from 18.1% in Illinois to 20.3% in Kentucky. There is considerable variation in West Virginia, however, when project use is compared to total state fresh water consumption in 1975.¹⁹ Project water withdrawal in that state amounts to about 61.6% of total 1975 water consumption. Comparable data for Illinois and Kentucky reflect percentages of 20.5 and 22.6, respectively. Though these data must be assessed on a site-specific basis to determine the impact on water systems, they appear to represent a considerable amount of total water use.

There are several considerations that must be taken into account in assessing water availability. Groundwater overdraft is a severe problem in many parts of the country. One of the problems associated with groundwater overdraft is that continuing current trends may result in a sharp decline in the availability of groundwater for uses such as irrigation and domestic water systems. In addition to total availability, water quality must be considered. For example, in West Virginia, problems have arisen from salt water intrusion and contamination that were caused by exposure of groundwater to iron and sulfur deposits encountered during well drilling.²⁰ Also, the effects of flooding in Kentucky are accentuated by the widespread occurrence of limestone deposits, allowing for increased exposure of groundwater aquifers to contamination by seepage.

It is not possible, at the programmatic level of analysis, to predict the ability of specific water systems to satisfy the requirements of synthetic fuels development. Such determinations must be made on the basis of site-specific considerations. It is safe to say, however, that neither the liquefaction facilities postulated nor any other synthetic fuel facilities will be constructed if sufficient water supplies are not available.

Two final considerations are worthy of note regarding water availability. It is possible that appropriate design changes could be made for specific regional siting, to allow complete water recirculation or zero discharge of wastewater. This would reduce both the overall facility water requirement and the ultimate amount of plant effluents.

1.4.3.4 Water quality

Impacts on water quality will depend upon the characteristics of wastewater discharge from the liquefaction facilities and the ambient conditions of the receiving waters. In some cases, several of the components are of particular concern since the ambient levels of these components in the receiving water may exceed current criteria. Concentrations and discharge quantities for several selected wastewater parameters are shown in Table 1.8 to provide a general estimate of the levels anticipated. It is important to emphasize, however, that the environmental impacts of liquid effluents from liquefaction facilities will be highly site-specific. A major factor is the size and flow rate of the receiving waters which affects the capacity of the waters to disperse or dilute the pollutant streams. In addition to the characteristics of wastewater discharge, ambient water quality is also an important factor. Over the past decade, primarily in response to Federal and state legislation, the quality of surface water in the United States has shown signs of improvement. However, river basins in almost the entire eastern half of the country are still affected by industrial waste discharges. If the surface water quality is to continue to improve, discharges from synthetic fuels and other industrial developments must be kept to an absolute minimum.

One impact of improving surface water quality has been the gradual deterioration of groundwater supplies. This has resulted from greatly increased disposal of solid and liquid wastes in surface containments which allow waste constituents to leach into groundwater supplies. Because the exact nature of wastes from the various liquefaction processes are not yet known, particular care must be taken in their disposal.

Facilities that are ultimately constructed will require National Pollutant Discharge Elimination System (NPDES) permits prior to operation in the event wastewater is discharged. It can be assumed, then, that facilities granted these permits will be able to demonstrate compliance with applicable Federal standards. Depending on the specific site, similar or more stringent permit requirements may be necessary for certification by states. In addition to being required to meet current Federal and state standards to operate, it should also be noted that during the time frame under consideration in this statement, control equipment development should continue so that plants will be able to achieve zero discharge levels.

One of the primary problems in predicting water quality impacts is that the impacts of individual effluent components are not yet fully understood. This problem is greatly aggravated at the programmatic level of consideration because of the chemical variation in the effluent receiving media and differences in coal feed characteristics. Continuing research and development efforts are being conducted by both DOE and EPA to (1) improve waste stream characterization from synthetic fuels facilities, (2) increase understanding of the potential environmental effects of the individual waste stream components, (3) increase understanding of the synergistic relationships between these components, and (4) develop improved methods of controlling the amounts of liquid effluents and specific components of liquid effluents.

One significant outgrowth of these efforts is the increasing interest in designing conversion facilities with essentially zero liquid discharge. This can be achieved theoretically by improving the recycle capabilities of plant water systems. By conducting a periodic purge of the water system to prevent contaminant buildup, potentially harmful wastes can be removed in a more easily contained solid form. Such systems could also prove extremely valuable in areas with poor or questionable water availability.

In the commercialization scenario developed in this report, liquefaction facilities in Illinois, Kentucky, and West Virginia, when not operating in a zero-discharge mode, would release effluents into receiving waters, that ultimately join the Mississippi River. Although each of the plants in these states may meet applicable standards at the time of construction, their combined effluents could well produce effects downstream that have not yet been foreseen.

1.4.3.5 Land disturbed

Land will be disturbed as a result of the preparation of plant sites, the mining of coal, and, in some cases, the construction of transportation corridors. Each plant site is expected to require 1300 total acres for the life of the liquefaction facilities in each state. In addition, the remainder of the site area will be unavailable for other uses. Estimates of total land disturbed are presented in Table 1.12.

Table 1.12. Land disturbed

State	Plant facility (acres)	State surface mining (total acres, 1976)	Mining for liquefaction	
			Acres/year	Percentage of state
Illinois	1300	2580	1380	53.4
Kentucky	1300	4770	1630	34.2
West Virginia	1300	2060	460	22.3

Additional acres will be disturbed by surface mining of coal to support the facilities. The number of acres in each state will vary, however, depending on the amount of coal required, the seam thickness of coal beds, and the type of mining. For example, acres disturbed from mining range from 460 acres in West Virginia to 1630 acres in Illinois. The relatively low figure in West Virginia results primarily from a larger proportion of coal being supplied from underground mines.

One way to provide an indication of the relative impact of land disturbed is to relate the acres disturbed by the project to a common base. In this case, project-related acres disturbed per year have been compared to total acres disturbed by all surface mining in each state. This base has been calculated from 1976 surface mine productivity data²⁹ using average seam thickness for each state. This provides an index for comparing project-related land disturbed to existing mining activity as shown in Table 1.12. For example, Illinois reflects a relatively high index of 53.4. This is higher than the Kentucky index of 34.2 even though the total acres disturbed by mining in that state is greater than in Illinois. The lowest index appears in West Virginia at 22.3 with 460 acres disturbed. Although surface mining creates the greatest land disturbance in some cases, the acreage shown in Table 1.12 will not all be disturbed at the same time. Typical surface mining operations involve simultaneous activities of surface clearing, top soil removal, coal removal, backfilling, and revegetation. As a result, the amount of land being disturbed at any one time will be considerably less than the total acres indicated. The 1300 acres in each state removed from use by each plant facility, however, will all be disturbed for the life of the plant.

Land could also be disturbed as a result of transportation of construction materials by truck and coal by railroads. All of the plants, however, are located in the east, where an extensive network of highways and railways exist. This system should be capable of accommodating transportation requirements. In areas where access roads are needed to reach the plant site, about 9 acres of land per mile of road will be disturbed if a 75-ft right-of-way (ROW) is built.²² Approximately 32 acres per mile of railroad will be disturbed if new spur lines are required, assuming a 260-ft ROW.²² The amount of time it will take to restore land to a usable state will vary from region to region. In West Virginia, for example, natural succession and recovery of hardwood vegetation could take 100 years. Natural hardwood disturbed in Illinois would require 150 to 200 years to reestablish.

1.4.3.6 Solid waste

The principal sources of solid waste associated with coal liquefaction are mining wastes, slag and fly dust from the gasifiers, auxiliary boiler ash, and secondary wastes (i.e., sludges) from pollution control equipment. Solid waste from underground coal mining is estimated at approximately 3% of the coal extracted.²² Solid wastes which are generated from surface mining are returned to the mining site and thus do not constitute a disposal problem. Table 1.13 shows that total solid waste from liquefaction would result in a 17 to 35% increase in estimated industrial solid waste generation on a state basis. This increase could be problematic in areas or states where disposal capacity is limited. Coal liquefaction wastes are under review but are not currently classified as hazardous under the Resource Conservation and Recovery Act (RCRA) regulations and, as shown in Appendix C, are not hazardous under EPA tests and thus are not subject to stringently regulated disposal practices. In the demonstration program, solid waste from the gasifier, which is over 95% of the total solid waste, is to be studied to confirm its nonhazardous characteristics, and a process will be devised for its ultimate disposal as road aggregate material or other construction aggregate.

Table 1.13. Solid waste generation by state [(tons X 10³)/year]

State	Coal mining waste ^a	Plant solid wastes (dry weight)	Total liquefaction wastes	Total solid wastes, 1995 ^b (dry weight)	Percent of total liquefaction wastes to total solid wastes
Illinois	507	2266	2773	15,881	17.5
Kentucky	353	2266	2619	13,489	19.4
West Virginia	575	2266	2841	8,110	35.0

^aCoal mining wastes are based on underground coal mined for each liquefaction plant. Plant solid wastes include approximately 350,000 tons/year of wastewater solids and 1,900,000 tons/year of other waste solids. Total solid waste by state includes pollution-controlled ash and dust, sludge from SO₂ removal, sludge from industrial wastewater treatment, other industrial sludges, and bottom ash process solid waste.

^bState total for all solid wastes as projected by the SEAS Model.

1.4.3.7 Socioeconomic

Socioeconomic impact is determined to a large extent by the size of the project population and its relationship to existing community facilities and services. In general, metropolitan areas can accommodate larger population increases than rural areas and experience less impact. Metropolitan areas also provide larger labor forces and thereby reduce the need to import workers and their families. It is unknown at this time, however, where the other five facilities postulated for this scenario will locate in relation to metropolitan areas. Assumptions for such parameters as migration rates, family size, and employment have therefore been based on calculations derived from the SRC-II case. The potential for variation from these basic assumptions is discussed in the following sections.

Employment

Direct and indirect employment for construction, operation, and mining are presented in Table 1.14. These data have been derived using the assumptions stated in Appendix BB.

Table 1.14. Project-related employment by state

State	Construction			Operation			Mining		
	Direct	Indirect	Total	Direct	Indirect ^a	Total	Direct	Indirect	Total
Illinois	20,000	5,520	25,520	960		960	5,623	1,423	7,046
Kentucky	20,000	5,520	25,520	960		960	4,840	1,225	6,065
West Virginia	20,000	5,520	25,520	960		960	4,329	1,095	5,424

^aAlthough indirect population increases can be calculated for operation of the liquefaction plants, such a calculation would not be meaningful in this instance. The construction force is approximately ten times larger than the operation force. The indirect employment generated during construction would be more than adequate for the operational labor force. Therefore, no additional indirect employees would be generated.

It is important to emphasize that these data must be interpreted in the context of time and space. In the case of direct construction workers, for example, the 20,000-man peak assumes that both plants in each state are constructed at the same time. In the ideal situation, the facilities would be built in series thereby reducing considerably the number of workers required at any one time. On the other hand, all plants will be operating at the same time once they have been completed. This results in a minimum total operational force of about 900 workers in each plant for each of the three states. In addition, coal miners required to support the facilities during operation range from approximately 4300 in West Virginia to about 5600 in Illinois. It should also be noted that the impact from these work forces will be reduced to the extent that the six plants are dispersed throughout the three state areas and by their proximity to metropolitan areas within the states.

One of the major concerns related to construction employment is the availability of skilled labor. A potential shortage could develop particular concern if the plants are located close to other large construction projects that might compete for labor. On the other hand, if construction schedules are spaced as in the ideal situation mentioned earlier and the plants are dispersed throughout the three-state area, the demand for labor would be reduced considerably. The magnitude of impact will therefore depend on the siting and timing of plant construction. This also applies, to some extent, to design engineers and operational employees. An adequate supply would be more readily available if plants are dispersed among labor markets of large metropolitan areas. Also, any potential shortages could be ameliorated if plants are constructed in series thereby providing sufficient lead time to initiate training programs in areas of skilled labor shortages.

Mining manpower must also be considered. Demand for miners is estimated to range from approximately 4300 in West Virginia to 5600 in Illinois. While the demand is relatively similar in the three states in terms of absolute number of mines, the incremental increase is quite different. For example, the 4300 figure in West Virginia represents about 8.0% of the average number of miners working daily in that state in 1976.²¹ In Illinois, however, the project-related demand amounts to approximately 42.4% of 1976 mine workers. Again, impact will depend on the siting of facilities and local supply of labor rather than overall impact on the coal mining industry manpower.

Population

Project-related population in relationship to community facilities and services is generally indicative of a wide range of socioeconomic impact. Population data related to construction, operation, and mining are therefore presented in Table 1.15. They have been derived using the assumptions outlined in Appendix BB.

Table 1.15. Increase in local population related to project

State	Construction	Operation	Mining	Total	1990 state total	Project percentage of state
Illinois	5,139	368	2,707	8,214	11,665	0.07
Kentucky	5,139	368	2,329	7,836	3,953	0.20
West Virginia	5,139	368	2,080	7,587	1,973	0.38

It is impossible to quantify the magnitude of socioeconomic impact of these data without knowing the baseline characteristics of community facilities and services. It is possible, however, to identify relative indices by comparing project-related population to a common base. In this case, project-related population has been compared to the official U.S. Census Bureau population projections for 1990 in each state.²⁴ These values are shown in Table 1.15 and range from 0.07 in Illinois to 0.38 in West Virginia.

It is important to emphasize that these data are not measures of socioeconomic impact. Construction timing and siting will ultimately determine the impact and must be assessed at the individual community level. Proximity to urban centers will have a significant influence on the magnitude of impact for two reasons. First, location within daily commuting distance of metropolitan areas will provide a greater supply of labor and thereby reduce the need to import workers and their families. This would result in lower estimates of project-related population than has been postulated in this scenario. Secondly, proximity to urban areas generally assures an adequate supply of the variety of community facilities and services required to support any influx of population. These include such things as housing, markets, school facilities, health care delivery systems, and public safety personnel and equipment. Impacts on these variables must, however, be addressed on a site-specific basis.

1.4.3.8 Occupational safety and health

Physical hazards

The most common causes of injuries occurring in virtually all industrial workplaces are falling from heights, slipping on wet floors, being struck by falling objects, and accidental contact with machinery. In many instances, these injuries result from human carelessness, malfunctioning equipment, or poor design. Other potential physical hazards to the well-being of workers in a coal conversion or combustion plant which should be readily controllable or preventable include excessive noise and heat and improper lighting. Control or prevention of these problems must be considered during plant design and modifications. The levels of noise, heat, and illumination may vary on a plant-specific basis, depending on utilization of engineering techniques, and would have to be ascertained for each plant. The degree of danger is not expected to be any more significant for liquefaction facilities than for other production and manufacturing facilities.

Dust hazards

Coal dust in the liquefaction facility must be controlled. Lung damage has been observed in coal miners suffering advanced stages of coal workers' pneumoconiosis, initiated by an accumulation of coal dust in the lungs and the resultant lung tissue reactions. The most likely location that may present a problem would be the coal crushing and grinding facility, although any unloading or transfer point may be a point of exposure. If this operation is automated and individual workers are not exposed, no health hazard should exist. Other dust exposure that may be considered a potential hazard originates in the insulation materials: fibrous glass and mineral wool. The principal consequence of inhalation of the particulate forms (0.5 to 5.0 microns) of these materials is pulmonary fibrosis. The level of exposure encountered in individual facilities will determine the extent of the hazard and, if necessary, properly fitted respiratory protectors can be used to reduce worker exposure on an interim basis when engineering controls are not effective.

Chemical hazards

The assessment of fugitive emissions from commercial-state liquefaction facilities must be inferred from emissions of related industries, since little published information exists and no commercial-scale plant has been built. Related industries in the United States which involve thermal and catalytic processing of fossil fuels (e.g., the petrochemical processing and utilization industry) are known to generate end-products and emissions containing substances that are potentially hazardous to human health. Liquefaction products, by-products, and process stream releases may pose a unique set of public health risks and environmental impacts during their production, transport, and use. Health risks may also result from chemical/biological transformations mediated by environmental factors. Potential carcinogenic polynuclear aromatic and heterocyclic hydrocarbons have been identified on coal combustion fine particulates and in various syncrude products.²⁵ Programs are under way to address these potential hazards and mitigating measures will be undertaken in the demonstration plant and will be further developed prior to commercialization (Sect. 4.1).

Transportation

As is discussed in Sect. 1.4.2.5, the facilities are expected to be located close to existing highways, railroads, and/or navigable waterways. The primary means of coal transport are rail and barge. In addition, for distances of up to 50 to 75 miles, truck transport is an option, and for distances of several hundred miles or more, coal-slurry pipelines may be considered.²⁶ Impacts associated with coal transport by these modes include transportation system capacity impact, energy consumption, air pollution, noise pollution, right-of-way acquisition, and safety.

Based upon the assumption that the average daily coal input to a unit plant would be 30,000 tons, the daily coal input for the six plants in the commercialization scenario would be approximately 180,000 tons/d. In terms of transportation system requirements, moving this amount of coal would require use of over 1800 rail cars at 100 tons per car, or 120 barge loads at 1500 tons per barge. In terms of truck transport, 180,000 tons of coal would be equivalent to 9000 loads at 20 tons per load. The above figures represent approximately 9% of present rail car capacity when calculated on an annual capacity basis of 840 million tons or 4% of barges currently estimated to be handling coal.²³ The size of the coal truck fleet is not currently known; thus, comparable percentages for truck transport cannot be calculated. Energy consumption and air pollution impacts related to transportation would be dependent upon the transportation mode used and the distance traveled. Noise pollution impacts would depend upon the transportation mode utilized and the proximity of sensitive receptors. The issue of safety is mode dependent and a function of the distance traveled.

1.4.4 Unavoidable adverse impacts

The environmental impacts of a commercial synthetic fuels industry are discussed in ref. 6. Regardless of control technologies and impact mitigation techniques utilized, commercialization of the coal conversion program will result in some unavoidable adverse effects.

1.4.4.1 Air

Localized degradation of air quality would unavoidably occur as a result of coal mining and conversion. Some increase in sulfur dioxide, nitrogen oxides, carbon monoxide, carbon dioxide, trace elements, hydrocarbons, and respirable particulates would occur in the vicinity of liquefaction facilities even though emission controls were employed.

1.4.4.2 Water

The water-related impacts of increased coal mining (i.e., aquifer disruption, acid mine drainage, etc.) are well documented in the literature. Some degree of impact will unavoidably occur in meeting coal requirements of the coal conversion program. Because these facilities are intended to be one component of a projected commercial plant which will ultimately be three to five times larger than the demonstration plants, water requirements will increase significantly in the future. However, impacts to water supplies and quality resulting from program-related mining increases should be minimal.

It should be noted that the exact constituent makeup of plant effluent streams is not known. Although liquefaction facilities will be designed to meet existing effluent limitation standards, some water quality deterioration will be unavoidable. Effluents from all facilities may ultimately reach major water courses with large capacities for pollutant dispersion and dilution.

1.4.4.3 Soils

Soil fertility may be unavoidably decreased in many areas as a result of activities associated with coal conversion facilities. However, this will be dependent on the type of reclamation practices being followed. Surface mining, facility construction, and solid waste disposal would all result in disturbance of topsoil. Even reclamation activities following surface mining will result in soil compaction and perhaps the burying of fertile soils. Toxic materials present in lower soil levels would be brought to the surface or mixed with the soils.

The disposal of ash from the facilities and mining wastes could cover large areas of topsoil making these areas permanently useless for productive purposes. Leaching from disposal sites could also adversely affect soil productivity.

1.4.4.4 Topography

Topography would be unavoidably altered by construction and mining activities. Actual plant locations would be marked generally by a leveling of all topographic features. Major changes in topography would accompany surface mining of coal, depending on the degree of reclamation. Similarly, underground mined areas could be adversely affected by ground subsidence and the creation of spoil piles.

1.4.4.5 Flora and fauna

The diversity, density, and composition of plant and animal species would be unavoidably altered in areas of mining and construction of the coal conversion facilities. Locations of the facilities would have to be selected keeping in mind the protection of endangered plant and animal species. It is anticipated that all native species will be removed from the actual facility sites; however, the area of construction will be relatively small and most animal species should be able to relocate in adjacent areas. However, wildlife populations would be permanently reduced because of habitat loss. Ponds and streams that are removed or altered by mining and construction activities will unavoidably experience some or total species loss. In addition, noise from coal mining activities as well as construction and operation of the facilities could adversely affect local species' behavior, particularly reproduction and migration functions.

1.4.4.6 Socioeconomic values

Increased coal mining and construction activities associated with the facilities should result in only moderate changes in population because of the preexisting labor pools. "Boomtowns" are unlikely to occur in states such as Kentucky, Illinois, and West Virginia, but some disruption of local lifestyles may be unavoidable. A large increase in population would, to some degree, change living patterns in impacted communities and could result in aggravation of social and economic problems. The potential impacts would depend upon the relative size of the existing communities, the rate of growth, the existing infrastructure, and the adequacy of advanced planning for the growth.

Land use patterns would be unavoidably altered because of the land requirements for plant sites, mining sites, waste disposal sites, roads, railroads, utility and pipeline corridors, and associated services. Some of this change would be permanent. Agriculture, grazing forest, and recreational lands would be removed from their existing uses.

1.5 PERMITS, APPROVALS, FINDINGS, AND CONSULTATIONS REQUIRED

1.5.1 Permits and approvals required for construction

Major permits and approvals required for construction of the demonstration plant are indicated in Table 1.16. As noted, some of these permits or approvals are required prior to initiation of construction activities [i.e., issuance of the FEIS and Prevention of Significant Deterioration (PSD) determination], while others are required prior to commencement of specific activities (i.e., permits for dredge and fill operations, waste discharge permits, etc.).

1.5.2 Permits required for operation

Major permits required for operation are indicated in Table 1.16.

1.5.3 Other required approvals, statement of findings, and coordination with Federal and state agencies

1.5.3.1 Endangered species

The Endangered Species Act, Public Law 93-205, requires that DOE evaluate the potential impacts of the proposed action on endangered, threatened, or rare animals or plants. Appendix E presents a letter requesting the U.S. Fish and Wildlife Service (USFWS) to provide any information available regarding the presence of listed or proposed to be listed endangered or threatened species or critical habitat for such species, and any potential impact of the proposed project on such species. The USFWS indicated that, except for transient individuals, no Federally listed or proposed species are known to exist in the project impact area. Therefore, no biological assessment or further Section 7 Consultation is required with the USFWS.

Table 1.16. Status of demonstration project permits

Agency, permit	Date permit required	Date application is scheduled
Federal Agencies		
<i>Environmental Protection Agency (EPA)</i>		
1. Prevention of Significant Deterioration (PSD) permit	9/81	5/80
2. National Pollutant Discharge Elimination System (NPDES) permit for construction runoff water	3/81	1/81
3. NPDES permit for discharge from sewage treatment plant	6/81	4/81
4. NPDES permit for water intake back-flushing and any other plant operating discharge	4/82	2/82
5. Resource Conservation and Recovery Act (RCRA) permit	9/81	1/82
6. Spill Prevention Control & Counter-Measure (SPCC) Plan	4/82	4/82
<i>Corps of Engineers (COE)</i>		
1. Section 10 and 404 permits for construction in a navigable river	6/81	1/81
<i>Federal Aviation Administration (FAA)</i>		
1. Notice of Proposed Construction permit	6/81	6/81
West Virginia State Agencies		
<i>Air Pollution Control Commission</i>		
1. Permit to construct, modify, or relocate an air pollution source	9/81	5/80
<i>Department of Natural Resources (DNR)</i>		
1. Water Pollution Control permit for construction runoff	3/81	1/81
2. Water Pollution Control permit for sewage treatment plant discharge	6/81	4/81
3. Water Pollution Control permit for plant discharge operations	4/82	2/82
4. Water Pollution Control permit for a landfill	12/81	10/81
5. Dam Certificates of Approval	12/81	10/81
<i>Department of Health</i>		
1. Permit to construct sewage treatment plant	6/81	4/81
2. Permit to operate sewage treatment plant	11/81	11/81
3. Permit to construct potable water supply system	12/81	9/81
4. Permit to operate potable water supply system	6/82	6/82
5. Permit to construct a Class III land fill for construction wastes	2/1/81	1/81
<i>Department of Highways</i>		
1. Permission to enter highway	2/81	2/81
<i>Department of Mines</i>		
1. Permit to plug a gas well	3/1/81	2/81
Local Agencies		
No county or city permits required		

1.5.3.2 Historic and archaeological sites

Based on field investigations and consultations with the State Historic Preservation Officer, it has been concluded that five sites eligible for the National Register of Historic Places will be adversely affected by the proposed project: Belldina's Bottom, Van Voorhis Farm, Fort Martin archaeological site, Gingrich House, and the Fort Martin School/Community Center. A Memorandum of Agreement is under negotiation with the President's Advisory Council on Historic Preservation. The memorandum will outline mitigation measures. Mitigation measures (Sects. 4.2.4.1, 4.6.3, and Appendix U) under consideration will include data recovery for three of the eligible archaeological sites and the use of the Gingrich House and the Fort Martin School/Community Center as an information center for the project.

These actions are necessary to meet specific requirements of the National Historic Preservation Act (NHPA) (Public Law 89-665), Executive Order 11593, the Memorandum, 36 CFR Part 800, "Determinations of Eligibility for Inclusion in the National Register of Historic Places" 36 CFR Part 63, National Environmental Policy Act (NEPA) (Public Law 91-190), the Council on Environmental Quality's regulations implementing NEPA (40 CFR Parts 1500-1508), and Historical and Archaeological Data Preservation Act (16 USC 469a et seq.).

1.5.3.3 Floodplains and wetlands assessment

On May 24, 1977, President Carter issued Executive Orders 11988 — Floodplains Management, and 11990 — Protection of Wetlands. The essence of these statements was a directive to Federal agencies to avoid the use of floodplain and wetland resources as sites for Federal actions unless no practicable alternative exists and to minimize impacts to the maximum extent practicable where no alternative exists.

The Executive Orders and subsequent implementing guidelines and regulations promulgated by the U.S. Water Resources Council and DOE, respectively, prescribed the assessment of the impacts of proposed actions on floodplains and wetlands as part of the review process under the NEPA (*Federal Register*, February 10, 1978, and March 7, 1979).

From the information currently available, it is possible to evaluate the maximum floodplain and wetland impacts on the construction of either the demonstration or commercial plants at the proposed site. The development of the proposed demonstration plant at the proposed site will necessitate the use of the west bank floodplain of the Monongahela River between river miles 93.2 and 94.5. The facilities to be located in the floodplain below the 100-year flood elevation include a barge unloading slip, a process water intake facility, a wastewater discharge structure, sections of a haul road and access ramps, and coal barge unloading and fleeting facilities. A limited area (about 1.2 ha) will be filled to support the product storage area and its associated spill containment facilities. Based on the analysis to date, no feasible alternatives exist to locating these facilities within the Monongahela River floodplain. A detailed floodplain/wetlands review, prepared in accordance with DOE regulations, is included in Appendix D, and a summary is presented in Sect. 4.8.

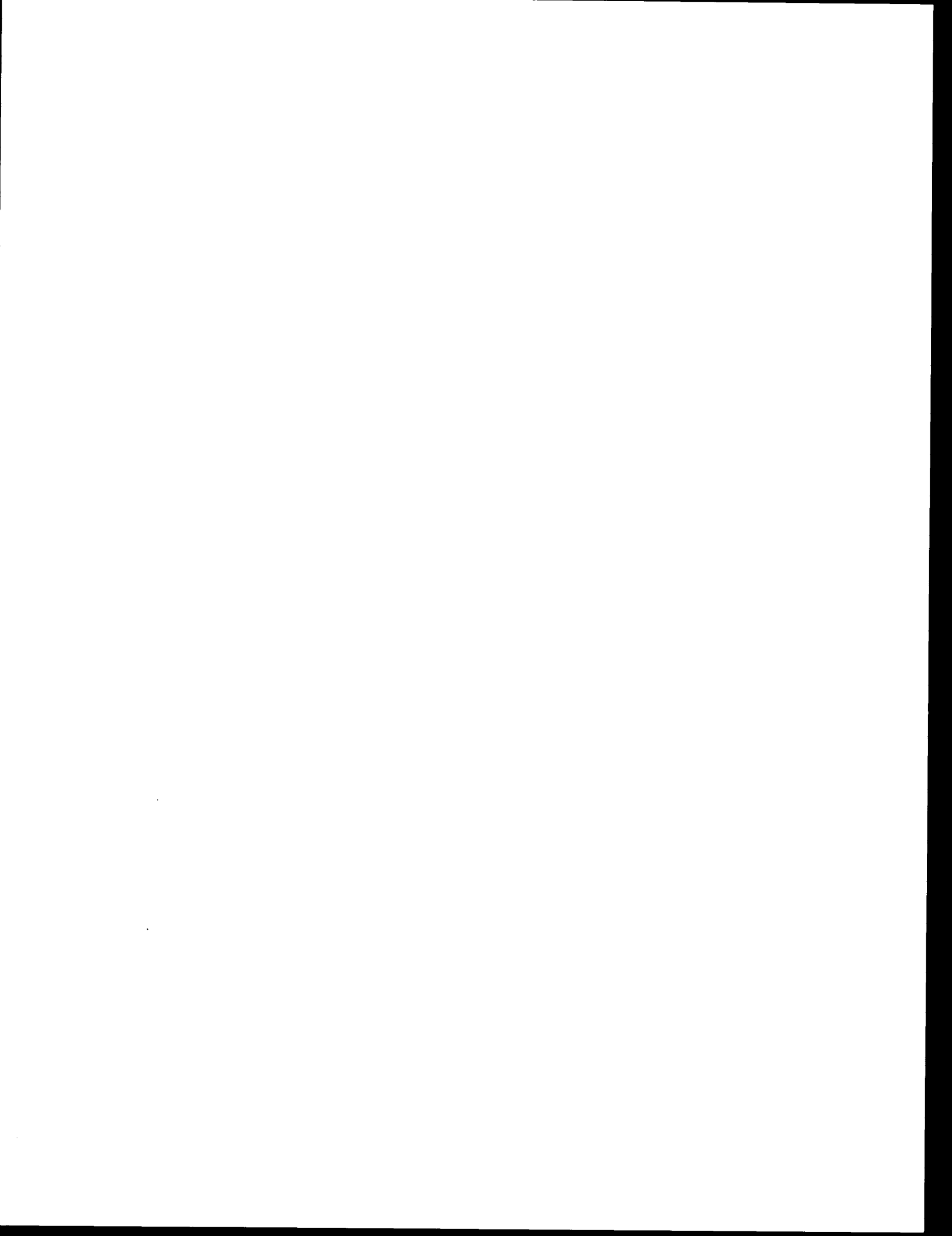
1.5.3.4 Toxic Substances Control Act

Discussions of the Toxic Substances Control Act relevant to solvent refined coal processes are given in Appendix T.

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2. ALTERNATIVES, INCLUDING THE PROPOSED ACTION

2.1 INTRODUCTION

2.1.1 Background

The proposed action is the construction and short-term operation of a facility to demonstrate the technical feasibility, economic viability, and environmental acceptability of the SRC-II solvent refined coal process at near-commercial scale with the potential to expand to commercial scale, if successful. Demonstration plants are expected to expedite commercial application of coal conversion technologies by reducing the technical and economic and environmental risks associated with the first commercial facilities. Information obtained by environmental monitoring and effluent and control equipment testing during demonstration operations will reduce the environmental risks associated with the first commercial plant.

The contract between DOE and the industrial partner directs the industrial partner to propose a site-specific design for a 6000-ton-per-stream-day (tpsd) plant. The site selected must be suitable for construction of a commercial facility having a capacity of about 30,000 tpsd. The demonstration plant design must be capable of complying with all applicable environmental requirements including:

- New Source Performance Standards,
- Prevention of Significant Deterioration Regulations,
- emission and discharge limitations,
- environmental quality standards, and
- other Federal, State, and local standards and regulations, including requirements to obtain construction and operating permits for air emission sources, wastewater treatment facilities and discharges, and solid waste storage and disposal facilities.

Although compliance with current and projected standards will require application of state-of-the-art control technology, standards do not yet exist for most of the chemical entities found in SRC materials or in many other chemical process operations. Thus, compliance with existing and even projected requirements for materials with currently known hazards will not ensure complete protection of the work force, the public, or the environment. For this reason, the plant has been designed to incorporate measures to mitigate the hazards associated with releasing harmful chemicals. These design features are discussed in Sects. 2.2.1 and 4.1 and Appendix C.

2.1.2 Alternative actions available to DOE

The proposed action is the construction and operation of a demonstration plant in accordance with the proposed process design evaluated in this Final Environmental Impact Statement (FEIS). This design is described in Appendix C.

The environmental impacts of the proposed action must be evaluated in comparison with the impacts of the alternative actions that may be taken by DOE:

- select an alternative site, design, or plant layout to further reduce environmental impacts and proceed with construction, or
- determine not to proceed with construction at any site (no action).

The proposed action is described in detail in Sect. 2.2, and the resulting environmental impacts are summarized in Sect. 2.3.1 and discussed in detail in Sect. 4. The impacts of alternatives are compared with those of the proposed action in Sects. 2.3.2 and 2.3.3.

2.2 DESCRIPTION OF THE PROPOSED ACTION

2.2.1 Proposed plant design

This section describes the basic SRC-II process and the major features of the currently proposed demonstration plant. The currently proposed design is described in Appendix C. The proposed design is evolving and is under evaluation by both the Department of Energy (DOE) and the industrial partner (SRC International, Inc.) and may be further modified. Alternative plant designs are discussed in Sect. 2.3.2.1.

Detailed information on various aspects of the plant design is given in Appendix C as follows:

1. process description and plant design;
2. air emissions under normal, startup, shutdown, and emergency operating conditions; fugitive emissions; and proposed and alternative air pollution control schemes;
3. wastewater discharge under normal, startup, shutdown, and emergency operating conditions; waste heat rejection; and proposed and alternative wastewater treatment schemes;
4. solid waste disposal information, including slag leaching tests, slag disposal area design, water soluble solid waste characteristics, and solid waste disposal alternatives;
5. construction emissions, including air emissions and water discharges;
6. plant resource requirements during the construction and operation phases;
7. results of SRC-II combustion tests; and
8. environmental characteristics of the expanded commercial plant.

2.2.1.1 Overall process description

The demonstration plant facilities have been designed to produce a primary product of low-sulfur distillate fuel oil from Pittsburgh seam coal. By-products include substitute natural gas, mixed liquid butanes, propane, naphtha, ammonia, elemental sulfur, and tar acids. A simplified flow diagram for the preliminary design is presented in Fig. 2.1. Product quantities from the demonstration plant are shown in Table 2.1. Figure 2.2 shows the layout of the plant on the proposed site, and Fig. 2.3 shows the layout of the process area specifically.

Coal sized to 5 cm x 0 (2 in. x 0) will be delivered by barge. From the unloading area, the coal will be conveyed for about 1158 m (3800 ft) to the storage area, which will consist of two piles. Coal will be reclaimed by a rotating drum system and conveyed to pulverizing-drying equipment for final size and moisture reductions. The fine coal will then be transferred to surge storage bins from which it will be withdrawn for slurry mixing.

The demonstration plant will use the noncatalytic, direct-hydrogenation SRC-II process to liquefy 6000 tons of bituminous coal per stream day (tpsd). The pulverized feed coal will be mixed with a recycled hydrocarbon-mineral-residue slurry stream from the process and pumped together with hydrogen-rich gases through a preheater to the dissolver. In the dissolver, hydrogenation and liquefaction reactions will convert the coal into liquid and gaseous products. Flue gases from the fuel-fired preheater will constitute the only source of air emissions from this area of the plant under normal operating conditions.

The stream leaving the dissolver will undergo a series of separations that produce a heavy-liquid stream containing the mineral ash, a lighter liquid stream, and a vapor stream. A portion of the heavy-liquid stream will be recycled to the slurry mix tank, and the remainder will be sent to a vacuum-distillation tower. The distillation will produce a mineral-residue slurry, which will be gasified to produce the hydrogen required by the process, and an overhead stream, which will be combined with the light liquid from the liquefaction separators and fed to a fractionator (distillation tower). The fractionator will separate this stream into naphtha plus light and heavy fuel oils. The vapor stream from the first separator will be treated to remove hydrogen sulfide and carbon dioxide and then cryogenically separated to produce a high-purity hydrogen stream that will be recycled to the dissolver, a methane-rich stream that will be upgraded to produce a pipeline-quality gas, and an ethane-rich stream, from which propane and butane will be recovered as products. Part of the residual stream will be used as plant fuel and the rest will be converted to substitute natural gas in the methanation step.

The thermal efficiency of the reactions that take place in the dissolver will be quite high. However, the overall efficiency of the plant, based on the heating value of the products in

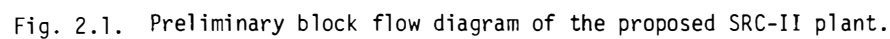


Table 2.1. Products from the demonstration plant^a

Quantity		Higher heating value		
		Btu/lb	Btu/bbl (×10 ⁶)	Btu/scf
Products				
Substitute natural gas	10.6 × 10 ⁶ scfd			950
Liquid propane product	2,924 bbl/d	21,630	3.85	
Naphtha (nominal boiling range 150-385° F, 31° API) ^b	3,368 bbl/d	17,500	5.02	
Light fuel oil (nominal boiling range 385-600° F, 14.4° API) ^b	6,278 bbl/d	17,110	5.87	
Heavy fuel oil (nominal boiling range 600-950° F, 7.2° API) ^b	2,871 bbl/d	16,930	6.40	
By-products				
Anhydrous ammonia	30 short tons/d	9,600		
Elemental sulfur	202 short tons/d	4,050		
Tar acids	43 bbl/d	20,000	7.50	
Plant fuel products				
Synthesis fuel gas	30.8 × 10 ⁶ ft ³ /d			
Mixed liquid butane product	1,590 bbl/d			
Methane-rich gas	34.6 × 10 ⁶ ft ³ /d			

^aExpected products if the decision is made not to burn naphtha as fuel. If naphtha is burned, rather than being a product, the substitute natural gas production would increase to about 40 × 10⁶ ft³/d.

^bLiquid fuel specific gravity and API gravity. A 10° API oil has a specific gravity at 70° F of 1.0 in relation to water at 60° F. The general formula for API is

$$^{\circ}\text{API} = \frac{141.5}{\text{specific gravity } 70^{\circ}\text{F}/60^{\circ}\text{F}} - 131.5$$

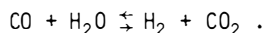
relation to that of the feed coal, will be 60% in the proposed design. The inefficiency results from heat lost in the form of flue and stack gases, as well as aerial and water coolers.

2.2.1.2 Supporting facilities

The SRC process requires a number of supporting facilities to (1) provide required materials and utilities such as steam, electricity, process water, air, and nitrogen; (2) treat products to market specifications; (3) recover by-products; (4) treat waste streams to remove pollutants and produce effluents suitable for in-plant reuse, emission, or discharge; and (5) provide for the safe disposal of solid wastes. The major environmentally important facilities are described briefly in the following sections.

Gasification

The most important process supporting operation will be the gasifier. The required hydrogen may be most economically produced by a partial oxidation gasifier (Sect. 2.3.2.1 discusses alternatives to the proposed gasification system). The Texaco gasifier will react (burn) a carbon source with a limited quantity of oxygen in the presence of steam to produce carbon monoxide and hydrogen. The carbon monoxide will then be reacted with steam in a shift conversion reaction to produce hydrogen and carbon dioxide in accordance with the following reaction:



A variety of carbon sources, including coal and oil, could be used as gasifier feed. In the proposed design, the mineral residue slurry (produced by vacuum distillation of the bottoms from the first dissolver effluent separator) will contain significant amounts of carbon. Gasification of this material will offer the dual advantages of recovering the carbon content of the mineral residue and converting the residue into a slag suitable for disposal. Alternatives for disposition

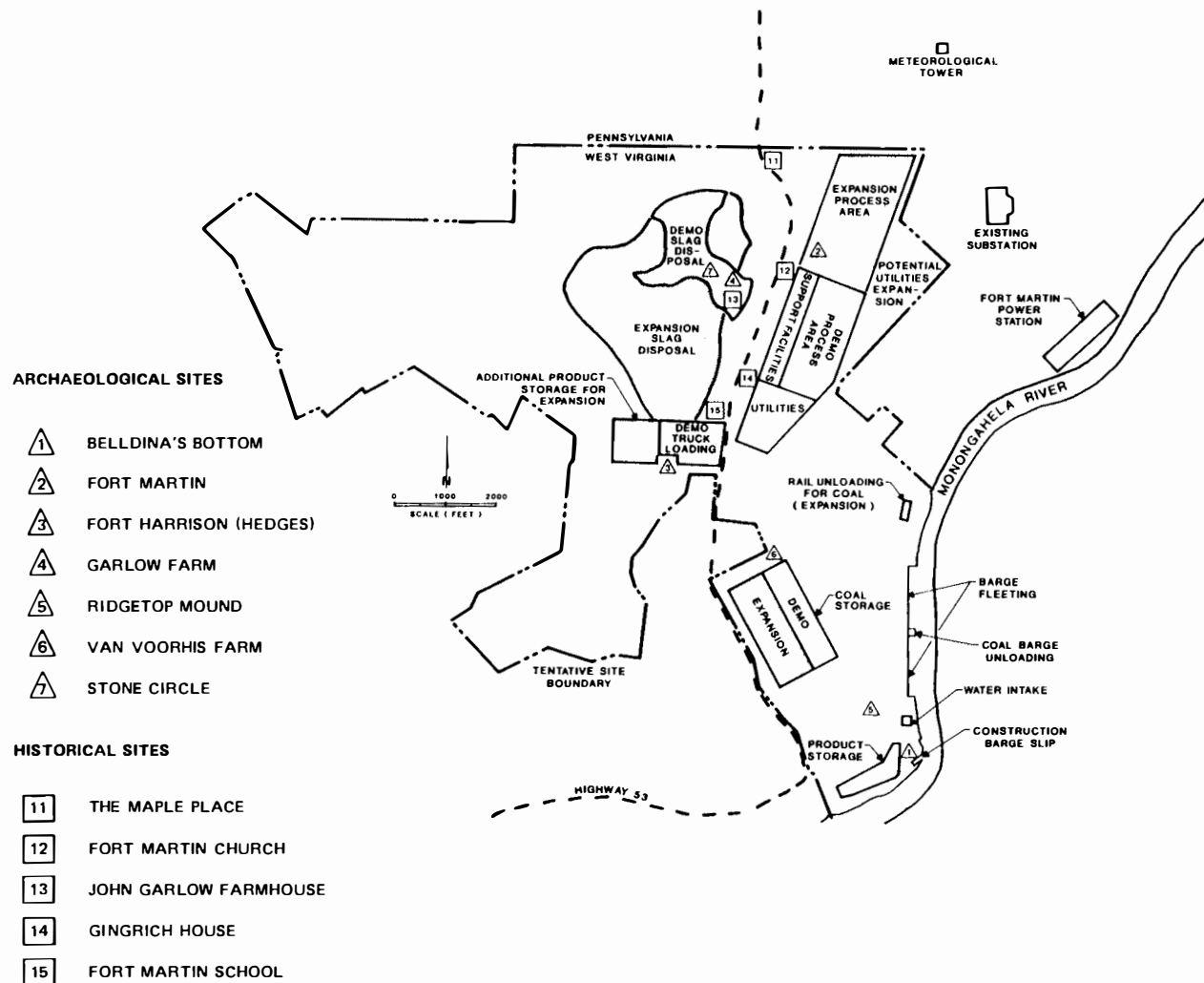


Fig. 2.2. Layout map of permanent SRC-II facilities at the Fort Martin site. Several onsite roads and the coal conveyor are not shown.

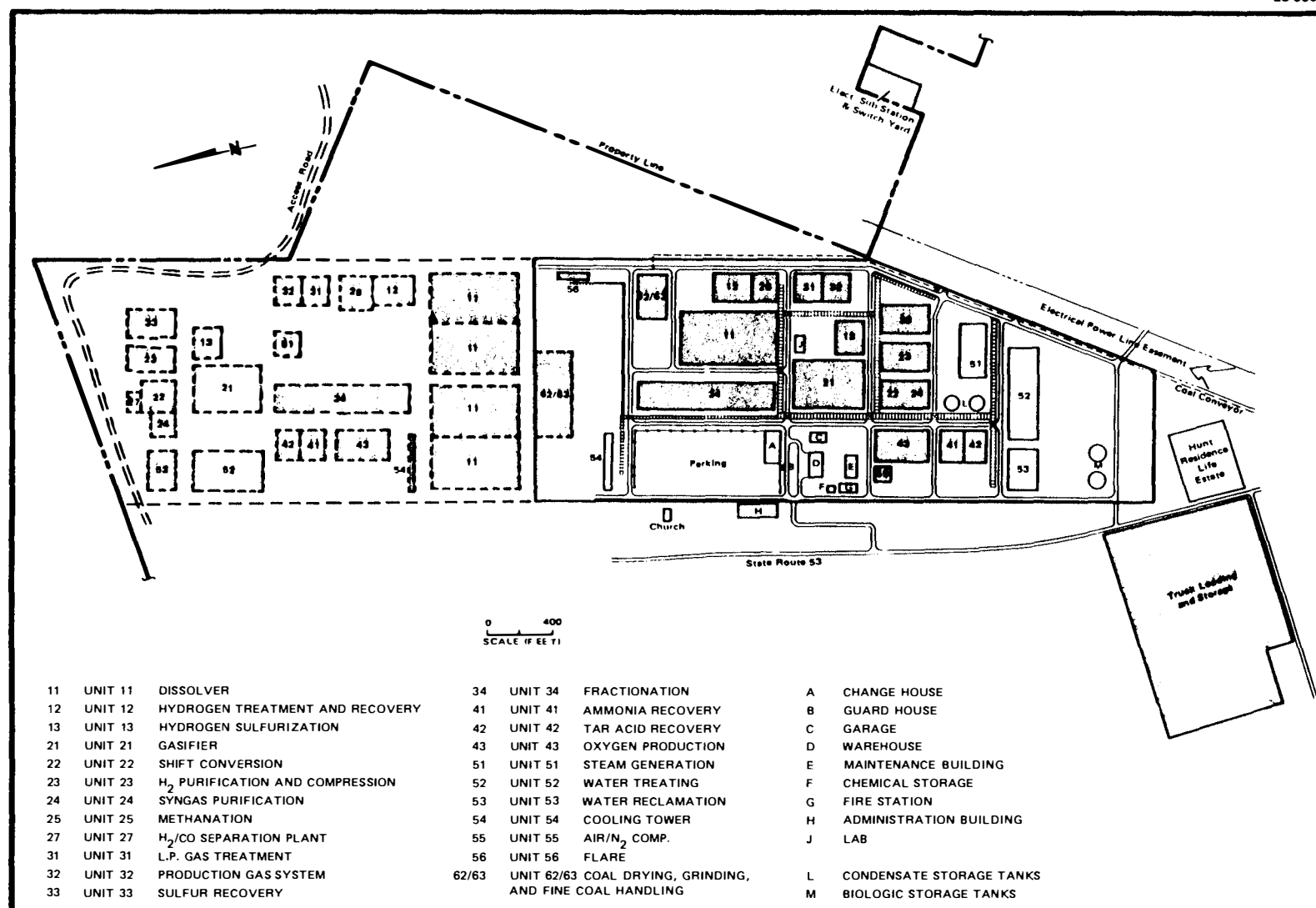


Fig. 2.3. Layout of the process area.

of the mineral residue and production of hydrogen are discussed in Sect. 2.3.2.1 and Appendix C. To facilitate separation of high-purity hydrogen for process use, oxygen will be supplied to the gasifier by the cryogenic separation of air. During normal operations, there will be no emissions to the atmosphere from the gasification process. The gasification and shift conversion processes will be net consumers of water; however, a wastewater stream will be produced that will be directed to the wastewater treatment system. The slag produced by the gasifier will be the major solid waste produced by the process. Disposal of the slag is discussed later in this section and in Appendixes C and K, and the environmental effects are discussed in Sect. 4.2.2.2.

Wastewater treatment and recovery

Major wastewater streams and contaminants. The expected normal wastewater flow to the treatment plant is shown in Fig. C.4 of Appendix C, and will consist of the following major streams:

1. process sour water,
2. cooling tower blowdown,
3. coal pile runoff,
4. process area runoff,
5. slag disposal leachate, and
6. wash water.

Appendix C describes the composition of these streams, and Appendix K describes the composition of leachates from coal and gasifier slag. About one-half the total wastewater flow will be the cooling tower blowdown, depending on the chlorine content of the feed coal and river intake water. The most significant contaminant in this stream will be chromium, which is added for corrosion inhibition. The common inorganic constituents that originate in the makeup water to the cooling system will be concentrated and present in the blowdown.

Another one-third of the wastewater flow will be process sour water, the most heavily contaminated stream. Hydrogen sulfide, ammonia, and phenolics should be the major contaminants in this stream, along with some cyanide, thiocyanate, and metals. Trace complex organics, such as polynuclear aromatic compounds, probably will also be present in the stream.

The remaining portion of the wastewater will come from various sources: runoff from raw coal piles; runoff from the diked areas where the process equipment, product storage, and shipping areas will be located; sanitary waste; oil bearing wastes; and such lightly contaminated waters as boiler blowdown and water filter backwash.

The contaminants in the runoff from the coal piles should be mostly dissolved inorganic solids containing trace quantities of heavy metals. The process area runoff should be contaminated with process liquids, including certain high boiling point hydrocarbons. The landfill leachate should contain the contaminants common to the coal pile runoff. The lightly contaminated wastewaters should contain chiefly inorganics and suspended solids.

Proposed design of the wastewater treatment system. The wastewater treatment system will treat process wastewater, leachates from the slag disposal area and from the coal storage piles, and contaminated rain runoff from the process area and from all product storage and shipping areas (Appendix C, Sect. C.3.6). The system will also treat spills of process liquids occurring in the main process area and in the product storage and shipping areas. These sources represent all the contaminated liquid streams in the facility.

The demonstration plant is designed to produce treated wastewater discharge under normal operating conditions and includes provisions for containment and treatment of runoff resulting from a 24-h rainfall event having a recurrence interval of ten years (the 10-year, 24-h storm). The plant design also provides a reduction of up to 100% elimination of water discharge during periods when river conditions and ambient or discharge water quality do not permit discharge in an environmentally acceptable manner.

The treatment processes will include separation of oily wastes, aerobic biological treatment followed by filtration, and final polishing of the effluent by activated carbon. The system will provide equalization and retention basins to retain large wastewater flows during rain events (primarily runoff and leachates) and to promote mixing, thereby preventing upset of the biological system resulting from shock by toxic components.

Initially, the sour water from the dissolver purge will be treated for phenol removal in the tar acid recovery unit. Dissolver sour water will then be combined with gasifier quench water and stream-stripped in the ammonia sulfide water stripping unit to remove H_2S and ammonia. Stripped water will then be biologically oxidized along with other organically contaminated wastes.

The effluent from the biological oxidation unit will be treated before discharge by filtration and activated carbon adsorption. Filtration will remove residual suspended solids, and adsorption will further reduce trace organics, particularly polynuclear aromatic hydrocarbons (PNAs). Sanitary waste will be treated separately in a package biological unit.

Carbon-filtered water, when the plant is operating in the zero-discharge mode, will go to the evaporator module.

Reduction or elimination of a discharge will be accomplished through use of the evaporation that takes place in the cooling towers plus a water reclamation and recovery system in which wastewaters will be pretreated and desalinated, producing a recycle water stream for process use and a brine stream (see Appendix C, Table C.11). Alternative disposal methods for the brine are being evaluated; alternative disposal methods are discussed in Sect. 2.3.2.1 and Appendix C. Residues from wastewater treatment will be disposed of in accordance with the requirements of the Resource Conservation and Recovery Act (RCRA). A flow diagram for the wastewater treatment system is shown in Fig. 2.4.

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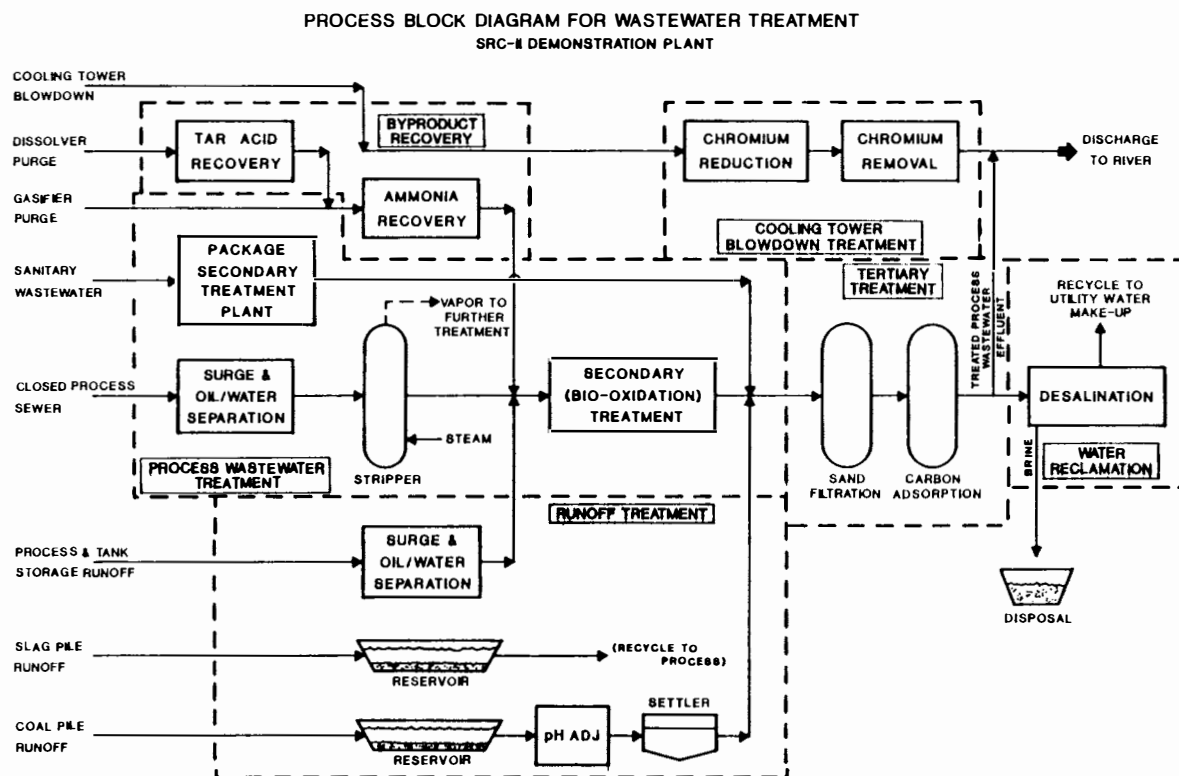


Fig. 2.4. Flow diagram of proposed wastewater treatment system.

Air pollution control

Emission inventory. The plant emission inventory is detailed in Appendix C (Sect. C.4.1) for various operating conditions. The estimated emission rates of criteria pollutants from point sources in the SRC-II facility under normal operation after control are as follows:

Criteria pollutant	Emission rate (g/s)
Sulfur dioxide	34.6
Particulates	16.3
Hydrocarbons	2.9
Nitrogen oxides (as NO ₂)	58.9
Carbon monoxide	3.9

Following are descriptions of the control technology employed for each of these pollutants.

Sulfur oxides control. Sulfur oxides control alternatives were considered for various parts of the plant and are discussed in Sect. 2.3.2.1 and Appendix C. Fired heaters and power boilers will be major sources of sulfur dioxide; therefore, selecting low-sulfur plant fuel will be the control technique.

As discussed later, a Claus unit will be used in sulfur recovery. The tail-gas cleanup of the Claus unit will employ a Shell Claus off-gas treating (SCOT) unit for additional sulfur removal. The SCOT effluent gas will be incinerated prior to its release up the stack. This stack gas will be the principal SO₂ release from the plant.

Hydrocarbon control. Hydrocarbon storage tanks will have vapor recovery systems in which vapors will be collected, compressed, and returned to the processing areas or to the controlled combustor unit. A directed maintenance program (Appendix C, Sect. C.3.5.1) will apply to all pump and compressor seals, valves, and drains in 2.5-cm (1-in.) and larger process lines and equipment that contain materials having the greatest potential for health impacts. During process upsets and emergencies, the hydrocarbons will be sent to the controlled combustor and flare system, which is described later in this section. Appendix C discusses the design and emissions from the hydrocarbon control systems.

Particulates control. Fugitive coal pile emissions will be minimized by enclosing conveyors and transfer points, selecting stacking and reclaiming equipment of low dusting potential, and by spraying the open storage piles with water or polymer dust inhibitors. Vent gas from coal pulverizing-drying and transport operations will be controlled by cyclone and baghouse systems. Plant fuel selection and firing control will be the control method for combustion-generated particulates and carbon monoxide. Slag handling selection (by wetted conveyors) is the control method to be used for slag dust emissions. Appendix C discusses alternative particulate control systems considered.

Nitrogen oxides control. The principal sources of nitrogen oxides (NO_x) will be the power boiler, coal dryer, and fired heaters. The quantity of NO_x emitted will be minimized by specifying low-NO_x burners and by applying several combustion modification techniques: flue gas recirculation, staged combustion, and minimized excess air subject to constraints of CO and soot production.

Solid waste disposal

Types, quantities, and classification. Four major types of solid waste resulting from the SRC-II process will be (1) slag from the gasifier, (2) process sludges, (3) a brine of soluble salts from wastewater desalination, and (4) spent catalysts and adsorbents. Appendix C provides additional discussion of solid waste characteristics. For design purposes, these wastes are assumed hazardous under the RCRA, subject to monitoring during the demonstration. The quantities produced (based on a 6000-tpsd coal feed) of the solid wastes are estimated in Table 2.2.

Table 2.2. Estimated production rate of SRC-II solid waste^a

Type of waste	Quantity (tons/year)
Gasifier slag	240,000
Process sludges	14,000
Zero-discharge brine	^b
Spent catalyst/adsorbent	250

^aAt 6000 tpd coal feed rate.

^bA liquid brine will be produced when operating in the zero-wastewater-discharge mode. See Appendix C, Sect. C.3.7.2, and Table C.11.

Methods of disposal. In the baseline design, all solid wastes and residues will be stored in hazardous waste landfills with the exception of raw water treatment sludge. The design will incorporate the final RCRA, Public Law 94-580, design standards for landfills as soon as they are available. Until then, the proposed standards published on December 18, 1978, will be used as a design guide. Construction of the disposal facility cannot begin until the final decision standards are effective and the necessary RCRA permit has been granted by the U.S. Environmental Protection Agency (EPA) or an approved state permitting authority. Appendix C presents a

cross-sectional diagram of the landfill. The landfills will be constructed and maintained in accordance with applicable Federal and State solid waste guidelines and regulations. Several alternatives are under investigation for disposing of the biological sludge, brine of soluble salts, and the spent activated carbon. These are discussed in Appendix C.

Based on a design ash content of 12%, the demonstration plant will produce about 720 tons of gasifier slag per day, which constitutes the major solid waste stream. The quantity of slag produced is equivalent in weight to the ash produced by conventional coal combustion at the same coal feed rate with particulate emission control. The wet slag will be transported by belt conveyor to the disposal area located on the west side of Highway 53, as indicated in Fig. 2.2. Although the leaching studies performed to date indicate that the slag will be designated as nonhazardous (see Appendixes K and C), the disposal area will be a secure landfill designed in accordance with the requirements for disposal of hazardous wastes in the RCRA.

Uncontaminated surface runoff will be diverted away from the disposal area, and leachate will be collected and pumped to the water reclamation system. Location of the slag disposal area is shown in Fig. 2.2, and conceptual plans and cross sections of the proposed disposal area are shown in Fig. 2.5 (which shows the disposal area under existing conditions, at the end of the demonstration period, and at the end of the commercial period) and Appendix C. The environmental impacts of slag disposal are evaluated in Sect. 4.2.2.2.

Water-soluble solid wastes will originate from the gasification and dissolver sections, from the cooling tower blowdown, and from coal pile runoff and slag leachate. Under conditions when river discharge of treated wastewater is restricted, water reclamation by desalination will concentrate these solid wastes, including some heavy metals, into a brine. Special methods of brine disposal will be necessary and are continuing to receive study. At this time, several alternatives are under consideration, as described in Sect. 2.3.2.1 and Appendix C. Evaporation facilities are also planned for use during plant shutdowns on collected rainwater when river conditions preclude discharge of treated water.

Small amounts of catalyst used in support processes will normally be returned to the supplier for reprocessing. Alumina and cation and anion resins will be disposed of in a landfill after a useful life of about three years.

Acid-gas removal, sulfur recovery, and tail-gas treating

In the dissolver, hydrogen will react with both organic and inorganic sulfur to produce hydrogen sulfide and other reduced sulfur compounds (COS , CS_2). Most of the sulfur will be contained as hydrogen sulfide in the vapor stream from the second separator; however, a significant amount of sulfur will remain with the liquid products, including the mineral residue, and will be partially liberated during subsequent processing steps. A sulfur balance for the plant is presented in Appendix C. The presence of hydrogen sulfide is considered undesirable from a process standpoint, and gaseous streams containing excessive quantities of hydrogen sulfide will be directed to acid-gas (carbon dioxide and hydrogen sulfide) removal systems at various locations within the plant. These systems will use several commercial processes in which the hydrogen sulfide will be absorbed into a scrubbing solution and then recovered from the solution by physical processing, subsequently producing a concentrated hydrogen sulfide stream and a clean gas stream for further processing or use. The concentrated hydrogen sulfide streams will be collected from the various acid-gas treating facilities and will be routed to the sulfur recovery unit. The sulfur recovery unit will consist of a two-reactor Claus plant and a SCOT unit following the Claus plant. In the Claus unit, a portion of the hydrogen sulfide will be burned to produce sulfur dioxide, which will then be combined with the unburned hydrogen sulfide and passed over a catalyst. The catalyst will promote an oxidation-reduction reaction between the hydrogen sulfide and the sulfur dioxide to produce elemental sulfur, which will be recovered and stored in molten form for sale as a by-product. The SCOT unit will recover additional hydrogen sulfide from the Claus tail-gas and send it to the Claus unit. The tail-gas from this unit will then be incinerated to convert residual hydrogen sulfide and other reduced sulfur species to sulfur dioxide. This will virtually eliminate sulfur recovery as a source of odors and will reduce the acute toxicity of the tail-gas. The sulfur dioxide emitted from the tail-gas incinerator constitutes the major sulfur dioxide emission from the plant and the environmental impacts are evaluated in Sect. 4.2.3. Alternative sulfur control technologies are described and analyzed in Sect. 2.3.2.1 and Appendix C.

Controlled-combustor-flare system

Under normal operating conditions, the only continuous emission sources will be the process heaters, the tail-gas incinerator at the sulfur recovery unit, the dust collection systems in the coal-handling areas, and the power boiler. The remaining process units are designed to operate without releases to the atmosphere; however, during abnormal operating conditions (upsets), it

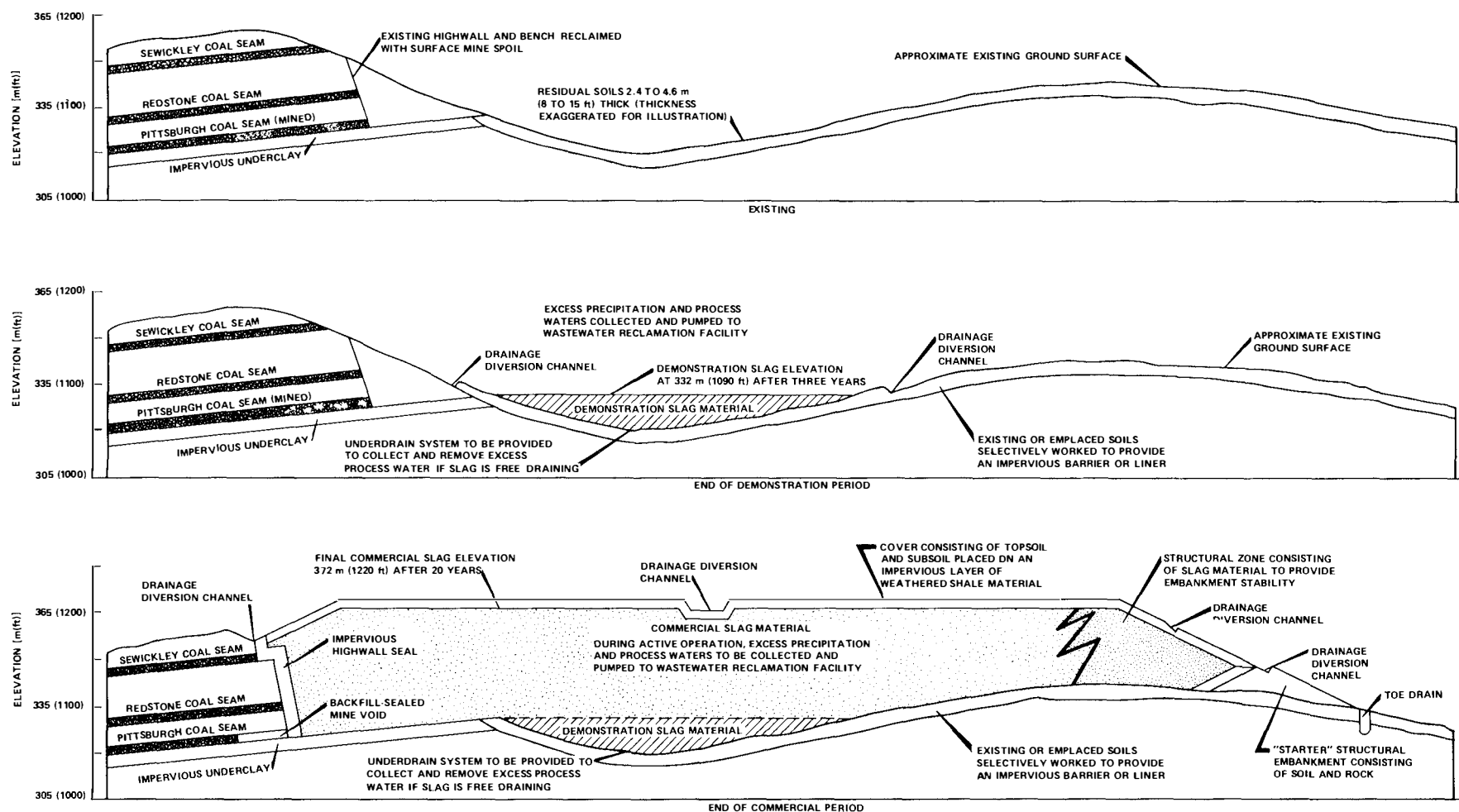


Fig. 2.5 Conceptual slag pile cross sections depicting phases from current condition to the expanded commercial phase.

will often be necessary to relieve pressure in process units to prevent damage to equipment or to prevent safety hazards. In conventional chemical and petrochemical processing facilities, pressure relief is normally accomplished by venting to an elevated flare stack, where the excess material is ignited and burns in the atmosphere without additional controls. Many of the SRC process streams contain complex organic materials, some of which are known to have toxic or carcinogenic characteristics, and conventional flares do not adequately assure that combustion of these materials will be complete. The currently proposed demonstration plant also includes a controlled combustion device, with a two-stage burner system that, by providing adequate temperature and residence time, will provide a high degree of assurance of complete combustion of materials released under many upset operating conditions. Liquid knockout vessels will be provided upstream of combustion devices in order to separate liquids for return to the main process. Emergency situations may require extremely rapid venting of process vessels, which will require a portion of the gas to bypass the controlled combustor, with the stream(s) directed to one of the elevated, smokeless flares.

The controlled combustor's principal advantage over the flare is that it reduces the emission of unburned hydrocarbons. Other streams, such as the gasifier output, contain materials that can be combusted in a flare as effectively as they could be combusted in a controlled combustor; the gasification system will therefore have a dedicated flare. The design of the controlled combustion system will assure that streams containing significant quantities of complex hydrocarbons are routed to the controlled combustion system on a priority basis and are not displaced by higher volume streams that contain lower concentrations of such substances. A purge-vent combustor to control fugitive leaks into the header system is also included.

The flare system design is evolving; alternatives to the flare system are being evaluated and are discussed in Sect. 2.3.2.1 and Appendix C. Sections 4.1 and 4.2.3 analyze the environmental and health aspects of the alternatives during normal operation.

As discussed in Appendix AA, a safety analysis report will be prepared that will describe emergency situations, the health and environmental risks involved, and the methods for safely handling these situations.

Process cooling

Control of processing operations will require the removal of significant quantities of heat from process streams. Wherever economically feasible, heat will be recovered by transfer to other process streams, by heat transfer fluids, or by steam generation to increase the overall thermal efficiency of the plant to 60%. The size of the demonstration plant limits the amount of heat recovery that can economically be employed. At commercial scale, additional heat recovery will be economically feasible, and the overall thermal efficiency of the plant is expected to rise to about 70%. Assuming only the heat recovery that is economically feasible at demonstration plant scale and the utilization of cost-effective direct air cooling, the demonstration plant will reject about 4.7×10^8 W (1.6×10^9 Btu/h) of excess heat (this quantity of waste heat is approximately 15% of the heat rejected from the adjacent Fort Martin power plant when it is operated at its rated capacity). The currently proposed design utilizes a recirculating cooling water system with mechanical-draft wet cooling towers together with aerial coolers on selected hot process streams. Portions of the cooling water system will use a barrier fluid loop to prevent hydrocarbon contamination of the cooling water from leaks in heat exchangers.

Replacing evaporated water in the proposed cooling system will consume more water than all other plant uses combined. Without a large water loss by cooling tower evaporation, zero-process liquid discharge could not be achieved when required by river flow conditions and water quality. Although a nonevaporative dry-cooling system could theoretically be used to reject the entire heat load of the plant, this would alter the overall water balance and result in the need to discharge water more frequently. Section 2.3.2.1 and Appendix C analyze the environmental impacts of waste heat rejection systems and address their effects on the plant's water balance and its wastewater treatment system.

Coal storage, preparation, and handling

The storage area will consist of two piles (both active), totaling a 30-d capacity (about 200,000 tons), and will occupy an area of about 2.8 ha (7 acres). The proposed location of the coal storage area is shown in Fig. 2.2.

Dust (from mechanical agitation and wind action) and rainwater runoff laden with suspended and dissolved solids constitute the principal effluents from receiving, conveying, storing, and reclaiming activities. Reclamation will be by mechanical reclaimer. To control fugitive dust, a water-spray suppression system will be used at storage piles and at the unloading facility, and a luffing-stacker and drum reclaimer will be used to reduce fugitive losses. Conveyors will be covered, and transfer points will be enclosed.

The area surrounding the storage piles will be graded to direct uncontaminated surface runoff away from the piles, and the area under the coal will be contoured, lined with a natural or synthetic material, and provided with a drainage collection system designed to minimize the release of leachates. Collected leachates will be pumped to the wastewater treatment system. Onsite soils are now being examined to determine their permeability characteristics. Should onsite soils prove unsuitable for use as liner material, a clay or synthetic liner will be provided at the coal pile. Appendix C discusses fugitive emissions from the coal pile, and Sect. 4.2.3 analyzes the air quality impact of these emissions.

Product storage and shipping

Two separate product storage areas are planned. The truck shipping area near the main process area (see Fig. 2.3) will store and handle tar acid, propane, butane, and anhydrous ammonia and will provide facilities for truck loading. The shipping area at the south end of the plant site, adjacent to the railroad and the Monongahela River, will provide storage for naphtha and light and heavy oils, and liquid elemental sulfur products and for facilities for loading rail cars (Figs. 2.2 and 4.3).

All liquid product and sulfur storage areas will be diked and lined with impervious material to contain the release of liquid product materials in the event of tank failure or operator error. The capacity of the diked area will be adequate to contain the contents of the tank plus precipitation from the 10-year, 24-h storm and water used in the event of a fire. Drainage from within the diked area and runoff from the product loading areas will be pumped to the wastewater treatment system. The drainage collection system will incorporate measures to prevent inadvertent releases of material to the environment as a result of equipment failure or operator error. The heavy product storage area on the Monongahela floodplain is discussed in the floodplain/wetlands review included in Appendix D and in Sect. 4.8.

2.2.2 Proposed site: Fort Martin, West Virginia

The proposed site consists of about 983 ha (2430 acres) surrounding the unincorporated community of Fort Martin, West Virginia. About 151 ha (373 acres) will actually be required for demonstration plant facilities. The site will be acquired through a combination of purchase and long-term lease arrangements. All areas required for process facilities have either been purchased by the industrial partner or are under purchase option to the Monongalia County Development Authority. Negotiations are in progress for acquisition of the remaining portions of the proposed site.

The proposed site is bounded on the southeast by the Monongahela River, on the east by the Fort Martin Power Plant (Monongahela Power Company), on the north by the West Virginia-Pennsylvania state line, and on the west and south by land in private or corporate ownership. Except for a narrow floodplain with small wetlands along the river, the site is hilly terrain at an elevation of about 338 m (1108 ft) (MSL), or 95 m (311 ft) above the river. The western portion of the site has been both deep- and strip-mined (strip mining is currently in progress); thus, this area consists primarily of reclaimed lands in various stages of recovery (Sect. 3.2.1.2). The central portion of the site along Highway 53 consists primarily of pasture and grassland (some of it reclaimed surface-mined areas), whereas the eastern portion, including the steep slopes along the river, is primarily forestland. No critical habitat for any threatened or endangered species is located on the site. Seismic risks are low (Sect. 3.2.1.2).

Water quality in the Monongahela has improved significantly in the last ten years and, although still subject to acid mine drainage and municipal and industrial discharges, it is considered adequate for plant use (Sect. 3.2.2.3). Previous studies have identified the Monongahela Basin as an area having limited water supplies for energy development (Sect. 3.2.2.1). The Water Resources Council (WRC) has conducted a study on the influence of the plant on water resources. The results of this study indicate that there are water availability concerns for the demonstration plant during low-flow conditions and for the commercial plant (Sect. 4.2.2.1). Use of shallow groundwater for domestic purposes is limited, but public water supplies are available; deeper aquifers are generally brackish (Sect. 3.2.2.2).

Ambient air quality monitoring conducted near the point of predicted maximum facility impact indicates current compliance with all National Ambient Air Quality Standards (NAAQS) and the availability of the full class II Prevention of Significant Deterioration (PSD) increments (Sect. 3.2.3.1).

About 65% of the required work force is anticipated to come from the site vicinity. The availability of single-family housing units and rental units in Monongalia County appears to be adequate to meet the demand exerted by in-migrating construction workers. However, demand for low-cost single-family units may exceed the supply, and it is possible that a problem could arise from construction labor competing with university students for rental units. In addition, mobile

rental units are in short supply in Monongalia County, and the demand may exceed the supply. Traffic congestion in the site vicinity has been identified as a potential significant impact area and the State of West Virginia has committed to provide adequate access to the site (Sect. 3.2.4).

See Sect. 3.2 for a more complete description of the site.

2.3 COMPARISON OF ALTERNATIVES AVAILABLE TO DOE

Three alternative actions may be taken by DOE:

- proceed with the proposed action (Sect. 2.3.1);
- select an alternative design, or site, to reduce environmental impacts further and proceed with construction (Sect. 2.3.2);
- determine not to proceed with construction at any site — no action (Sect. 2.3.3).

The environmental impacts resulting from each of these alternatives are summarized and compared below.

2.3.1 Proceed with construction in accordance with the currently proposed action

2.3.1.1 Impacts during demonstration

The environmental impacts resulting from construction and operation of the demonstration plant at the proposed Fort Martin site in accordance with the currently proposed design are described in Sects. 4.1 and 4.2.

In summary, construction and operation of the plant in accordance with the proposed design and site are expected to result in the following impacts:

- Through chemical reactions involving coal, the SRC process will produce a broad range of materials that contain carcinogenic and mutagenic organic compounds, including aromatic amines, aromatic and heterocyclic compounds, highly substituted phenols, and other compounds. The public could be exposed to these substances in fugitive emissions (leaks), emissions from the plant flare system, wastewater discharge to the Monongahela River, and SRC liquid spill during product transport. Point source air emissions, onsite spills, and solid waste disposal are not significant sources. Fugitive hydrocarbon emissions will be reduced through the use of special mechanical design and equipment selection for potential leak points and a "directed maintenance" program. The flare system serving the liquefaction and distillation equipment will be used to reduce emission of these hazardous substances through the use of a controlled combustor. Discharge of hazardous substances to the Monongahela River will be reduced through the use of an extensive wastewater treatment system with zero-discharge capability. Impacts from SRC liquid product spills will be reduced by careful selection of markets, routes, transportation equipment, a developed plan for spill cleanup and countermeasures, and cooperation with the EPA and the Coast Guard in the event of a spill (Sect. 4.1.3).

For workers involved in maintenance operations, skin contact and inhalation are of concern. For other categories of workers at the plant site, fugitive emissions to the atmosphere are expected to be the major exposure source and will be reduced by the measures discussed above. Highly detailed maintenance procedures will be developed based on experience at the SRC pilot plants and at other industries involved in handling materials that are hazardous if personal contamination occurs (Sect. 4.1.3.4).

The pilot plants at Fort Lewis, Washington, and Wilsonville, Alabama, have operated since 1974 without any overt health effects unique to their operation. However, the size of the work force and the length of study times are not adequate to allow conclusions concerning potential long-term effects to be drawn in an epidemiologically significant manner. The DOE and other agencies are sponsoring programs for characterizing and assessing the health risks of SRC processes as soon as possible. In addition, all TSCA requirements relative to health risks of products will be met before operation of the demonstration plant begins. Major long-term chemical, biological, and monitoring studies are under way to determine the specific characteristics of SRC materials and the effects of management and controls on them (Appendix Y). Results of programmatic efforts to date are encouraging. Industrial hygiene management within the Fort Lewis plant appears to be effective and to provide a sound basis for developing the program to be employed at the demonstration plant. Exposure monitoring for both the work force and the public will be a major feature of the health protection program (Sects. 4.1.3.5, 4.1.3.6, 4.5.3.1, and 4.6.9). Construction and operation of the plant in accordance with the proposed design and monitoring and mitigation measures will ensure low exposures and thus low risk to the public, the work force, and the environment (Sect. 4.1).

- Spills of SRC-II products have the potential for causing significant adverse impacts to surface waters and groundwaters. The SRC-II facility will be designed for maximum containment of any materials spilled on site. Areas susceptible to spills will be lined with impervious material to prevent infiltration of contaminants to groundwater and will be surrounded by dikes to prevent contamination of surface waters. Spilled material will be collected by the runoff containment system and routed to oil and water separators for recycle or treatment of spilled materials. These facility-design and spill-control measures will greatly reduce the consequences of onsite spills (Appendix C, Sect. C.3.5.3).

Spills of SRC-II products during transportation may at some time result in direct or indirect exposure of the public (Sect. 4.1.3.8 and Appendix Z). Spilled materials may enter surface water or groundwater supplies, be dispersed into the atmosphere, or cause exposure during cleanup operations. It is assumed that SRC-II liquid fuel products will be shipped by unit train to Baltimore, Maryland, and will cross numerous streams. Based on observed rail spill frequencies for similar products, spills of SRC-II liquids to water bodies can be expected to occur every 30 to 60 months (see Appendix Z, Sect. Z.4.1). The worst-case spill of SRC-II liquids in transit is considered to be a loss of 75,800 liters (20,000 gal) to the Potomac at the Harper's Ferry, West Virginia, crossing. Such a spill could cause a minor water-supply emergency for Washington, D.C., whose water intake is 80 km (50 miles) downstream from that crossing. Such a worst-case spill is considered to be exceedingly unlikely (see Appendix Z, Sect. Z.5.2).

A worst-case spill to a stream could result in massive mortality of river biota for a distance of 5-15 km downstream from the spill site. Impacts would be due principally to the water-soluble compounds, specifically the phenolic and aniline compounds. Impacts on aquatic ecology and water quality would decline downstream as dilution, uptake by organisms, adsorption by sediments, photolysis, and volatilization occurred. Selective mortality of river biota would occur downstream from the zone of massive mortality (Appendix Z, Sect. Z.5.2.1).

- About 151 ha (373 acres) of land will be converted from rural agricultural and residential use to industrial use for the life of the plant and removal of 540 ha (1350 acres) of land (primarily pasture) from agricultural production (Sects. 4.2.1.1 and 4.2.1.3).
- About 60 people (24 residences) will be displaced from the unincorporated community of Fort Martin (Sect. 4.2.1.1).
- Increased erosion and resultant sediment loads to surface waters will occur during construction. These impacts may be reduced to low levels by implementing control and mitigation measures (Sects. 4.2.1.2, 4.2.2.1, and 4.2.2.3).
- Vegetative communities and in available wildlife habitat will be reduced, which will not impact any Federal- or State-listed endangered or threatened species. Breeding habitat will be reduced for several West Virginia Heritage Trust Program and Audubon Society *Blue List* species, and proportionate population reductions may occur (Sect. 4.2.1.3 and Appendix E).
- Several important factors suggest that groundwater impacts from slag disposal will be minimal: (1) laboratory leaching tests of SRC-II pilot plant slag indicate that the slag appears to be nonhazardous under proposed RCRA criteria; (2) the soils are generally deep, of low permeability, and have high silt and clay contents (all favoring attenuation of contaminants); and (3) RCRA guidelines for construction of a secure landfill will be followed. A monitoring program will be implemented to identify potential failures in the containment system and resulting water quality impacts (Sects. 4.2.2.2, 4.5.3.1, and 4.5.3.2). As discussed in Sect. 2.2.2.1, disposal of several other solid wastes and soluble salt brines that may be hazardous is still under study and has not been specified in the current plant design.
- The destruction of shoreline habitat for construction of the barge dock, barge slip, water intake structure, and wastewater discharge structure will occur. Shoreline development will remove habitat that is valuable for spawning and feeding for some fish species. These habitat losses may be mitigated by preserving and enhancing habitat along the remaining undisturbed shoreline at the site (Sects. 4.2.2.4, 4.6.6, and 4.6.7).
- Operation of the demonstration plant will result in the consumption of 226 liters of water per second from the Monongahela River. Under normal flow conditions, water use by the SRC-II facility will have no significant impact. However, during low-flow conditions (the 7-d, 10-year low flow) the demonstration plant would consume 2.2% of the river's flow at the site. This water use would decrease water availability to downstream users and reduce the downstream river flow, which dilutes incoming pollutants, causing up to 2.3% greater concentrations of these pollutants. Barge traffic for SRC-II feed coal will also increase the streamflow required for lock operation. Under extreme drought conditions (recurrence of the drought of record), there will be inadequate streamflow to maintain navigation. Under

such conditions, shutdown of the demonstration plant will probably be necessary. DOE recognizes that the water availability problems of the Monongahela Basin require basin-wide comprehensive planning for water management (Sect. 4.2.2.1).

- When the Monongahela River's assimilative capacity is adequate, the plant will discharge treated wastewater. This discharge will create a mixing zone having degraded water quality; outside this mixing zone, however, only minor changes in water quality are expected. Significant water quality impacts will be prevented by operating the wastewater treatment plant in a zero-discharge mode during periods of low river flow or when high contaminant loading is found in either the discharge or the river (Sect. 4.2.2.3).
- Increased stress will be placed on aquatic ecosystems by treated wastewater discharge. The discharge of trace elements and organic compounds will create a mixing zone populated principally by pollution-tolerant organisms. In and near the discharge mixing zone, organisms will suffer chronic effects from exposure to sublethal concentrations of toxicants. The SRC-II discharge, however, is not expected to degrade substantially water quality or ecosystem health outside this immediate discharge mixing zone (Sect. 4.2.2.4).
- The water intake structure will withdraw 304 liters of water per second from the Monongahela River. Planktonic organisms will be entrained in the intake flow, most notably ichthyoplankton (fish larvae). (Juvenile and adult fish are not expected to be entrained due to the low intake velocity.) The shoreline water intake structure may cause significantly more entrainment of aquatic organisms than would a submerged intake closer to midstream. The only ichthyoplankton data available are for midchannel; however, ichthyoplankton density may be greater at the shoreline based on observations of fish nests along the river's edge. For a worst-case analysis it was assumed that low river flow and peak ichthyoplankton density occur simultaneously, when actually several months typically separate these two occurrences. Under low-flow conditions the plant would withdraw 3.2% of the river's streamflow. The shoreline intake could therefore entrain more than 3.2% of the river's ichthyoplankton under these worst-case conditions. Although midchannel appears to be the environmentally preferable location for water intake, it is highlighted for further evaluation (Sect. 4.2.2.4). During detail design, DOE and the industrial partner will evaluate shoreline and submerged water intake structures near midstream and their environmental effects.
- Collectively, the multiple impacts on the aquatic environment (loss and disturbance of shoreline habitat during construction, wastewater discharge, occasional nonroutine discharges, and other minor impacts) have the potential to change the river's character near the facility and shift the composition of the biological community toward those species more tolerant of disturbance and elevated contaminant levels. Therefore, it is important that high priority be given to minimizing the facility's impacts during construction and operation, to employing suitable mitigating measures (Sect. 4.6.6), and monitoring to determine which impacts actually occur and the success of the mitigating measures (Sect. 4.5.3.3).
- Air quality dispersion modeling indicates that plant operation will comply with the allowable PSD increment consumption (Sect. 4.2.3.1).
- Criteria air pollutants of the greatest concern will be particulates and sulfur dioxide, which will consume 34.9 and 13.3%, respectively, of the 24-h PSD increment (Sect. 4.2.3.1).
- The expected release of fugitive hydrocarbons will be about 95 tons per year, which produces a maximum ground-level concentration of about 0.2% of the background concentration (Sect. 4.2.3.1).
- Ozone concentration is not expected to be affected locally because of the long-range transport nature of the photochemical reaction of ozone's precursors (Sect. 4.2.3.1).
- Reduced-sulfur-compound emissions will be controlled through recovery as elemental sulfur (Sect. 4.2.3.1 and Appendix C).
- Carbon monoxide emissions will be of a minor nature (Sect. 4.2.3.1).
- Cooling tower drift losses will be minimal, and nearly all of the drift will be deposited within about 300 m (1000 ft) of the towers. Cooling towers will be sited to minimize visibility and icing effects. The heat rejection rate will be equal to 15% of adjacent Fort Martin Power Plant when operated at its design capacity. Virtually all cooling tower impacts will occur on site. The two sensitive locations for cooling tower impacts are Highway 53 and the electrical substation, neither of which will be significantly affected (Sect. 4.2.3.1).

- Normal startup and shutdown operation emissions will be less than emissions at the design level (Sect. 4.2.3.1 and Appendix C, Sect. C.4.1).
- Emergency upsets will vent gases to a controlled-combustion/flare system with high emissions of short duration (Sect. 4.2.3.1 and Appendix C).
- Higher noise levels caused by construction of the plant. Most of the construction will take place a sufficient distance from receptors that they will be exposed to no more than normally acceptable noise levels [not exceeding 74 dBA at about 18.3 m (60 ft)]; the exception would be when construction activity is within this distance of a sensitive receptor. Temporary barriers appear to be feasible in these areas (Sect. 4.2.3.2).
- Direct construction employment will peak at between 3800 and 5000 in 1983. The creation of between 1600 and 2700 indirect jobs will result. Labor shortages expected in six key crafts (electricians, millwrights, ironworkers, boilermakers, pipefitters, and insulators) will result in between 1400 and 1800 construction workers' moving to the general site area. Including dependents, this move is predicted to result in a population increase of between 2400 and 3100 persons, with 67% (about 1260 persons) expected to move to Monongalia County. This population increase will likely cause a shortage in mobile home spaces unless mitigating actions (Sect. 4.6.2) are quickly taken. In the worst case, Monongalia County public schools will not be significantly affected, but greater stress will be placed on the high schools. There may be localized inadequacies in availability of water and sewer service (Sect. 4.2.4.1). DOE is working with the Department of Housing and Urban Development and local planning agencies to identify means for mitigating housing, sewer, and water shortages (Sect. 4.6.2).
- The best estimate of the total population growth in the area of Monongalia County, West Virginia, due to peak demonstration phase construction activity at SRC-II is between 2.0 and 2.5% of projected 1985 county population. This anticipated growth falls far short of the conventional criteria for an anticipated boom-town impact. Consequently, it is expected that the boom-town effects simply will not occur (Sect. 4.2.4.1).
- Five sites eligible for the National Register of Historic Places will be adversely affected by the proposed plant: Belldina's Bottom, Van Voorhis Farm, Fort Martin archaeological site, the Gingrich House, and the Fort Martin School/Community Center. A Memorandum of Agreement is under negotiation with the Advisory Council on Historic Preservation. The memorandum will outline mitigation measures. Mitigation measures (Sects. 4.2.4.1 and 4.6.3 and Appendix U) under consideration include data recovery for three of the eligible archaeological sites and the use of Gingrich House and the Fort Martin School/Community Center as an information center for the project.
- Removal of the proposed site from the local tax base will occur for the duration of demonstration operation. As a result, there will be no direct tax payments. During the construction period, however, approximately \$11 million in business and occupation tax revenue is expected to accrue to the State of West Virginia indirectly from construction subcontractors (Sect. 4.2.4.1).
- Additional traffic will occur on local roads leading to the site. These roads are inadequate both structurally (to accommodate materials movement) and in capacity (to accommodate the work force commuting traffic). Substantial upgrading of roads and bridges will be necessary. Detailed planning for this road upgrading is under way by the State of West Virginia, and upgrading is expected to be completed in time to accommodate the peak demand (Sect. 4.2.4.1).
- Direct employment of approximately 460 persons during the operation phase and secondary employment of an additional 465 persons. The Morgantown-Monongalia County area is expected to have the capacity to absorb all long-term project-related growth without major negative impact; the plant payroll will have a large positive impact on the area (Sect. 4.2.4.2).
- Increased river traffic will occur for coal delivery by barge. The U.S. Army Corps of Engineers has determined that the existing river navigation system is adequate to accommodate the coal transportation needs for the demonstration plant (Appendix M).
- Increased rail traffic will occur for product shipment. An average of one unit train (74 cars) every other day will be required. The existing rail system is considered adequate to accommodate the added traffic without significant impact (Appendix Z, Sect. Z.2.1.1).

- The development of the proposed SRC-II demonstration plant at Fort Martin, West Virginia, will necessitate the use of the west bank floodplain of the Monongahela River between River Miles 93.2 and 94.5. The facilities to be located in the floodplain below the 100-year flood elevation include a barge unloading slip, a process water intake facility, the wastewater discharge, sections of a haul road and access ramps, and coal barge unloading and fleeting facilities. A limited area (about 1.2 ha) will be filled to support the product storage area and its associated spill containment facilities. Based on the analysis to date, no feasible alternatives exist to locating these facilities within the Monongahela River floodplain (Appendix D and Sects. 4.6.6, 4.6.7, and 4.8).
- Development in the floodplain and in upland areas will necessitate the elimination of several small areas of wetland habitat. Based on the analysis to date, no feasible alternatives are available to further reduce these impacts. Mitigation measures, including facility design modifications and replacement strategies, have been incorporated into the overall site development plan, and the resultant floodplain-wetland impacts of the proposed SRC-II demonstration plant are considered to be minimal (Appendix D and Sects. 4.6.6, 4.6.7, and 4.8).

Cumulative effects

The five-state region surrounding the SRC-II site (West Virginia, Virginia, Ohio, Maryland, and Pennsylvania) was examined to determine existing or potential sources of competing labor demands that may influence the ability of the SRC-II contractors to obtain skilled craftsmen not available from within the specified commuting zones.

Extensive examination of current secondary data sources and interviews with local officials did not reveal any other major construction projects that are or would be likely to represent any significant competing demand for skilled construction labor in the five-state region. This examination considered refinery construction and/or major maintenance, the often proposed Lake-Front Steel Mill in Ohio, the retrofitting of various power plants for air pollution control, governmentally mandated conversion of oil- and gas-fired power plants to coal burning, the DOE Gas Centrifuge Plant, general power plant construction, and the Fairmont Energy Corporation coke plant near Morgantown.

Another procedure undertaken to ascertain labor demand in the five-state region was specifically in regard to power plant construction and involved projections made by the Construction Labor Demand System (CLDS) developed by the U.S. Departments of Energy and Labor. These projections are by craft and indicate that from 1979 to 1983 large numbers of skilled construction workers will become available for employment as the anticipated level of power plant construction declines in the five-state region. Barring a substantial, unanticipated increase in power plant construction, it appears that no critical skill shortages are likely, with the possible exception of boilermakers. Any decline in activity from that utilized for CLDS projections would only reinforce this finding. The most likely situation currently is that even a significant increase in labor requirements over current projections should not create insurmountable labor shortages in the five-state region (Sect. 4.2.4.1). It is known that four other potential coal conversion plants are being considered for West Virginia. However, it is not considered likely that construction scheduled for such plants would overlap SRC-II construction; thus, the construction-phase cumulative socioeconomic impact should be negligible (Sect. 4.2.4.3).

The additive air quality effects of the nearby Fort Martin steam plant as well as all existing sources are included as observed background (Sect. 3.2.3.1). The cumulative air quality effects of these plants are thus included in the dispersion modeling presented in Sect. 4.2.3.1. Analysis of the interaction of SRC-II with facilities such as the proposed Fairmont Energy Corporation coke plant and the asphalt plant in Morgantown indicates that because of their relative locations, the distance separating them, and the prevailing wind, the cumulative air quality impacts will be small (Sect. 4.2.3.1).

During extreme droughts, the Monongahela River Basin will face serious streamflow deficits with or without the SRC-II project. The demonstration project, however, will be a significant new water consumer and will require substantial streamflow to operate the navigation locks if coal is to be transported to the site by barge, as is currently proposed. To reduce or eliminate SRC-II's contribution to low streamflows; the demonstration project will develop alternative plans of operation that reduce or eliminate river water consumption. To resolve the Monongahela Basin's current and future water problems, the Water Resources Council and the Ohio River Basin Commission recommended development of basin-wide water management programs (see Sect. 4.2.2.1).

2.3.1.2 Impacts of alternative fates of the facility after the demonstration

One of the major objectives of the demonstration program is to expedite the commercial application of the technology by providing a base for construction of the first commercial facility. If a decision is made to proceed with construction of the demonstration plant as proposed, the contract calls for a two-year demonstration period, at the conclusion of which the facility may be purchased by the industrial partner. If the demonstration plant is not sold, DOE may elect to continue operation under the existing contract for a period of up to nine months.

The following fates for the demonstration plant may result from a decision to proceed with construction:

- commercialization by the industrial partner at an expanded capacity,
- continued operation of the facility at demonstration plant capacity,
- conversion of the facility to another government use,
- mothballing of the facility, or
- decommissioning.

Because construction of a commercial facility at an expanded capacity is a major objective of the demonstration program, the suitability of the site for a commercial facility and the environmental impacts of its construction and operation are primary considerations in a decision to proceed with the project. However, it is possible that the sale of the demonstration plant will not occur and that one of the alternative fates will result. The probable impacts associated with each of the possible alternative fates are identified below. The impacts of commercial operation at expanded capacity are also discussed throughout Sect. 4.2.

Commercialization

One of the primary objectives of the demonstration plant program is to obtain an environmental data base. This data will be used by regulatory agencies to establish requirements for maintaining acceptable environmental quality and by industry for evaluating the economics of a commercial facility, including the required environmental controls. It is assumed that the decision to construct a commercial-scale facility at the demonstration plant site will be made in consideration of information that is currently unavailable and that will be obtained only by construction and operation of the demonstration facility. The analysis that follows focuses on environmental issues that can be identified at this time as potential impacts of, or limitations to, commercial development at the proposed site. It is currently estimated that commercial development would increase the production capacity of the demonstration facility by a factor of 5. Emission estimates used in the impact analyses of commercialization are conservative. It should be noted that DOE's National Environmental Policy Act (NEPA) strategy (Appendix X) and cost-sharing agreements provide that before any transfer of the demonstration plant to the industrial partner, DOE will prepare the appropriate NEPA documentation.

Air quality. Estimates have been made of the total suspended particulates (TSP), SO₂, NO_x, CO, and nonmethane hydrocarbons (NMHC) from the 30,000-tpsd expanded commercial plant. Because the layout of the expanded commercial plant is still conceptual, the location of emission sources (e.g., heaters, boilers, sulfur recovery plant, etc.) cannot be identified to the extent required for dispersion modeling. The emission estimates for the commercial-scale plant must be considered as preliminary. During operation of the demonstration plant, extensive source testing and area monitoring will be conducted to determine the total emissions and resulting ambient concentrations and to provide appropriate emission factors for use in design of the commercial facility.

Estimates of the various contributions to TSP from the expanded commercial plant, compared with those from the demonstration plant, are shown in Appendix C, Table C.31; the rationale used in these determinations is also explained in the table. The emission rate of fugitive dust from coal and slag handling is estimated to increase by a factor of 5 over that of the demonstration plant. The estimated increase in the rate of fugitive dust emissions from coal storage is a factor of 3. Point sources such as the coal dryer/pulverizer, pneumatic transfer, heaters, and boilers are expected to emit less than five times the amount of particulates emitted from the demonstration plant. The estimated total particulate emissions would increase from 18.0 g/s for the demonstration plant to 37.6 g/s for the expanded commercial plant, or by a factor of 2.09.

A comparison of SO₂ emissions from the demonstration plant with emissions from the expanded commercial plant is shown in Table C.32. For the expanded commercial plant, it was assumed that the fuel for all heaters and boilers would be plant gas (with a sulfur content of 100 ppmv); for the demonstration plant, a mixed fuel of plant-produced hydrotreated naphtha (with a sulfur content of 0.1 wt %) and plant gas (with a sulfur content of 100 ppmv) was assumed. Therefore, only about one-half as much SO₂ would be emitted per Btu of fuel burned in the expanded commercial

plant as in the demonstration plant. It was also assumed that the expanded commercial plant would have a substantially higher thermal efficiency because of additional process and design information and because of such design features as increased waste heat recovery, higher gasification pressure, and the use of combined-cycle gas turbine drives for large compressors, with the hot turbine-exhaust gases utilized for steam generation. Fuel requirements for the expanded commercial plant are estimated to be 4.5 billion Btu/h compared with 1.47 billion Btu/h for the demonstration plant. It further was assumed that the technical performance and reliability of some of the sulfur recovery technologies would be improved and alternatives chosen so that the sulfur concentration in the H_2S incinerator stack effluent would essentially be cut one-half. For example, Selexol desulfurization (a commercially proven technology) could be used in place of Benfield and would reduce sulfur emissions by more than 50% (for the demonstration case, Benfield was assumed in the estimate of emissions and in air quality impact analyses to provide a worst case). The ratio of SO_2 emissions from the expanded commercial plant to that from the demonstration plant is 2.21.

The major factors affecting increased emissions of NO_x and CO from the expanded commercial plant, as compared with the demonstration plant, are

- the expanded commercial plant would have a fuel consumption rate about three times that of the demonstration plant, and
- fuel used in the expanded commercial plant would consist entirely of plant gases (low nitrogen content) rather than of a mixture of naphtha and plant gas.

Worst-case assumptions for NO_x and CO emissions from the commercial plant predict an increase over those for the demonstration plant of 2.5 for NO_x and 2.6 for CO.

The plot plan of the expanded commercial plant shows two commercial processing trains added to the 6000-ton/d demonstration processing train. A 200% increase in piping and NMHC fugitive emission potential is probable. As a worst-case assumption, expanded commercial plant emissions of five times those of the demonstration plant are used in the air quality analysis.

The air quality impacts of operating an expanded commercial SRC facility were based on preliminary information on its emissions, which is contained in Appendix C (Sect. C.8). It was assumed that the contribution of each source to the increase in maximum ambient concentration, above that produced by the demonstration plant, would be in proportion to the increase in that source's emissions. Thus, the demonstration plant's impacts were scaled up to give projected commercial-scale impacts. It should be noted that this approach is extremely conservative and should lead to high-side estimates of maximum ambient concentrations. The assumption made is that all the additional emissions occur at precisely the same locations and from the same release heights as do the demonstration plant emissions. In all probability, the increased emissions would occur over a larger physical area, which would tend to reduce the atmospheric concentrations that were calculated by merely scaling up emissions.

The results of these calculations for the commercial scale facility appear in Table 4.14. The consumption of PSD increments is highlighted in Table 4.15. Based on the concentrations predicted for the commercial-scale plant given in Tables 4.14 and 4.15, it is expected that the expanded plant and other potential sources would consume 33.2% of the allowable 24-h PSD increment for SO_2 and 75.6% of the allowable 24-h PSD increment for particulates. It should be noted that the availability of PSD increments cannot be projected to the date of the commercial plant operation.

Because the regionally available PSD increment is limited, a commercial plant would consume a portion of the PSD increment which could potentially be assigned to other industrial operations. Permitting the emissions from the plant could therefore potentially limit other future industrial development opportunities in the region. However, it should be noted that consumption of the PSD increments, especially the short-term (3- and 24-h) increments, is extremely local in nature. It is highly unlikely that the short-term maximum impacts of two separate emitting facilities will occur in the same location unless they are almost adjacent to each other and meteorological conditions are favorable to such an occurrence.

See Sect. 4.2.3.1 and Appendix C, Sect. C.8.

Water use. The Monongahela River would be the primary source of water for a commercial plant. The U.S. Army Corps of Engineers currently regulates flow in the Monongahela River at the Tygart Lake Dam to maintain a minimum flow of about 9630 liters/s (340 cfs) between Tygart Lake Dam and Lock and Dam 7.

While the production capacity of the commercial plant is currently projected to be five times that of the demonstration plant, water consumption is not expected to increase in proportion to the increase in capacity. The estimated consumption by the expanded commercial plant is 793 liters/s

(28 cfs or 12,500 gpm) compared with 225 liters/s (8 cfs or 3588 gpm) for the demonstration plant. The reduction in water consumption per unit of capacity for the expanded commercial plant is due primarily to those design features (discussed in Appendix C, Sect. C.8.2.2) that would result in increased thermal efficiency for the expanded commercial plant. The expanded commercial plant would consume 8.2% of the current minimum flow. Before commercialization, a Water Resources Council (WRC) water assessment would be made to more accurately assess water availability and related water impacts. Evolution of the design basis for the commercial plant has enabled this estimate of water consumption used in this FEIS, which is more accurate than the value used in the WRC report. In addition, if the commercial plant used the same source of coal as the demonstration plant and uses barge transport, the flow required for lock operation with SRC-II feed coal could range from 736 liters/s (26 cfs) to 1700 liters/s (60 cfs), depending on whether existing lock capacity is increased.

During low-flow periods, consumption by the commercial plant would contribute to significant streamflow deficits and would affect downstream water users. Under Pennsylvania's water consumption policy, the State could require municipal water suppliers to curtail their withdrawals or to make compensatory releases from storage. Consumption by the SRC-II commercial plant could increase the frequency of this occurrence. In addition, streamflow deficits (due to the SRC-II commercial plant and other new water users) could affect navigation, contribute to water quality problems, and affect fish and wildlife.

It is anticipated that, during the demonstration phase, comprehensive basin-wide planning will be undertaken, as suggested by the WRC. This planning, together with the experience gained in the demonstration phase, will provide a basis for developing a strategy to deal with water supply problems during low flow. Options for reducing streamflow deficits, which could be used under a coordinated basin plan, include basin-wide water conservation, additional storage and/or allocation of storage at existing basin reservoirs, additional water storage on site or off site, and development of supplemental groundwater resources.

See Sect. 4.2.2.1.

Water quality and aquatic ecology. The wastewater handling and monitoring system envisioned for the expanded commercial plant would be similar to the one being planned for the demonstration plant. This system includes provision for discharging treated wastewater to the Monongahela River when the river can assimilate it without violating in-stream water quality standards and for recycling treated wastewater within the process when river conditions do not allow discharge. Wastewater concentrations of contaminants in the treated wastewater discharge would be similar to those for the demonstration plant, with reductions in specific contaminants depending on improvements in the state of the art. Because of the increased quantity of treated effluent water, the impact of the expanded commercial plant on the Monongahela River with regard to total dissolved solids (TDS) would be greater than for the demonstration plant. Therefore, it is anticipated that the plant would operate in the zero-discharge mode more frequently and that proportionately less water and dissolved solids would be discharged to the river from the expanded commercial plant than from the demonstration plant. As a result, more soluble salts per ton of coal feed would be recovered on site by the expanded commercial plant than by the demonstration plant.

Salt production is basically proportional to coal input to the plant so that the expanded commercial plant would produce 120 tons of salts per day compared with 22 tons/d for the demonstration plant. If the demonstration plant produces 22 tons/d of TDS and is allowed 10% of the Monongahela River's assimilative capacity by the regulatory agency, the river's capacity to assimilate TDS would have to be 220 tons/d. The probability graph in Appendix C, Sect. C.4.2.2, indicates that the river would have this assimilative capacity 95% of the time. If the salt production for the expanded commercial plant is 120 tons/d and 10% of the river's capacity to assimilate TDS is allowed for the plant, the river's capacity to assimilate TDS would have to be 1200 tons/d. The probability graph indicates that the river would have this assimilative capacity 60% of the time. It is therefore estimated that the expanded commercial plant would be allowed to discharge treated wastewater 60% of the time without violating in-stream water quality standards and would operate in the zero-discharge mode 40% of the time. This estimate assumes that TDS are the governing discharge limitation. In actuality, the decision to operate in either the discharge or recycle mode will be made by monitoring both the treated wastewater and the river for many chemical constituents. It is anticipated that EPA will develop effluent limitations during preparation of the National Pollutant Discharge Elimination System (NPDES) permit application.

If the water intake structure withdraws water from near the shoreline (as is currently planned), the potential exists for losses of more than 10% of the river's ichthyoplankton during extreme low flows. The impacts of raw water withdrawal on ichthyoplankton are uncertain, and additional monitoring is needed. Further baseline and/or operational monitoring may indicate the need for placement of the intake structure in an area of minimum ichthyoplankton density (Sect. 4.2.2.4).

Under worst-case assumptions, the wastewater discharge from the commercial SRC-II plant would cause significantly more stress to the aquatic ecosystem than would the demonstration plant.

However, design of the commercial plant will take advantage of the knowledge and experience gained from demonstration plant operation. The reliability of wastewater treatment systems will be better understood. If operation of the demonstration plant has revealed problems caused by a particular contaminant (e.g., bioaccumulation of heavy metals), specific treatment processes for control could be incorporated into the commercial plant's design.

See Sects. 4.2.2.1, 4.2.2.3, and 4.2.2.4.

Impacts on floodplain and wetlands. Rail service is provided at the base of the hillside, out of the 500-year floodplain. Therefore, the storage and loading facilities on the upper terrace of the Belldina property will not be enlarged during commercial expansion. The barge and water intake facilities for the demonstration plant will be sized to accommodate the commercial plant. Therefore, no new encroachment will occur; thus, no adverse impacts on either wetlands or floodplain will result from the expanded commercial plant (Appendix D).

Land use and terrestrial ecology. A total of about 160 ha (395 acres) of additional land will be required for expansion of the process, coal storage and slag landfill areas, utilities, and product storage. Some expansion of the product storage and shipping area on the floodplain may also occur, depending on the mode of product shipment. Secondary growth may occur in the area of the commercial facility, but this cannot be predicted at this time. The use of additional land will cause further loss of wildlife habitat and further permanent reductions of wildlife populations. Greater levels of air pollutant concentrations will put additional stress on vegetation, although the concentrations will meet air quality guidelines established to provide sufficient protection of vegetation.

Socioeconomic. The construction labor force for commercialization would rise to a peak of about 5000 to 10,000. Due to regional competition for labor, careful planning would be necessary to assure the availability of an adequate labor force. A shortage of labor would not prevent the plant from being built, but it would tend to lengthen the construction schedule. The size of the in-migrating labor force and their families during construction of the commercial plant would be much larger than during construction of the demonstration facility. Experience gained by the local area in accommodating demonstration plant construction might help in planning for growth during commercial plant construction. Plant construction would create between 2500 and 5000 secondary jobs, 90% of which are projected to be filled by people living in the area.

Commercialization would provide a significant economic benefit to the area in the form of an increase to the local tax base, since ownership of the facility would be transferred from the Federal government to private industry at the end of the demonstration phase. Commercialization would also result in an increased strain on community services and resources. All problems associated with the demonstration plant would be magnified.

Secondary commercial development is expected to occur to provide support for the demonstration facility. This development would be likely to expand to provide the required support for the expanded commercial plant. This would represent a net benefit to the area in the form of jobs and tax revenue. A work force of about 900 would be required to operate an expanded commercial facility (about double the size of the demonstration plant's operation work force). It is expected that most of the work force would be made up of local residents. Approximately 465 secondary jobs would be created by commercial plant operation, of which 90% are projected to be filled by people living in the area.

See Sect. 4.2.2.3.

Solid waste. The expanded commercial plant would produce approximately 4000 tpsd of slag plus increased quantities of other solid wastes, some of which may be hazardous. The demonstration plant will have an extensive monitoring program to determine the long-term fate of the contaminants in the solid waste materials (Sects. 4.5.3.1 and 4.5.3.2). Runoff and leachate will be routinely analyzed. Such data will determine more definitively whether or not a waste is hazardous. Current research indicates that the slag will be nonhazardous (Appendix K). The requirements for brine disposal during zero-wastewater-discharge operation would increase because of the greater quantity of soluble salts being processed in the expanded commercial plant and the increased frequency of operating in the zero-discharge mode to avoid exceeding the assimilative capacity of the Monongahela River. Disposal plans for brine and other solid wastes are now being developed for the demonstration plant (Appendix C, Sect. C.3.7.2). Experience during the demonstration will aid in identifying disposal requirements for the expanded commercial plant.

Continued operation of the demonstration plant

It is possible that the proposed two-year operation of the demonstration facility will not provide the data base desired for commercialization. A likely result would be an extension of the demonstration program and continued operation of the plant.

Changes in the design and operation of the plant will undoubtedly occur during the operating phase, but the environmental effects of continued operation are likely to be essentially the same as those described in Sect. 4. Process and environmental monitoring during operation will be used to identify the significant environmental impacts, their sources within the plant, and the available methods for mitigating them (Sect. 4.5). Consumption of available water and of PSD air quality increments would continue, limiting other potential users.

With the Federal government continuing to own the site, the area would continue to experience a loss of tax revenue. However, this loss of tax revenue would be somewhat offset by the continued employment of approximately 460 persons. The additional secondary jobs created through the growth of support industries and services during construction and initial operation of the demonstration plant would also partially offset this loss.

Conversion to another government use

If, at the conclusion of the demonstration plant operation, there is no interest on the part of private industry in construction of a commercial plant, DOE may elect to convert the facility to another use or to offer it to other Federal agencies.

The potential environmental impacts of an alternative use of the site would depend on the intended use and cannot be evaluated at this time. In view of the availability of facilities for the receipt, transport, storage, and preparation of coal, it is likely that an alternative use would be related to coal utilization and that impacts associated with coal receipt and handling would continue.

Continued government ownership of the site would result in continued loss of tax revenue and, more significantly, would prevent the revenue increase that would result from transferring the site and improvements to private ownership. The significance of this loss of anticipated revenue would depend on the degree to which local financial plans had been developed in anticipation of such revenues. This reduction in revenue would be partially offset by continued employment resulting from the alternative use of the site.

Conversion of the facilities to an alternative use would probably require some construction work and an associated work force. Impacts resulting from construction would probably be relatively minor, since most of the disturbance would have occurred during construction of the demonstration facility and since new construction activities would probably be limited primarily to the process area. The work force required for conversion would probably be smaller than that required for construction, and, in the absence of a major competing project, significant impacts would not be anticipated.

Mothballing

If there is no interest in constructing a commercial facility or in converting the site to an alternative use, DOE may elect to discontinue operation of the demonstration facility for an indefinite period, with the intention of resuming operation at some time in the future. In this alternative it is assumed that all process operations would cease and that equipment would be drained, cleaned as necessary, and prepared for an extended shutdown. There would be minimal dismantling or removal of process equipment. The coal and product would be removed from the site. The slag disposal area and any other solid waste disposal areas would be closed and revegetated; leachate monitoring and treatment, if required, would be continued in accordance with RCRA requirements.

Mothballing the demonstration facility would eliminate air emissions, water consumption, and slag production. Solid waste production would be reduced to that resulting from the treatment of leachates from solid waste disposal areas and of surface runoff. Elimination of evaporative cooling and its associated water consumption would result in the discharge of treated effluent. The facility would probably be maintained on the State emission inventory for a period of 18 months, temporarily limiting siting options for other emission sources. Location in the area by other industries could result in reduced availability of PSD increments and water resources for resumed operation.

Continued government ownership of the site would result in the continued loss of property tax revenue and would prevent the increase that would result from transferring the improved site to private ownership. This loss of revenue would not be offset by continued employment. It is anticipated that mothballing the facility would result in the layoff of most of the demonstration facility work force of approximately 460 and the elimination of essentially all secondary employment.

Decommissioning

If there is no interest in constructing a commercial facility, converting the site to another government use, or resuming operation of the demonstration facility, DOE may elect to decommission the facility and declare it excess property for disposal by the General Services Administration.

If decommissioning occurs, it is probable that the significant value of the improvements and the short operating history of the plant would make the site desirable as an industrial facility and that it would be sold for this purpose. Impacts resulting from conversion to an industrial use other than an SRC commercial facility would result in impacts that cannot be fully evaluated at this time. As in the case of conversion to another government use, it is probable that an alternative use would involve coal utilization and that the impacts of coal receipt, handling, and preparation would continue. As in the case of conversion to another government use, the impacts of construction required for conversion to another use would probably be relatively minor. Sale of the facility for an industrial use would result in a tax benefit, since the site and improvements would be placed on the tax rolls. Continued employment would also be a positive benefit.

Should there be no interest in purchasing the site for alternative use or should the government elect not to sell, the impacts would be essentially equivalent to those resulting from mothballing. It is probable that major vessels and equipment would be removed. However, complete restoration of the site to its original condition would not be undertaken, and the site would be available for future redevelopment for industrial use.

2.3.2 Selection of an alternative design or site

One of the three basic alternatives available to DOE is to modify the currently proposed action. Such modifications could be used to lessen the environmental impact of the proposal. The following sections evaluate the feasibility of using alternative plant designs to lessen the environmental impacts of plant operation (Sect. 2.3.2.1) and compare the impacts of locating the proposed facility at the proposed site with those of locating the facility at either of the two alternative sites (Sect. 2.3.2.2).

2.3.2.1 Alternative plant designs

Introduction

Analysis of the plant design began with a screening of the major process areas to identify effluents and emissions under normal and upset conditions, the potential for adverse environmental impacts, and the control requirements. The following major process areas and control options, identified as having potential for causing significant adverse impacts, were evaluated to determine if the proposed design was complete and whether alternative plant designs exist that could achieve superior environmental performance. The following areas and options were evaluated and are discussed below and in Sect. 2.3.2.1 and Appendix C:

- sulfur recovery and emission control,
- water consumption, treatment, and cooling,
- wastewater treatment,
- wastewater treatment under abnormal conditions,
- desalination of treated wastewater for recycling,
- brine disposal during zero-discharge operation,
- waste heat rejection,
- process hydrocarbon emission control,
- reduction of fugitive emissions by double piping and enclosures,
- disposal of process sludges,
- particulate emission control,
- plant fuels,
- electric power supply,
- plant layout (including floodplain-wetlands considerations),
- separation and disposition of mineral residue,
- hydrogen production, and
- gasification processes.

Incomplete design requiring further evaluation

On the basis of the engineering data presented in the proposed conceptual design, several process operations in the plant may be amenable to the use of alternative plant designs with potentially superior performance from an environmental standpoint. Other environmentally important features of the plant have not yet been fully designed. The alternative and incomplete designs highlighted below will receive priority treatment during the detailed design phase of the project. Appendix C includes a more complete discussion of plant design alternatives.

As described in Appendix X, DOE will complete a Final Environmental Impact Statement (FEIS) before a decision to proceed with a major detailed design of the plant. Important quantitative information such as material and energy balances around all process components is therefore missing at this time. Thus, a strategy is required wherein the assessment of adverse impacts is based on conceptual design and worst-case estimates of effluents. The EPA and DOE will work closely in integrating the appropriate environmental controls as final design work proceeds.

A tiered approach to NEPA compliance will be followed, in which final design data as they become available are given in interim reports to EPA and made publicly available and in which the impact analysis is compared with the worst-case impact analysis given in this FEIS. Based on design or operating information, DOE will make a determination as to whether supplemental NEPA review is required.

The environmental impacts of the designs of the following plant features have been evaluated in this FEIS. However, the specific designs will be the subjects of additional design work.

Sulfur recovery. The sulfur-recovery operation will make up about 65% of the plant's overall atmospheric emission rate. The air quality analysis is based on the Benfield-Claus/SCOT system (proposed in the DEIS), which has a higher emission rate than the currently proposed Selexol-Claus/SCOT system. This provides a worst-case impact analysis. Each of these alternatives, and others that offer the potential for lower emissions, is discussed in Appendix C, Sect. C.3.2.1.

Capacity of wastewater treatment system. A number of circumstances will cause a substantial deviation from the normal operating mode of the wastewater treatment system. The occurrences that are expected to tax the wastewater treatment system include shutdown and startup, extended shutdown, abnormally low river flow, and abnormally high rainfall. These occurrences will be used in the design basis of the wastewater treatment systems.

Desalination. The need exists for wastewater reclamation facilities that will eliminate or reduce the treated wastewater discharge to the Monongahela River. This system will separate a salt-free water stream for use within the utilities section, and will, when required, concentrate the effluent brine for storage or alternate disposal. The processes considered for this service were the common desalination processes of evaporation, reverse osmosis, electrodialysis, and ion exchange; currently, evaporation is preferred. This evaluation is ongoing and will receive priority consideration during detailed design.

Controlled combustor/elevated flare system. Although the main processing units will normally not emit hydrocarbons, process upsets and emergencies may occur that require immediate disposal of combustible vapors and gases to relieve internal pressures. Some of these combustible materials may contain complex organic compounds including carcinogenic substances, and flaring (a conventional refinery and chemical industry practice) may not adequately destroy these compounds. The proposed design incorporates a controlled-combustor/elevated flare system that would significantly reduce this problem in all but the most severe emergency events. The design of this system is incomplete and is under evaluation by DOE and the industrial partner and represents one of the major environmental control decisions to be made during the detailed design phase.

Location of water intake. The analysis of impacts on aquatic ecology has revealed that the shoreline water intake structure may cause considerably more entrainment of aquatic organisms than would a submerged intake closer to midstream. The industrial partner and DOE will evaluate these alternatives and their environmental effects during the detailed design phase.

Design of coal conveyors. Fugitive dust from coal conveyance will be reduced by using covered conveyors. Fully enclosed conveyors would virtually eliminate coal conveyance as a source of fugitive dust but may pose unacceptable safety hazards. DOE and the industrial partner will evaluate the viability of this alternative during the detailed design phase.

Coal pile dust control. As currently proposed, the plant will use a conventional coal dryer and a wet dust suppression system for the coal piles. A polymer coating for one of the two active piles is also being evaluated that would reduce fugitive dust emissions.

In addition to the above plant features, this list identifies those aspects of plant design for which the environmental impacts have not been evaluated in this FEIS due to a lack of detailed design information.

Method of brine disposal. The proposed system of treated wastewater discharge cannot operate during periods of low river flow and high dissolved solids loading in the river without violating in-stream water quality standards. The secondary operating mode of reduced or zero liquid discharge will produce a brine that will probably be considered a hazardous material under RCRA criteria. The ultimate disposal method for this brine waste, which is under continuing evaluation by DOE and its industrial partner, represents one of the major environmental control decisions to be made during the detailed design phase.

Water storage. The analysis of water use and water availability in the Monongahela River Basin has revealed possible water availability problems during periods of low flow. Off-stream water storage on site is a possible mitigating measure. In the unlikely event that this alternative is chosen, the size, design, and location of such storage facilities have not yet been specified and will receive priority consideration during the detailed design phase.

Cooling system. The proposed design calls for the combined use of several types of cooling on selected streams in the plant. For selected hot streams expected to be free of carcinogens, aerial coolers will be used. To prevent process materials from leaking into the cooling water and then being discharged to the atmosphere through the cooling tower, moderate-temperature streams containing hydrocarbons likely to be carcinogenic will be cooled by an indirect cooling system. The bulk of the process cooling on streams other than the above will be done by conventional wet evaporation methods. Final design selection of which streams to cool by which method will be based on an integration of additional toxicity testing on representative process materials, safety analysis, cooling needs, and selection of wastewater treatment strategy, because the ability to achieve zero discharge requires substantial evaporative cooling capacity for disposal of treated wastewater.

Location of hazardous waste landfill. As currently envisioned, solid wastes will be stored in two landfills designed for storage of RCRA hazardous wastes — one for gasifier slag only and the other for several process sludges. The location of the second landfill, which will contain hazardous wastes, has not yet been proposed, and the chemical composition of the sludges will probably remain unknown until the plant is operating. These uncertainties will also be among those to receive priority consideration during the detailed design phase.

Sulfur recovery and emission control

Sulfur enters the plant as a component of the coal. Product specifications dictate that very little sulfur remain in final products. Most of the sulfur can be recovered as elemental sulfur, but no recovery process is 100% efficient. Therefore, sulfur compounds will be released from the plant in the various product and effluent streams (see Appendix C for a sulfur balance). Under normal operating conditions, sulfur dioxide will be emitted from plant fuel-fired process heaters, from the steam plant, and from the final tail-gas treatment unit on the sulfur-recovery plant. As shown in Table C.12 of Appendix C, the final sulfur-recovery tail-gas will make up about 65% of the total sulfur dioxide emission from the plant. For this reason, alternatives to the proposed sulfur-recovery and final tail-gas treatment systems are being examined. The air quality analysis is based on the Benfield-Claus/SCOT system (proposed in the DEIS), which has a higher emission rate than the currently proposed Selexol-Claus/SCOT system. This provides a worst-case impact analysis. The adverse environmental effects of SO_2 are well known, and currently there is great emphasis in the electric-power generation and smelting industries to reduce the emissions of this compound to the environment. The direct release of reduced sulfur compounds (such as hydrogen sulfide, carbonyl sulfide, and carbon disulfide) is not considered an acceptable alternative because of significant odor problems, the toxicities of the above compounds, and their atmospheric conversion to sulfur oxides and sulfates.

Gaseous streams containing sulfur compounds originate from hydrogen purification, Syngas purification, low-pressure gas purification, the ammonia-recovery area, and the methanation plant. Two acid-gas-removal processes are proposed for removing H_2S and CO_2 from the process streams: the Selexol process, which uses a proprietary solvent, and a diethanolamine solvent process. Because the concentrated $\text{H}_2\text{S}/\text{CO}_2$ stream produced by both processes is sent to sulfur recovery, there is no emission to the atmosphere from these areas, and they have no direct effect on the environment.

The proposed plant design specifies a Claus sulfur-recovery/ H_2S -control system with a SCOT tail-gas treatment system. The output of the SCOT unit is incinerated to convert any residual H_2S to SO_2 before it is discharged to the environment. This system recovers 202 tpsd of sulfur so that the final effluent to the environment contains approximately 230 parts per million by volume (ppmv) of SO_2 or 790 tons of SO_2 per year. At an effluent concentration of 230 ppm SO_2 , this system will meet the EPA New Source Performance Standards (NSPS) for sulfur-recovery units in petroleum refineries. [The EPA has determined that the NSPS for petroleum refineries will be applicable to the SRC-II facility (Appendix O).] Alternatives to the proposed system fall into

two categories: the Claus sulfur-recovery/ H_2S -control system and alternatives to the SCOT tail-gas cleaning system. Coal beneficiation (sulfur and ash removal from the feed coal) was rejected as an alternative because the SRC process relies on the catalytic action of the iron sulfides present in the coal to drive the liquefaction reactions at a desirable rate.

Two commercially available alternative technologies exist (Stretford and Giammarco-Vetrocoke) that could potentially replace the Claus sulfur-recovery system. Both of these systems have demonstrated lower sulfur emissions than Claus systems in other applications. An examination of these systems indicates that they would be considerably more costly for the sulfur throughput (202 tons/d) of this plant. The performance and operating reliability of these systems are sensitive to variable feed rates and feed stream composition, and the feed stream in the proposed plant may contain process contaminants that would preclude the effective use of these alternative systems.

Several alternative technologies exist that could potentially replace the proposed SCOT tail-gas treatment system. One alternative would be the use of a different solvent in the SCOT absorber. The use of an alternative solvent could potentially reduce the concentration of SO_2 in the final tail-gas to about 150 ppmv — a reduction in SO_2 emissions from 790 to 474 tons per year. Another alternative is Benfield H_2S removal plus SCOT tail-gas treatment. An alternative to the SCOT system would be a Beavon-Stretford tail-gas treatment system. The resulting off-gas could potentially be reduced to about 40 to 80 ppmv SO_2 , a reduction in SO_2 emissions from 790 tons per year to from 126 to 253 tons per year. The Stretford process would produce liquid effluents (sour water and solvent blowdown) leaving the Beavon unit which might have to be treated to remove the vanadium used as a reactant in the process. Also, the capital cost is higher. A Giammarco-Vetrocoke alternative could replace the Stretford unit in the Beavon-Stretford system, reducing the SO_2 concentration to less than 40 ppmv in the tail-gas — a reduction in SO_2 emissions from 790 to less than 126 tons per year. The major drawback here is the use of arsenic compounds, which would appear in trace quantities in all effluents, including the sulfur product. Incineration plus the Chiyoda Thoroughbred 101 process is a potential alternative that would produce a salable gypsum product from the remaining sulfur in the tail-gas instead of elemental sulfur. Sulfur dioxide in the off-gas might be slightly less than that for the proposed system. Other potential alternatives include the Dual Alkali process, the Cleanair process, the Wellman-Lord system, the IFP-2 system, and a lime-limestone slurry system.

In conclusion, several potential alternatives exist to the proposed Claus/SCOT system that could reduce SO_2 emissions. The Claus/SCOT system was proposed largely because of its reliability. It is recognized that the selection and design of the sulfur-recovery system must be carefully integrated into the overall plant design and that the applicability of alternative systems can only be determined by a detailed design study.

Water consumption, treatment, and cooling

Several water-related factors and features will individually and collectively affect the design, operability, and environmental effects of the SRC-II demonstration plant. These include quantity of water withdrawn and released to the river and the net water consumption; types of wastewater treatment; degrees of application of evaporative, dry, and indirect cooling; size and number of wastewater reservoirs; and methods for disposing of soluble salts.

Based on available data, it now appears feasible and environmentally desirable to design the plant with the flexibility for (1) discharge to the river of suitably treated cooling tower blowdown; process wastewater; and rainwater runoff from the process area, product storage area, coal pile, and slag pile during those periods when river conditions allow it to be done in conformity with applicable permitting requirements and regulations and without violating in-stream water quality standards and (2) substantial reduction or possible elimination of the discharge of treated cooling tower blowdown and treated process wastewater, with its associated salts, during periods of high soluble salts loading in the river, with particular attention to sulfate concentration in the ambient river. Compositions of the wastewater discharge and the ambient river will be monitored to determine when to discharge treated wastewater. If monitoring indicates that the available assimilative capacity of the Monongahela River for a particular discharge species will be exceeded, evaporators will be brought on line and the wastewater treatment plant will convert to the zero wastewater discharge mode. Retention basins will be used to equalize and minimize swings in the concentration of constituents in the discharge.

The zero wastewater discharge operating mode will mean a decrease in plant thermal efficiency and an increase in the quantity of soluble salts removed from the process that require disposal by special means.

Significant reductions in consumptive water use can be achieved only by favoring dry cooling over wet cooling methods for process heat rejection. However, the ability of the proposed wastewater treatment system to achieve zero wastewater discharge relies on the presence of wet evaporative cooling towers to serve as users of recycled, treated wastewater. During the detailed design stage, it will be necessary to thoroughly evaluate rainfall patterns and plant operating modes and their effect on water evaporation to ensure that, under all combinations of weather, river conditions, and process operating conditions, all contaminated water can be adequately processed within the plant and that zero-discharge capability exists when necessary.

Wastewater treatment

Baseline plant design provides for river discharge of tertiary-treated and polished effluent most of the time, as described in Appendix C, Sect. C.4.2.2. This is a revision from the DEIS, which specified a zero-discharge system. The reasons for preferring the discharge mode in normal plant operation include:

- lack of operating history on zero-discharge units at coal conversion facilities, implying that unintended emergency discharges may occur frequently (e.g., as a result of extended plant shutdown or abnormally heavy rainfall);
- increased energy consumption by evaporators in zero-discharge operations;
- problems of brine or soluble salts disposal may exceed the problems of adding trace concentrations of salts, metals, or organics to the rivers; and
- zero-discharge must be applied site-specifically, and its principal applications occur in arid regions, not in the region where the SRC-II plant is proposed to be located.

The capability for zero-discharge operation is retained in the baseline design but will only be used when required by terms of the plant operating permit (i.e., low river flow and/or inability of the river to accommodate TDS or other chemical species due to water quality standards being approached).

Favoring the use of treated discharge, experience at the Fort Lewis SRC pilot plant and conceptual studies indicate that the biochemical oxygen demand and the acute toxicity of the combined waste can be effectively controlled through a combination of physical pretreatment, biological oxidation, and final physical-chemical treatment including filtration, activated carbon adsorption, and ozonation prior to discharge. Because biological oxidation and carbon adsorption, it is probable that a treated effluent would contain low concentrations of materials whose long-term health and environmental effects cannot be accurately evaluated with the current data base.

The zero-discharge mode utilizes the significant evaporation capacity provided by the wet cooling system plus a combination of by-product recovery, secondary and tertiary treatment with desalination of treated effluent, and recycle of purified water. It is thereby possible on demand to reduce or eliminate the return of any process-water effluent including dissolved salts to the river except as a result of precipitation exceeding the ten-year, 24-h storm.

Associated with the zero-discharge operating mode is a potential brine-disposal problem that must be evaluated in relation to the risk of discharging all TDS and residual quantities of hazardous substances to receiving water. All the nonvolatile dissolved and suspended solids in the contaminated runoff and the various liquid-waste streams would appear in the brine, which will contain major, minor, and trace elements and will probably be classified as a hazardous waste under the RCRA. To prevent mobilization of toxic substances and resultant contamination of surface water and groundwater, the residue would have to undergo special disposal. The disposal of brines and water-soluble salts from processing feed coal and concentrating cooling-tower water is recognized as one of the key environmental decisions to be made during the detailed-design phase. This decision is a key factor in the ultimate decision to retain the capability for zero-discharge water treatment and will influence the choice of cooling systems because evaporation in the cooling system is a principal means for disposing of reclaimed water. Alternative disposal techniques for brine are being evaluated (see Appendix C, Sect. C.3.7.2), which include onsite chemical landfill, onsite chemical fixation and landfill, deep well injection, barging to sea, offsite chemical landfill, and storage on site with subsequent river (high-flow period) disposal.

Current data support the conclusion that the annual cycle of river conditions will preclude a discharge at certain times during the year. Although the risks associated with the discharge of an effluent that has received tertiary treatment and polishing are believed to be small, the zero-discharge alternative is considered to be technically feasible and is included for use and evaluation on a selective basis in this facility. Comparative information gained during operation of both the SRC-I and the SRC-II demonstration plants will provide the basis for selection of a wastewater-treatment system for subsequent full-size commercial-scale liquefaction plants.

Wastewater treatment under abnormal conditions

A number of circumstances will cause a substantial deviation from the normal operating mode described above. The design features included in the wastewater treatment system to prevent an adverse impact under abnormal conditions are described below. The occurrences that are expected to tax the wastewater treatment system include (1) shutdown and startup, (2) extended shutdown, (3) abnormally low river flow, and (4) abnormally high rainfall. The strategy for handling these events is evolving and will receive priority consideration during the detailed design phase.

Shutdown and startup. Because this facility will be a demonstration plant, shutdown and startup of the principal process units are expected to occur frequently, producing variations in quantities and concentrations characterizing the inflow and producing a significant effect on the operation of the wastewater treatment systems.

A concern during startup is the means used to store raw untreated wastewater and possibly to recycle treated wastewater until the wastewater treatment system is functioning properly. If heavy rains occur during the startup, runoff and leachates will also require retention. The strategy for handling startups and the retention system are not fully defined and will receive priority consideration during the detailed design phase.

During a major shutdown of the plant, wastewater treatment facilities will continue to operate. Wastewater flows from the gasifier and dissolver will stop, but those from the slag pile, coal pile, and process area runoff will continue to be generated at their normal rate. Emptying and flushing of process equipment in preparation for maintenance activities will increase the flow of process wastewaters for a time.

Facilities will be provided to permit handling and treatment of flushing wastewater with a minimum disruption of wastewater treatment operations. These facilities will include a flushing sewer and storage system equipped with vapor recovery, flow and concentration equalization, and, where appropriate, treatment capacity allowances to accommodate these noncontinuous flushing wastewater flows.

As inventories of dissolver and gasifier wastewaters are depleted to preselected levels, the tar-acid recovery and ammonia recovery facilities will be shut down. If the shutdown is to extend over a long time period, dissolver-wastewater inventory will be retained to serve as a sustaining feed for the biological treatment system, which will be operated throughout the shutdown.

Sufficient boiler and cooling tower capacity will remain onstream to provide for the steam requirements of the wastewater treatment systems and to provide evaporation of treated wastewater when required. It is therefore expected that zero wastewater discharge can be achieved during shutdown.

During the shutdown, untreated wastewater inventories will be depleted to preselected levels so that, when normal operations are resumed, flows to the wastewater treatment units can be gradually increased to normal levels.

Flow rates and contaminant loads of effluent to the river will decline substantially during a shutdown. During the subsequent startup, flows or contaminant loading are not expected to exceed normal levels.

Extended shutdown. During a shutdown of the principal process units for an extended time, rainwater runoff from the process area, coal pile, slag pile, and product storage areas can accumulate in holding ponds to the extent that it needs to be either treated for discharge or evaporated. Treating and discharging to the Monongahela River is the preferable approach as long as the river conditions allow this to be done. However, during periods of high TDS concentrations in the river, discharge may not be acceptable and evaporation may be required. This eventuality will be handled by operating a utility boiler and the cooling tower at reduced loads. The boiler and throttling system will produce low-pressure steam to drive the evaporators, which will, in turn, produce cooling tower makeup. This strategy will enable zero wastewater discharge for some period of time.

Abnormally low river flow. Under conditions of abnormally low river flow, the mass discharge rate of TDS or toxic metals to the river may result in levels of TDS or toxic metals in excess of in-stream water quality standards. Under these circumstances, the facility will operate in the zero-discharge mode. Various alternatives for handling these accumulated wastes are being explored, including (1) subsequent discharge to the river when flow and assimilative capacity

increase and (2) concentration, followed by deep well disposal to a compatible brine-bearing aquifer, secured chemical landfill, barging to sea, chemical fixation, or encapsulation and landfill. These alternatives will receive priority consideration during the detailed design phase.

Abnormally high rainfall. During periods of abnormally high rainfall, the capacity of runoff storage ponds associated with the coal pile and the slag pile will occasionally be exceeded. Under these conditions of extended heavy rainfall, river flow will be high, so the bypass of the dilute runoff water from contaminated plant areas should not present a serious environmental problem. Possible exceptions to this statement would include (1) process fluid spillage from process equipment during an extended rainy period and (2) residual acid drainage from the coal pile.

During such an extended rainy period, process area runoff will be designated the priority stream and slag pile runoff will be diverted to the river. Coal pile runoff will be diverted to the river through a pH correction system that will neutralize acidity. As a result, the full capacity of the runoff wastewater treatment system would be made available for treatment of excessive process area runoff flow, which may be contaminated with hydrocarbons. This method of operation (using boilers, cooling towers, and evaporators as water consumers) is expected to reduce significant adverse impacts on the river.

Desalination of treated wastewater for recycle

The need exists for wastewater reclamation facilities to eliminate or reduce the treated wastewater discharge to the Monongahela River. This system will separate a salt-free water stream for use within the utilities section and will, when required, concentrate the effluent brine for storage or alternate disposal.

The levels of contamination in the salt-free distillate stream are not expected to adversely affect the performance of the cooling tower and, with minor ion exchange polishing, will produce acceptable boiler feedwater. This distillate stream will be monitored to ensure that a malfunction of the evaporator does not result in the use of unacceptable water in the utilities section.

Ion exchange was eliminated from further consideration because the required regenerated solutions would increase the salt-disposal problem. Electrodialysis was eliminated because of limited commercial experience, questions of reliability in producing a permeate of very low salt content, and potential membrane fouling problems.

The reclaimed water from the desalination equipment will produce water of a quality suitable for boiler feedwater makeup, with perhaps only minor polishing necessary, using ion exchange equipment.

An alternative method for making boiler feedwater would involve processing clarified raw water through demineralizers. Not only would this increase the river water intake requirement, but the discharge of spent regenerant solution to the river would increase the dissolved solids concentration in the Monongahela River.

One evaporator configuration was successfully tested by the Resource Conservation Company in pilot-scale equipment. In this test, purge water from the Texaco gasifier at Montebello was limed and steam-stripped to remove ammonia and then reconcentrated to a salt slurry in a pilot-plant vapor compression evaporator.

Multiple-effect evaporation is being considered as an alternative to vapor-compression evaporation. The technology finally selected will depend on the availability of low-pressure steam. If the overall steam balance for the demonstration plant indicates that an oversupply of low-pressure steam exists, the use of multiple-effect evaporators would be strongly favored.

Reverse osmosis is still under consideration for this application. It has been demonstrated commercially and is being used to produce high-quality water from salty cooling tower blowdown in the electrical power industry. It may also be practical to include a reverse-osmosis unit in the desalination system. Although this process would not make water of boiler feed quality, it could produce cooling tower makeup at a lower energy cost. Both salt precipitation and bacterial residue would present potential membrane fouling problems, so that a pilot demonstration of this technology would be required to establish its feasibility for the demonstration plant.

The processes considered for this service were the common desalination processes of evaporation, reverse osmosis, electrodialysis, and ion exchange; currently, evaporation is preferred.

Brine disposal during zero wastewater discharge

Due to the relatively low initial production rate of brine (see Appendix C, Table C.11), especially during reduced plant capacity, a long-term plan for brine disposal will not be a pressing need for several years. This will provide time to determine adequately the chemical characteristics of the brine and to develop an acceptable alternative disposal plan for the soluble salts. If the options described below are not sufficiently developed to produce an acceptable solution within the time frame demanded by the startup of the demonstration plant, soluble salts produced early in the operation of the demonstration plant may be transported by truck to an offsite chemical landfill. Factors that will affect the need for brine disposal are discussed in Sect. C.3.7.2.

Options that have been identified for the alternative disposal of brine waste containing water-soluble salts are

- onsite chemical landfill,
- onsite chemical fixation and landfill,
- deep well injection,
- barging to sea,
- offsite chemical landfill, and
- storage with subsequent river (high-flow period) disposal.

Onsite disposal of these soluble salts, either in a lined hazardous waste facility or by chemical fixation, would reduce, but not eliminate, the long-term risk of contaminating subsurface fresh-water supplies with soluble chlorides or other potentially hazardous substances. These alternatives are being considered as disposal options either for the intermittent requirements of the demonstration plant or for the long-term requirements of the expanded commercial plant.

Deep well injection is considered a viable option for the long-term disposal of soluble salt. The fully treated wastewater can be injected into a brine aquifer of similar salinity and, with adequate geological barriers, as is now done in the area near Morgantown, with low potential for environmental effect.

Barging of the soluble salts to the Gulf of Mexico may result in a significant environmental hazard. Operating costs and the impact on barge traffic might preclude a long-term use of this disposal option. It could, however, be an environmentally desirable method for meeting any intermittent requirements of the demonstration plant.

Finally, the concentrated brine could be stored onsite during periods when the assimilative capacity of the river cannot accommodate a wastewater discharge from the plant; it could then be released in a controlled fashion when river conditions permit.

For the longer term, potential for use of the waste as a chemical feedstock could be explored. This effort and efforts to explore the conventional disposal alternatives described above are hampered by a lack of detailed knowledge of the composition of the product salt. A thorough exploration of these alternatives will, in some cases, have to follow the actual production of a product salt.

Waste heat rejection

During normal operations, and in addition to recovery in waste heat boilers, the SRC-II demonstration plant will generate approximately 1.63 billion Btu/h of nonrecoverable process heat. The heat rejection rate is comparable to that of a coal-fired steam plant of about 250 MW(e) output.

A major environmental concern affecting the selection of cooling systems for the SRC-II demonstration plant is the potential for contamination of the cooling water by PNAs and other hydrocarbons. These contaminants may enter the cooling system through leaks and failed tubes in high-pressure heat exchangers. The coal dissolver, liquid refining and fractionation, hydrogen recovery, and naphtha hydrogenation units are areas where high-temperature and -pressure hydrocarbon streams require cooling and are therefore areas where heat exchanger failure and contamination of cooling water by hydrocarbons and PNAs could occur. The cooling system ultimately used in the demonstration plant will minimize or eliminate the release of toxic and carcinogenic compounds to the environment (Appendix C, Sect. C.3.5.5).

Five types of cooling systems are available for waste heat rejection: aerial coolers, conventional or wet (evaporative) cooling towers, dry indirect cooling towers, wet indirect cooling towers, and wet/dry cooling towers. Appendix C presents a discussion of these alternatives along with a flow diagram for each and a discussion of how each system interacts with the plant water balance and wastewater treatment system.

Dry cooling methods are most effective when used on high-temperature streams; however, it is difficult to contain fugitive emissions from leaking air fin heat exchangers. Thus, the proposed cooling strategy for the demonstration plant involves using dry cooling on the hottest and least-hazardous streams, with a barrier fluid (indirect) wet cooling system used on the more hazardous high-pressure streams as discussed in Sect. C.3.5.5. A high-pressure direct wet cooling circuit (i.e., without the barrier fluid) is being considered, instead of the indirect system, for the low-pressure more-hazardous streams. This is being considered for situations where, in the event of a leak, the process fluid would not contaminate the cooling fluid because the cooling fluid would be forced into the process fluid by its higher pressure. Conventional (i.e., atmospheric) direct wet cooling will be used on all nonhazardous process streams where dry cooling is not economically advantageous.

Aerial coolers will be used to decrease water consumption whenever they are technically acceptable and economically justified. To prevent their potential leakage into the environment, streams containing significant quantities (more than 2%) of +316°C (+600°F) material — believed to be associated with carcinogenic hazards — will not be cooled in aerial coolers.

Mutagenicity and carcinogenic potential of narrow boiling cuts of middle [177 to 288°C (350 to 550°F)] and heavy [>288°C (>550°F)] distillates are currently being measured. Final design of the heat exchanger system will account for the results of this study with a safe-side allowance of about 10°C (50°F). The data will not be available in time for publication of this FEIS. Preliminary indications are that Ames test effects are minimal, with cuts boiling below 316°C (600°F) and begin to be noticeable above 404°C (760°F).

The major heat rejection will be through evaporative water cooling towers. Preliminary mutagenicity tests indicate little effect for those streams boiling below 316°C (600°F). Therefore, an indirect cooling system is planned for cooling streams containing more than 2% of >316°C (>600°F) material (Fig. C.7) to prevent leakage into the cooling tower system.

Additional data are being developed that could result in a change in this preliminary composition criteria for selection of cooling alternatives for each stream.

Another alternative under study during the detailed design phase is the use of cooling tower biocides other than the proposed chromate-based inhibitor. Phosphate inhibitors are also under study.

Process hydrocarbon emission control

Although the hydrocarbon processing facilities are designed to operate without producing atmospheric emissions, almost all will sometimes require venting to reduce pressure or remove trapped gases. In addition, filling of storage tanks and process vessels will displace hydrocarbon vapors. Vapor recovery will be used wherever practicable; however, some vapors will still require disposal. Four alternatives are available: direct venting, uncontrolled combustion (flaring), controlled combustion, and incineration. Direct venting, even through an elevated stack, is considered unacceptable in view of the potential for fire hazards or the release of toxic and/or photochemically reactive materials.

Uncontrolled combustion (flaring), a standard practice in many petroleum refineries and chemical and petrochemical industries, would significantly reduce the concentrations of potentially toxic materials such as H₂S. It would not ensure complete combustion of complex organic materials, and incomplete combustion could result in the formation of additional complex materials. In addition, utilization of a conventional flare (open flame) would make it impossible to sample the combustion products. For gases of simple molecular configuration (e.g., gasifier output), flaring is still the preferred method of disposal.

Incineration, in which the waste materials are mixed with a supplemental fuel (as required) and burned in a special combustion chamber, is designed to ensure complete combustion through maintenance of a specified flame temperature and residence time in the presence of excess air. Incinerators permit sampling of the combustion products and, when operated at design conditions, provide a very high degree of assurance that the materials for which they are designed will be destroyed. Because they are designed for specific combustion rates and feed compositions, incinerators are very sensitive to variations in these parameters, and relatively minor deviations from design conditions may produce significant reductions in their efficiency.

Controlled-combustion devices represent a compromise design intended to provide the flexibility to accommodate wide variations in process emissions and flow rates while still providing a high degree of assurance that the materials of concern will be destroyed. Based on the limitations of incineration systems, particularly their susceptibility to significant reductions in efficiency when operated outside their design range, the controlled combustion concept is believed to be environmentally preferable. It should be noted that the design of this system is not yet complete and that a quantitative evaluation of expected performance cannot be made at this time. The design of this system is one of several important environmental control decisions to be made during the detailed design phase. Appendix C discusses the plant upset and emergency conditions that would require use of a flare/controlled combustor. Sections 4.1 and 4.2.3 discuss the environmental effects of such events.

Other sources of process hydrocarbon emissions are fugitive sources, which are categorized as unintentional dispersed sources, such as leaks, as opposed to continuous point sources, such as stacks or vents. It should be noted that fugitive hydrocarbon emissions are characteristic of chemical and petrochemical plants as well as many other industries handling gaseous and/or volatile liquid hydrocarbons. In general, best refinery and best petrochemical practices for minimizing fugitive gaseous emissions are being employed in the design of the demonstration plant. Examples of these practices are enclosed vapor-recovery systems for storage tanks and loading and transfer equipment and the extensive use of mechanical seals on rotating shafts that leak less frequently than when packing seals are used. To address the concern that some coal-derived liquids are more likely to contain carcinogenic compounds than do natural crude oil derivatives, special considerations are being given to new features to reduce the exposure of the public and plant personnel to fugitive hydrocarbons. Examples of such features are the use of double mechanical seals wherein the outer seal contains a safer fluid, the use of enclosures around some reciprocating pumps, the use of dry or indirect cooling in some areas of the plant to prevent heat exchanger leaks that could result in hydrocarbon releases through conventional evaporative cooling towers, the use of enclosures for the oily water separator on the plant drain system; and the use of enclosures for local sumps for specific drains such as Selexol, amine, and Dowtherm systems. Appendix C describes the directed maintenance program that will be used to control fugitive hydrocarbon emissions.

Alternative means of controlling fugitive emissions that have been evaluated include double piping and enclosure of process areas. Evaluation results are summarized below.

Double piping:

- Double piping does not change the possibility of flange leaks, which are expected to be greater than line leaks.
- Reduction of wall thickness and the strength of pressure parts is a concern related to corrosion and erosion. This method would prevent monitoring of wall thickness during operation or even during shutdown periods.
- Many of the pipe runs handling vacuum bottoms at 204°C (400°F) or more must be heated electrically because steam or Dowtherm tracing is not considered desirable to supply heat at this temperature. In this application, double piping is impractical.
- Process material leaked into outer piping, at least on many of the streams, would solidify and/or cake and would be essentially impossible to remove.
- Differential expansion of the inner and outer pipe would present difficult design problems and would increase potential for piping ruptures.
- The greater complexity would increase design, operational, and maintenance problems.
- Cost would increase significantly.

Enclosing the process area:

- This method is unacceptable and impractical from a safety viewpoint. Even small leaks of toxic hydrogen sulfide and carbon monoxide would create a serious health and safety hazard for personnel. Even small leaks of hydrogen and carbon monoxide would cause serious explosion hazards because of inadequate dispersion. Firefighting would be hampered and firefighters would be subjected to far greater hazards. Even closet-size enclosures present serious problems such as the inability to detect small leaks early enough for corrective

maintenance to be taken; increased potential of exposure, especially of maintenance personnel, to hot and toxic materials, including hydrogen sulfide; and an increased chance of explosion due to the confinement of small leaks.

- Some small localized enclosures, such as shrouding, will be considered for some specific areas of high leak potential.

Residual waste disposal control

Process sludges. Relatively small quantities of process sludges are expected to be generated from cooling tower blowdown treatment, coal pile runoff treatment, and raw water treatment. These sludges will consist primarily of metal hydroxides, calcium sulfate generated through addition of lime, and polymers. Because environmental isolation is necessary to prevent solubilizing the metals caused by contact with rainwater, groundwater, etc., the most practical disposal options available are secured landfill disposal and chemical fixation. Secured landfill disposal is considered the preferred disposal method because of the reduced material handling requirements and the increased reliability. The landfill wall and clay liner design would be similar to that of a slag disposal landfill. The process sludge landfill would occupy a smaller area in accordance with the site plan (Fig. 2.2).

Catalysts and adsorbents. Because of the small quantity of this material, disposal should not be a significant problem. Plans are to return much of the catalyst to the supplier for reclamation. Except for spent activated carbon, the remainder of the catalysts and adsorbents will be disposed of in a secured landfill. It is expected that the spent activated carbon will be incinerated onsite and the residue disposed of in the common secured landfill provided for process sludges. The landfill wall and clay liner design would be similar to that of a slag disposal landfill. The catalyst/sorbent landfill would occupy a smaller area in accordance with the site plan (Fig. 2.2).

The location and design of these facilities are not available. Disposal of the above solid wastes will receive priority consideration during the detailed design phase.

Particulate emission control

Process emissions. In general, four particulate control alternatives are available: cyclones, scrubbers, electrostatic precipitators, and baghouses (or filters). Although cyclones could probably comply with applicable emission standards in some applications, they generally produce only moderate particle collection efficiencies. Scrubbers produce a sludge requiring special handling. Both electrostatic precipitators and baghouses can yield high particulate recoveries; however, for equivalent cost installations, baghouses provide significantly higher collection efficiencies and were selected as the preferred alternative from both a process and an environmental standpoint.

Coal storage. A coal stacker that produces minimal particle losses was selected. A wet suppression system is proposed to control fugitive emissions from the active coal piles. The water forms a thin, wet layer on the surface of the pile, thus trapping dust particles. Wet suppression systems have typical efficiencies of 60% for active piles.

An alternative would be the application of a polymer crusting agent on the pile being reclaimed. By spraying a bonding agent on the coal, a thin, solid crust would be formed that would trap the loose, small particles. This process would increase the particulate control efficiency to better than 90% for the undisturbed portion of this pile and may be the environmentally preferable alternative. However, further studies are needed to confirm that polymer use creates no appreciable downstream processing problems such as foaming. This method would be ineffective for use on the pile being built, as it is continually being disturbed, and the crusting agent would have to be applied to each layer.

A coal reclaimer was selected that produces minimal particle losses. In order to minimize potential for coal pile fires, no reserve pile is planned.

Coal conveying. Covered conveyors will be used to control wind dusting. Trade-offs of cost, performance, safety, and operating complexity are being evaluated for the alternative of totally enclosed conveyors.

Coal drying. Two methods of coal drying are available. The currently proposed design uses conventional technology in which wet coal obtained from the stockpile is simultaneously ground

and dried in a system heated by combustion flue gases. An alternative is flash drying, a technique in the development stage, in which wet coal is ground and dried separately. In the flash dryer case, wet coal is injected into warm solvent. The coal-solvent mixture flows to the slurry mixing vessel where a hot process recycle solvent and a recycle slurry are added and slurried. The water flashes off as steam and is later condensed, leaving a hydrocarbon gas that would then be injected into the vapor-recovery system. The flash drying system would not produce a particulate emission, whereas the proposed conventional dryer would generate approximately 19.8 lb of particulates per hour (14% of the plant's overall emission rate). Since flash drying is not a proven technology it is not being considered for the demonstration plant.

Commercial plant. Operational process and area monitoring during the demonstration phase will be conducted to determine the actual particulate emissions and resulting ambient concentrations. These data will be used to identify additional emission control needs for the expanded commercial facility. Several additional particulate control alternatives are available for reducing commercial plant emissions and will be evaluated during the commercial plant design phase. These include flash drying of coal in the coal-slurry mixing system, polymer crusting agents for coal storage piles, the use of all gaseous plant fuel, special enclosures or water/additive sprays for dust recovering from barge unloading, underground reclaiming from coal piles, totally enclosed coal conveyors and transfer towers, and a portable dust recovery system for the coal stacker-reclaimer.

Plant fuels

Operation of the SRC and supporting processes requires the input of significant quantities of heat that must be supplied by combustion of fuel in fired heaters. Four alternative fuels were considered: gaseous fuels [natural gas or liquid propane gas (LPG)], petroleum distillate fuels, coal, and process-generated fuels. Gaseous and light distillate fuels are acceptable from an environmental standpoint; however, their utilization would consume resources that are already in short supply and they were rejected. Use of heavy distillate fuels or coal would require extensive facilities for control of sulfur dioxide and particulate emissions to meet emission limitations and PSD requirements. Although implementation of required controls is technically feasible, the cost of control equipment must be weighed against the possibility that the process may not be commercialized. Utilization of process-generated gaseous and hydrodesulfurized light distillate fuels allows compliance with applicable environmental standards without requiring additional control equipment and was selected as the preferred alternative based on economic and political considerations. Ability to comply with environmental standards without reliance on additional control equipment subject to failure makes use of process-generated fuel the environmentally preferable alternative for demonstration plant operation. However, utilization of coal with appropriate control equipment may be feasible at the commercial scale. (Appendix C discusses the combustion characteristics and effluents associated with burning the SRC-II product.)

Plant-derived synthesis gas, propane, butane, and hydrotreated naphtha and mixtures thereof are being considered for use as plant fuel. All could be burned with no appreciable hydrocarbon emissions, and CO and NO_x emissions should be roughly equivalent. Naphtha combustion would produce more particulates and sulfur dioxide than the others, but the difference would not be significant in comparison to the plant's overall emission of particulates and SO₂.

Electrical power supply

The demonstration plant requires power in the forms of heat (steam), shaft work, and electricity. Initial plans were to generate the plant steam requirements in waste heat and auxiliary boilers; to purchase electricity from the local utility; and to generate shaft work by steam turbines and electric motors. Alternatives to purchasing electric power were examined because of the uncertainty regarding the reliable availability of power at the start of the operating phase. Electricity consumption may be approaching the capacity of the utility grid by then, and it is conceivable that the grid may experience reduced reliability because of reduced reserve capacity. An alternative to the purchase of electric power is the redesign of the plant utility system to allow onsite generation of the plant requirement (about 40 MW). This may be done by installing an independent steam-electric generating plant onsite or by using cogeneration techniques. The fuel for this generation capacity may be selected from the following forms available at the plant: coal, SRC product, naphtha, light hydrocarbons, substitute natural gas, and synthesis gas (a CO-H₂) mixture or mineral residue slurry.

As discussed in the earlier subsection on plant fuels, clean-burning process-derived fuels are the environmentally preferable alternative. Onsite electric power generation as currently planned for the plant will increase the plant's overall firing rate by about 12% compared to the purchased power alternative. The air quality impact analyses in Sect. 4.2.3.1 assume onsite power generation for the purpose of providing an impact analysis of worst-case emissions, using mixed plant gas/naphtha fuels.

If the power is generated in a conventional steam-electric plant, about two-thirds of the fuel heating value will be lost as waste heat, which would be released to the atmosphere by a cooling tower. If evaporation cooling is employed, there will be additional impacts from cooling tower drift, fogging, icing, blowdown, and water consumption effects.

Based on information currently available regarding the availability of process-derived fuels and the reserve capacity and reliability of the existing utility grid, the environmental trade-offs for electrical power supply alternatives cannot be fully evaluated at this time.

Plant layout

The currently proposed site plan was reviewed to determine whether an alternative site arrangement could significantly reduce the impact resulting from construction and operation of the demonstration plant. The currently proposed site plan was presented as an alternative in the Phase Zero deliverables and was subsequently selected to avoid the possibility of subsidence of mined areas initially proposed for disposal of slag produced by future commercial operations. The revised site plan appears to avoid geologically unsuitable areas (especially undermined areas for solid waste disposal) and to utilize areas of low environmental significance to the maximum extent possible.

The proposed location of the cooling towers should reduce the significance of the visible plume and the increased fogging, icing, and salt deposition resulting from their operation. Areas sensitive to cooling tower operation, Highway 53 and the electrical substation, should not be significantly affected.

Throughout the development of the SRC-II facility, layout and design alternatives that could reduce floodplain/wetlands impacts of the proposed facility were considered. Major design alternatives affecting floodplain/wetlands that were considered (Appendix D) include (1) alternative design of the barge slip, (2) alternative layout of the product storage area, and (3) elimination of the coal barge dock facility (i.e., the exclusive use of railroads for coal shipments).

Alternative barge slip. An alternative proposal reviewed in lieu of the proposed barge slip for unloading heavy equipment was the use of a breasting dock. An analysis of the project requirements indicated that a breasting dock may be cheaper to construct; however, this type of dock facility would not lend itself to the direct off-loading of large process equipment. In light of project requirements, this alternative was not considered feasible.

Alternative layout of the product storage area. From the beginning of site layout design, spill security of the product storage area has been a prime design consideration. The proposed design, a modification of an earlier design, decreased the amount of floodplain encroachment. The tank layout as proposed in the Draft Environmental Impact Statement (DEIS) was outboard of the currently proposed tank layout and would have entailed larger floodplain encroachment. An HEC-2 computer flood profile analysis of the amount of floodwater hydraulic changes caused by the earlier design indicated that the backwater curve would raise the 100-year flood level by 0.02 ft at a location 0.8 km (0.5 mile) upstream of the tanks and that it would increase the flood velocities from 7.2 to 7.3 fps. These flood changes were considered small. The reduction of encroachment in the current design will further reduce this small flood impact.

An alternative evaluation of locating the storage at an upland location that required pipelining the product down to the train loading area was also considered. An engineering analysis indicated a hilltop storage facility would cost an additional \$1.2 million, would create operational problems because of its remoteness from process and loading areas, and would potentially lead to a greater spillage risk. From this analysis it was concluded that a storage site adjacent to the railroad loading area was preferred (Sect. C.3.5.3).

Elimination of the coal rail shipment facility. During the initial design of the facility, the concept of rail shipment of the coal to the site was proposed. A reanalysis of the feasibility and economical merits of this concept indicated that coal rail shipment was impractical and would cost an additional \$27 million over the five-year project life. In view of these factors, coal shipment by barge became the preferred transportation mode. The small floodplain impacts of constructing and operating the barge unloading facility are considered warranted when weighed against project demands and the transportation cost savings.

Mitigation measures. The design and construction of the floodplain facilities have been carefully designed based on a balance between project requirements and environmental protection. The mitigation measures that have been designed into the facilities and are being considered for the construction and operation of the plant include surface water runoff and spill containment and treatment, minimizing floodplain filling and grading, and developing wetlands and

wildlife habitats at different locations within the site. The project will be constructed under the conditions of the Corps of Engineers and the State of West Virginia construction permits.

The ability to reduce the minor wetland impacts at the site by alternative site layouts is not considered feasible. The loss of the small amount of wetlands caused by the proposed layout and design would be inevitable with alternative site layouts.

Separation and disposition of mineral residue (ash plus unconverted coal)

The mineral residue (ash) and a small portion of the feed coal pass through the SRC-II process essentially unchanged. In order for the hydrocarbon liquid products to meet environmental particulate and sulfur standards when they are utilized as fuel, the mineral residue must be separated and subsequently disposed of in an environmentally acceptable manner. Two methods* of separation and disposal were considered. One was the use of filtration to separate the mineral residue, followed by its disposal in one of several ways — direct disposal (land fill), using it as a boiler fuel, incineration, and gasification. Filtration equipment requires extensive maintenance and exposes workers to heavy hydrocarbon materials, some of which have been shown to have carcinogenic properties. With regard to disposal of the filtered mineral residue, direct disposal (landfill) is undesirable because of its heavy hydrocarbon content and its pyrophoric properties. Use of the filtered mineral residue as a boiler fuel or incinerating it would convert the ash in the mineral residue to a material suitable for direct disposal but would require the use of supplemental fuel to sustain controlled combustion and extensive equipment to limit particulate and sulfur dioxide emissions. Gasification of the filtered mineral residue would convert the ash to a slag suitable for direct disposal and the unconverted coal to gaseous products. However, due to the low hydrocarbon content of the filtered mineral residue fed to the gasifier, the gaseous products would be of little economic value. The other alternative for separation and disposal of the mineral residue is to concentrate it in a heavy organic stream by vacuum distillation and then gasify the concentrated slurry. Gasification of this type of slurry converts the ash to a slag suitable for direct disposal and converts the unreacted coal and heavy hydrocarbons to a synthesis gas from which the sulfur can be readily removed and recovered with technically and economically proven equipment. Part of the cleaned gas can be used as a plant fuel, and the remainder can be processed further to provide the hydrogen required for the liquefaction reactions. The combination of vacuum distillation and gasification is the preferred alternative for process, environmental, and economic reasons.

Hydrogen production

Four alternatives were considered for producing the hydrogen required for the process: electrolytic production from water, steam reforming of methane, gasification of coal or oil, and gasification of the mineral-residue slurry from vacuum distillation. Electrolytic production of hydrogen from water would have the advantage of also producing oxygen in sufficient quantities to gasify most of the mineral-residue slurry from vacuum distillation. However, electrolysis of water consumes large quantities of electricity, the generation of which has adverse environmental impacts, and would reduce the thermal efficiency of the demonstration plant. An alternative use for the large quantity of synthesis gas from the required gasification of vacuum bottoms would also have to be determined. For economic reasons, the electrolytic production of hydrogen was rejected. Methane reforming is feasible, but it would consume a resource already in short supply and was rejected on that basis. The gasification of coal or oil is also feasible; however, it would consume additional coal or a more valuable oil product. Methane-reforming or gasification of coal or oil would require an alternative disposition of the mineral-residue slurry. The preferred alternative for hydrogen production is by gasification of the mineral-residue slurry, which will also provide a major part of the plant's fuel needs and convert the mineral residue to an inert slag suitable for direct disposal.

Gasification processes

Though many processing options may be available, only three available gasification systems are considered usable for gasification of the mineral-residue slurry: the Texaco and Shell-Koppers processes, which operate at high pressure, and the GKT process, which operates at atmospheric pressure. The GKT process has the most extensive operating history of these. Comparison of environmental control requirements and slag-disposal characteristics indicate no advantages of the Shell-Koppers and GKT processes compared with the Texaco process. The Texaco process was selected as the preferred alternative on the basis of process considerations.

* Solvent-deashing systems have recently been developed that do not have the problems associated with filtration systems. In this application, they offer no advantages over separation by vacuum distillation from either a process or environmental standpoint.

2.3.2.2 Alternative sites

Emissions and discharges from the demonstration plant are determined primarily by the design of process and support facilities and may be reduced through application of the various design alternatives discussed above. Assuming that the design of the demonstration plant is unchanged, the significance of the impacts produced by construction and operation is determined to a large extent by the physical characteristics and quality of the environment of the site at which the plant is located.

To evaluate the impacts of construction and operation at possible alternative sites, an independent analysis of available sites was conducted. Based on this analysis, which is described briefly below and in detail in Appendix B, two reasonable alternative sites were identified for evaluation against the proposed site: one on the Green River near Equality, Kentucky, and one on the Ohio River near Ravenswood, West Virginia. The relative location of these sites and the proposed site is shown in Fig. 2.6.



Fig. 2.6. Regional setting of alternative sites.

A definitive analysis of the environmental acceptability of alternative sites is severely constrained not only by the degree to which judgmental factors enter the analysis but also by the availability of consistent and detailed information on each site. In this case, detailed information exists for the proposed site from a one-year baseline monitoring program, whereas only reconnaissance-level information is available for the alternative sites. Since the possession of detailed data on any site enables the more certain detection of a flaw or flaws at that site, a bias will tend to exist in favor of the alternative sites identified. However, the purpose of this alternative site comparison is not to select the environmentally preferable site but rather,

in response to NEPA, to evaluate reasonable alternatives to the proposed action. Even though environmental comparisons such as these are based on dissimilar levels of baseline data, sufficient information is available to enable a reasoned choice among alternatives.

In summary, the proposed site was selected by the industrial partner using the procedures and criteria described in Appendix B (Sect. B.2). The proposed site will experience environmental impacts, as would any alternative site. Based on available information, neither of the alternative sites is obviously environmentally superior to the proposed site.

The environment at the proposed site is described in Sect. 3.2, and the Equality, Kentucky, and Ravenswood, West Virginia, sites are described in Sects. 3.3 and 3.4, respectively. The environmental impacts of the proposed facility are discussed in Sect. 4.2 for the proposed Fort Martin site and in Sects. 4.3 and 4.4 for the Equality and Ravenswood sites. The impacts of construction and operation at the proposed and alternative sites are summarized and compared in Sect. 2.2.2. Mitigation measures are described in Sect. 4.6.

Selection of the proposed and alternative sites

The contract awarded for the phase 0 design study required that the industrial partner submit a site-specific proposal. In 1975, Gulf Oil Corporation undertook an alternative site analysis for selection of a site for a 6000-tpsd SRC-II plant capable of accommodating an expansion in capacity to 30,000 tons/d. Although environmental factors were considered, the siting criteria used in the Gulf study were primarily physical, engineering, and economic factors that were judged to be important for construction and operation of the SRC-II plant. Fort Martin, West Virginia, was chosen as the proposed site. At that time, DOE was not a participant in the project.

After Gulf completed its site selection activity for the SRC-II project, two important events transpired: DOE became a participant in the project and Executive Orders 11988 and 11990 pertaining to floodplain/wetlands encroachment were issued (May 24, 1977). Although a proposed site had already been chosen for the project (as specified in DOE's RFP and the contract with its industrial partner), it was recognized that an evaluation of the reasonable alternatives to the proposed action, including alternative sites, was necessary.

Appendix B (Sect. B.2) describes the actual site selection process conducted by Gulf in 1975, which includes the Fort Martin site. Section B.3 describes the ORNL analysis, which evaluated sites other than Fort Martin for selection of two comparative sites for evaluation against Morgantown in Sects. 2.2.2, 4.3, and 4.4.

Summary descriptions of proposed and alternative sites

Except for the plant layout, the design alternatives discussed in Sects. 2.1.1 and 2.2.2.1 are essentially independent of site considerations, so it may be reasonably assumed that the plant design and resultant emissions would be the same at either the proposed or the alternative sites. However, the impacts of construction and operation of the demonstration plant depend on the site's environment and physical conditions. The alternative sites are described briefly below and in more detail in Sects. 3.3 and 3.4.

Proposed site: Fort Martin, West Virginia. A summary description of the proposed Fort Martin site is presented in Sect. 2.1.2.

Alternative site 1: Equality, Kentucky. The Equality site is located on the Green River between River Miles 75 and 80, about 1.6 km (1 mile) west of the town of Equality in northwestern Kentucky. The entire site is within the boundaries of Ohio County, about 21 km (13 miles) west of the county seat of Hartford on the two-lane Equality access road. The major trade center for the area is Owensboro, 64 km (40 miles) north in Daviess County. Although no boundaries have been delineated, the site consists of more than 400 ha (1000 acres), which is about equally divided between floodplain and moderate-to-steep hills. Current land use is primarily rural-agricultural.

There are about 10 residences in the hilly portion of the site area. About one-half of the floodplain is currently cultivated for corn production. Over 75% of the site qualifies as prime farmland, and an additional 69 ha is classified as having statewide importance. Two slough wetlands are also located on the floodplain. The hill slopes are in pasture and idle forestland. On the basis of available information, no critical habitat for any threatened or endangered species is believed to be located on the site. The site is in seismic risk zone 2 (moderate risk) near the boundary with zone 3 (high risk).

Water availability at the Equality site is adequate for the SRC-II demonstration plant, but water availability during periods of low flow might constrain operation of a full-scale commercial facility.

Water quality in the Green River is adversely affected by soil erosion and acid mine drainage plus municipal, industrial, and agricultural wastes. High concentrations of suspended and dissolved solids present the most significant problems; however, the water quality is considered acceptable for the plant's use. The area has been designated as being in attainment for all air pollutants except photochemical oxidants; however, ambient concentrations are approaching NAAQ standards. The major share of the socioeconomic impacts resulting from construction and operation of the SRC-II facility is expected to occur in a multijurisdictional impact region comprised of Ohio, Daviess, McLean, and Muhlenberg counties. Throughout much of this region, current housing stock and public service systems have only limited capacity to absorb new population growth. At the same time, there are numerous other ongoing or proposed projects in the area, including four being evaluated by DOE — the SRC-I and W. R. Grace commercial project, the H-Coal commercial plant (Breckinridge Project), and the Tri-State Synfuels Project.

Alternative site 2: Ravenswood, West Virginia. The Ravenswood site is located on the Ohio River, near Mile Point 230, in Jackson County, West Virginia. Meigs County, Ohio, is directly across the Ohio River to the west of the site, and the town of Ravenswood, West Virginia, is about 8 km (5 miles) to the northeast on West Virginia Highway 2. Seventy-five km (47 miles) to the south, on Interstate 77, lies Charleston, West Virginia; Parkersburg, West Virginia, is 65 km (41 miles) to the north, also on I-77. The site is bounded on the north by the Ravenswood Works of the Kaiser Aluminum and Chemical Company, which owns the largest tract [400 ha (1000 acres)] of the four that constitute a potential site area of about 641 ha (1585 acres). The site is bounded on the south by Ripley Landing, a community of several dozen residences; by the Ohio River on the west; and by the Keraland Recreational Area on the east. Land use on the site is rural, slightly over half agricultural, with the remainder woodland, although adjacent land uses are residential and industrial. Slightly more than half the site has been classified as prime farmland by the U.S. Soil Conservation Service. The site does not constitute a critical habitat for any threatened or endangered species, although one area, the Spring Creek forest, represents an unusually diverse habitat of interest to researchers and conservation groups. Both the portion of the site parallel to the Ohio River and the area along Spring Creek are within the 100-year floodplain. The site is in seismic risk zone 1 (low risk).

Water quality in the Ohio River is adequate for plant use and is available in sufficient quantities for both demonstration and commercial operation. The site area is considered to be in attainment for all NAAQ standards; however, no monitors are located in the vicinity. Emissions from the adjacent Kaiser facility may be adversely affecting air quality. The socioeconomic impact region is comprised of the West Virginia counties of Jackson and Mason and the Ohio counties of Gallia and Meigs. The availability of housing varies considerably among these impacted jurisdictions, but the current capacity of public service systems to absorb new growth is more uniformly limited throughout the area. As at the other two sites, impacts here could be compounded by the presence of other proposed large-scale construction projects in the same general area.

Analysis of impacts at proposed and alternative sites

Construction and operation of the demonstration plant at any site will result in changes in land use and socioeconomics and impacts on air and water quality, terrestrial and aquatic ecology, and social and economic resources. Assuming the process design remains unchanged, the significance of these impacts depends on action-specific considerations. Mitigation measures such as adjusting plant layout and installing pollution control equipment can be implemented. The following sections compare potential impacts at the proposed and alternative sites and requirements for mitigating measures.

Land use

Construction of the demonstration plant at the proposed or alternative sites will result in conversion of land from predominantly rural-agricultural to industrial uses. Although the proposed site is significantly larger than either of the alternatives, only about 151 ha (373 acres) is actually required for permanent plant facilities at any of the sites. The total area required for the site is determined by the topography, pattern of current ownership, desirability of buffer zones between adjacent land uses, and the wishes of adjacent landowners.

Although no plant layouts have been proposed for the alternative sites, it is assumed that all agricultural uses within the site boundaries would be discontinued and that all other areas not required for facilities or disturbed by construction would be left to natural succession. It is also assumed that the entire Ravenswood site [641 ha (1585 acres)] and at least 400 ha (1000 acres) at the Equality site would be acquired.

Since the agricultural use of the proposed site is limited, the impact on agricultural productivity resulting from the change in land use would be somewhat greater at the alternative sites.

At the regional scale, however, loss of agricultural land is not considered significant. Use of the Equality site could result in the actual loss (covered by facilities) of about 151 ha (373 acres) of prime or high-quality farmland. A similar loss would occur at the Ravenswood site. Approximately 300 ha (750 acres) of prime farmland at the Equality site and 320 ha (790 acres) at the Ravenswood site would cease production.

Use of either the proposed site or the Equality site would result in conversion of some residential property to industrial use. The 24 residences included in the proposed site and 10 in the Equality site would normally be purchased and vacated unless other arrangements are mutually agreed upon. At the Ravenswood site, no residences are within the site boundaries, but residences are in close proximity.

Use of the proposed site would cause relocation of most of the residents of the unincorporated area known as Fort Martin, which would probably cease to exist as a definable community. About 10 residences would be eliminated by construction at the Equality site. Although no residences are directly involved at the Ravenswood site, there are more residences in the immediate vicinity of the plant, particularly in the community of Ripley's Landing, and the number of occupied residences directly impacted by construction and operation of the plant would be somewhat greater if this site were used.

Construction at either the proposed site or the Equality site would impact on semipublic land uses in the form of churches and cemeteries. A church and two cemeteries are located within the boundary of the proposed plant site, and two churches and two cemeteries are located within the Equality site. At the proposed site, the plant layout has been arranged to avoid disturbing either the church or the cemeteries; it is not known whether this would be possible at the Equality site.

Based on the current limited agricultural use of the proposed site and the fact that a significant portion of the site is reclaimed mined land, the proposed site is the preferred alternative from the standpoint of land-use consideration. Since zoning for the area is not imposed, industrial use of the site is not in serious conflict with planned development. Location of the plant at either of these alternate sites will not conflict with any zoning or land-use plan because neither is in effect. However, any industrial construction would probably be viewed by area residents as an undesirable or conflicting land use because of the rural nature of the proposed and alternative sites.

Geology and soils

Because of the higher seismic risk and relatively steep terrain, the Equality site is considered less favorable than either the proposed or Ravenswood sites based on geology. A potential for slippage of steep slopes along the Monongahela River has been identified at the proposed site, but it is not considered a major limitation. The Ravenswood site is considered to be equal or slightly preferable to the proposed site.

Soil disturbance during construction will result in increased erosion and, without control, increased sediment loads and adverse impacts on water quality and aquatic ecology. Although erosion control measures would be incorporated at any site, the relatively steep terrain of the proposed and Equality sites would require more extensive controls than the Ravenswood site and would probably be least effective at the proposed site. However, due to the higher quality of the soils on the alternative sites, the effects of soil loss at the alternative sites would be more significant.

Floodplains/wetlands

Location of the proposed SRC-II project at either the proposed Fort Martin site or at one of the alternative sites will constitute an encroachment in floodplain/wetland areas. At the proposed site, risks to the project resulting from a 100- or 500-year frequency flood may be greatly reduced by mitigation measures (fill, diking, riprap, etc.). The largest extent of floodplain disturbance and/or encroachment would occur at the Equality site, and the least amount would occur at the proposed Fort Martin site.

Flood risks to the proposed project are expected to be minimal. Although a small portion of the site (currently designated for heavy oil storage and product loadout at a railroad siding) is located in the 500-year floodplain, mitigation measures presently call for the base of the product storage area to be elevated to a height above the 500-year flood, and dikes will be constructed to contain the contents of the tank plus water from a 10-year, 24-h storm. Impacts of flood flows due to this site development indicated that the effects will be minor. Impacts of a 500-year flood on the facility itself can be minimized with proper design and construction techniques. If the Equality site is chosen, the plant layout would have to specify use of flood

mitigation measures to reduce risk to facilities because approximately 50% of the site is in the floodplain of the Green River. During the 100-year frequency flood, the entire floodplain will be covered by at least several feet of water. Therefore, siting of plant facilities on the floodplain portion of the Equality site would significantly increase the risk of flood damage to the project. Because the Ohio River floodplain occupies only a small portion of the Ravenswood site, an SRC-II plant would be subject to negligible risk of flood damage if it were located on the higher elevation of the site. However, facilities such as barge loading areas, coal conveyors, pipelines, and utility lines may be exposed to flood risk.

The proposed layout for the SRC-II facility at the Fort Martin site will occupy a portion of the Monongahela River floodplain and displace two small segments of forested wetland adjacent to the river. In addition, an area of sedge rush meadow wetland, not in the floodplain, will be displaced for the truck unloading facility. In all, it is anticipated that approximately 2.5 ha (6 acres) of floodplain and 25 ha (62 acres) of wetland will be disturbed or encroached upon by the project at the proposed site. The most serious wetland impact resulting from the proposed action will be the total loss of forested wetland and severe disruption of the mixed mesophytic forest occupying the narrow valley through which the haul road and railroad spur will be located. These two areas contain plant species not encountered elsewhere on the site. The forested wetlands represent 10% of all wetland types and 36% of forested floodplain wetlands found in a survey of bottomlands along 17.5 miles of the Monongahela River in the vicinity of the site (Sect. 4.2.1.3). Because of its small size, its importance as a regional resource is minimized.

In conclusion, floodplain/wetland impacts resulting from the location of the SRC-II facility at the proposed Fort Martin site are expected to be minimal. Impacts on floodplain/wetland at either of the alternative sites would likely be more significant than those at the proposed site. Most of the project facilities are located on the portion of the site above the 100- or 500-year floodplain. Of those facilities which will be located in the floodplain, mitigating measures are expected to effectively reduce potential risk to the project and to the surrounding environment. Adverse impacts either upstream or downstream resulting from the proposed action are projected to be slight and almost undetectable. Increased floodplain encroachment in the area, however, may result from the future presence of a commercial synfuel plant and may increase the risk of flooding downstream from the project.

Terrestrial ecology

Construction of the demonstration plant at any of the three sites will not affect any Federally listed threatened or endangered plant species or Federally designated critical habitat for any threatened or endangered terrestrial animal species. It is possible, however, that the Indiana bat, an endangered species, could occur at any of the three sites during spring, summer, and fall. Construction at the Ravenswood site might destroy the unique Spring Creek forest area, and this site is considered to have the greatest potential for significant impacts on terrestrial ecology. At the Equality site, construction activities would destroy a mixture of upland, floodplain, and swamp hardwood forest, reducing potential habitat for seven animal species considered rare in Kentucky. Although construction at the proposed site would result in destruction of valuable wildlife habitat in the relatively undisturbed hardwood forest along the Monongahela valley slope, the extent of this habitat is relatively limited, and the proposed site is considered to have the least potential for impacts on terrestrial ecology.

Groundwater

Short-term groundwater impacts resulting from construction activities are expected to be minimal. The plant design will minimize groundwater contamination from process operations, coal and product storage, wastewater treatment, solid waste disposal, and accidental releases of product or process materials. Although these measures are expected to be effective, the possibility of liner failure in coal storage or waste disposal areas or of a spill outside the drainage collection area cannot be totally eliminated. The greater seismic risk at the proposed and Equality sites increases the probability of liner failure. Should liner failure or a major spill outside the drainage collection system occur, severity of impacts would depend on site characteristics. Although all three sites are underlain by aquifers, the aquifers under the alternative sites are used as water supplies. The aquifer under the proposed site is not a major source of water for the surrounding community and is inadequate to meet the plant's operational requirements. Plant water requirements could be derived from groundwater at the alternative sites, so the alluvial aquifer could be impacted by development at those sites. In summary, the impacts of groundwater withdrawal or contamination associated with plant construction and operation could be more serious at the alternative sites.

Based on a comparison of the potential for impacts on groundwater, the proposed site is considered to be environmentally preferable, and the Equality site is considered least desirable.

Surface water

Impacts to surface water quality of adjacent streams and rivers will result from increased sediment loads during plant construction wastewater discharge, accidental spills during operation, and increased barge traffic. Construction of the plant at the Ravenswood site will have the least impact on surface water quality and hydrology.

The Equality and Fort Martin sites, with relatively steep terrain, would require more extensive erosion controls than the Ravenswood site. Although erosion mitigation and control measures will be incorporated at any site, small increased sediment loads would unavoidably occur at both the Equality site and the Fort Martin site. Construction impacts would result in increased turbidity in the Ohio River if the Ravenswood site is selected, but the water quality impacts would be less significant than the anticipated impacts at either the Fort Martin (Monongahela River) or the Equality (Green River) sites. These impacts are expected to be temporary.

During the operation phase of the SRC-II plant, water withdrawal from the Monongahela River may present a problem during low-flow periods. Low-flow water availability at the Fort Martin site is a problem that has been investigated by the Water Resources Council and will be resolved before facility construction. Low-flow water availability at the Equality site is similar to that of the proposed site. Low-flow water availability at the Ravenswood site does not present a problem.

Impacts of the SRC-II facility's treated wastewater discharge would be least severe at the Ravenswood site because of the large dilution capacity provided by the Ohio River. If the facility is located at the Equality site, it would probably be necessary to operate occasionally in the zero-discharge mode during low-flow periods to avoid exceeding water quality standards and criteria. Other than at low-flow periods, treated wastewater could probably be discharged without violating instream standards. At the Fort Martin site the existing water quality problems (e.g., with TDS) may require zero-discharge operations 5% of the time (primarily during low flows) or perhaps more often. By operating in the zero-discharge mode significant degradation of water quality will be avoided, so that impacts of the SRC-II discharge will be roughly equivalent at the Fort Martin and Equality sites. However, because of the Monongahela River's problems with TDS, operations at the Fort Martin site may require operating in the zero-discharge mode more often than at the other sites.

Zero-discharge operation results in the production of a brine of soluble salts that requires special handling and disposal. The overall quantity of brine produced is related to the amount of time the zero-discharge equipment operates and the quantity of solids in the raw river water withdrawn for process use. Both of these factors would be greatest at the proposed site, and consequently brine production would be the greatest.

Impacts of increased barge traffic on water quality are considered to be more significant at the proposed site than at either of the alternative sites.

Aquatic ecology

No Federally designated threatened or endangered species' "critical habitats" would be encroached upon or affected by plant location at any of the sites. The spawning habitat, nursery, or refuge for various biota may be destroyed by habitat degradation during construction, but these habitats are not considered rare or of unique ecological importance. The aquatic ecology of the small streams at the Equality and Fort Martin sites may be adversely affected by SRC-II project construction. The slough of Spring Creek at the Ravenswood site may serve as a spawning habitat, nursery, or refuge for Ohio River biota, and the creek and slough are important from the standpoint of terrestrial ecology.

Adverse impacts on aquatic ecology due to water intake would be greater at the proposed site than at either the Equality or Ravenswood sites. In addition, impacts of wastewater discharge will be most severe at the Fort Martin site because of the recent trend of recovery in the fish community. The expected impacts caused by locating the plant at the Equality site would be slightly less severe than those for the other two sites.

Air quality

Construction of the demonstration plant at any site will result in increased particulate emissions (fugitive dust) as a result of site clearing, grading, and excavation. Equality site construction will require extensive earth moving, similar to that for the proposed and Ravenswood sites, causing fugitive dust levels to increase. Although construction at the Ravenswood site would require similar earth moving activities, lower wind speeds would account for lower impacts of fugitive dust. Fugitive dust impacts are temporary for all the sites.

Emissions during plant operations at all three sites would result in approximately the same short-term maximum pollutant concentration increases. Impacts at the Equality and proposed sites are expected to be similar, while impacts at the Ravenswood site could be slightly less. During emergency release conditions, adverse impacts are expected to be greatest near the Ravenswood site because of the surrounding population at the Kaiser facility and Ripley Landing. Also, impacts of releases resulting from a major accident would be more significant. Impacts of emergency and accidental releases are estimated to be similar at the Equality and proposed sites.

Socioeconomic

After careful consideration of the data presented in this FEIS, it is considered that the Fort Martin, West Virginia, site is preferred over either the Equality, Kentucky, or Ravenswood, West Virginia, sites with respect to socioeconomic considerations. The following discussion summarizes issue areas in which impacts are expected to differ among the three sites.

Because the urban areas surrounding the Fort Martin site are substantially larger and have a significantly better developed public and private infrastructure than do those in the vicinity of the alternative sites, project-induced in-migration can be better absorbed in the primary impact area than in the alternatives. This is illustrated in the analysis of housing and public services (Sects. 4.2.4.1, 4.2.4.2, 4.3.2.2, 4.3.2.3, 4.4.2.2, and 4.4.2.3), which shows a greater degree of stress for communities in the vicinity of the two alternative sites.

At the proposed site, about 65% of the required construction labor force is expected to be available in the surrounding region. Construction at the Ravenswood site would result in competition for labor with numerous ongoing projects, particularly DOE's Gas Centrifuge Enrichment Project at Piketon, Ohio. Construction at the Equality site would result in competition for labor with ongoing projects, including TVA's Hartsville Nuclear Station and the Rockport Power Plant, and potential competition with four other synthetic fuel projects now being evaluated by DOE — the SRC-I Demonstration Plant near Newman, the W. R. Grace commercial plant near Henderson, the H-Coal commercial plant (Breckinridge Project) in Breckinridge County, and the Tri-State Synfuels Project near Henderson. Construction of the demonstration plant would result in increased in-migration of construction workers and resultant greater impact on available public services.

Although increased traffic congestion has been identified as a potentially serious impact at the proposed site, potential impacts at the alternative sites are believed to be as severe. Traffic congestion in the Henderson, Kentucky, area would be severe should the plant be constructed at the Equality site in addition to construction of either or both the Grace and SRC-I projects. Efforts to improve the roads in the Fort Martin area, however, are already under way and should alleviate any traffic problems.

Problems often experienced by impacted communities related to local inflation during large construction projects and economic dislocations afterward should be least evidenced at the Fort Martin site because of the larger and more diversified economic base in this area.

Finally, in terms of impacts on archaeological resources, the proposed site is comparable to the Ravenswood site but superior to the Equality site. The archaeological sites in the Fort Martin area have been identified and mitigation measures have been proposed.

2.3.3 Determining not to proceed with construction at any site — no action

If the alternative of not proceeding to construct the demonstration project at any site is chosen, the opportunity to obtain the intended environmental, technical, and economic data on the SRC-II process at near-commercial scale would be greatly reduced. Provided that the proposed SRC-I demonstration program is carried out, it could provide information of a generic nature on hydrogen production via gasification; ash and slag disposal; pressure letdown; large-scale oxygen production; wastewater treatment; solid-liquid separation; and high-temperature and -pressure handling of hydrocarbon, hydrogen, and oxygen mixtures. However, the conceptual designs for each of the two SRC demonstration plants have unique features, such as solid-liquid separation and wastewater treatment. Demonstrating both technologies would provide a valuable diversity of information about, and operating experience with, alternative designs. The Exxon Donor Solvent and H-Coal pilot plants, which have been constructed and are presently in the mechanical shake-down and testing phase, could also contribute generic information for advancing the SRC-II technology.

Demonstration plants are a key factor in reducing scale-up risks (technical, financial, and environmental) from pilot plant to commercial facilities to a reasonable level. A decision not to build SRC-II would delay commercialization of this technology for direct coal liquefaction.

Concerning the development of the proposed plant site, the adverse impacts on the physical and biological environment and on the socioeconomic conditions in the region would not occur if the no-action alternative is chosen. However, the region would not receive the economic benefits of increased employment and revenue associated with the construction and potential continued operation of the SRC-II demonstration plant.

3. DESCRIPTION OF THE EXISTING ENVIRONMENTS

3.1 INTRODUCTION

This chapter presents a description of the existing environments at the proposed site, Fort Martin, West Virginia, and two alternative sites, Equality, Kentucky, and Ravenswood, West Virginia. (The method for identifying alternative sites is presented in Appendix B.) These descriptions focus on the significant features of the site (as it now exists without the proposed plant) to provide the reader with the environmental data needed to understand the impacts of constructing and operating the proposed plant, which are presented in Sects. 4.2, 4.3, and 4.4. Section 3.2 describes the existing environment at the proposed site, and Sects. 3.3 and 3.4 describe the existing environments at the Equality and Ravenswood sites, respectively. The description of the proposed site includes data obtained from an extensive, one-year baseline environmental-monitoring program. The alternative sites are described in terms of existing information available to the public. Each of the site descriptions (e.g., Sect. 3.2) is divided into four basic subsections: (1) land, (2) water, (3) air, and (4) economic, social, and cultural features. These four sections are further divided by specific environmental categories. For example, the land subsection for the proposed site (3.2) is presented in the following manner:

- 3.2.1 Land
- 3.2.1.1 Land use and development
- 3.2.1.2 Geology and soils
- 3.2.1.3 Vegetation and wildlife

In addition, within the text each of the above subsections may be broken down into several additional subcategories. The water section contains information on groundwater hydrology and quality, surface water hydrology and quality, and aquatic ecology. The air sections contain information pertaining to meteorology, air quality, and noise. The economic, social, and cultural features sections contain information on population, housing, labor and income, public services, transportation, and historical, cultural, and archaeological features.

3.2 PROPOSED SITE — FORT MARTIN, WEST VIRGINIA

3.2.1 Land

This section presents information about the proposed site in the areas of land use and development; geology, soils, and seismicity; and vegetation and wildlife.

3.2.1.1 Land use and development

Introduction

Land use and development and land use controls for the proposed SRC-II site and for each of the five counties that comprise the study area are discussed below.

The distribution of area population centers and the status of the regional road network are of primary concern in defining the study area. Because potential project impacts are likely to be closely tied to project work-force migration patterns, the study area has been defined in terms of the probable form of those patterns.

A zone consisting of the area within a 60-min commuting time of the site has been established to identify the communities likely to receive new residents because of the project. This area includes parts of five counties (Fig. 3.1): Monongalia, Marion, and Preston in West Virginia and Greene and Fayette in Pennsylvania. Waynesburg and Uniontown in Pennsylvania and Morgantown and Fairmont in West Virginia are principal population centers within the zone.

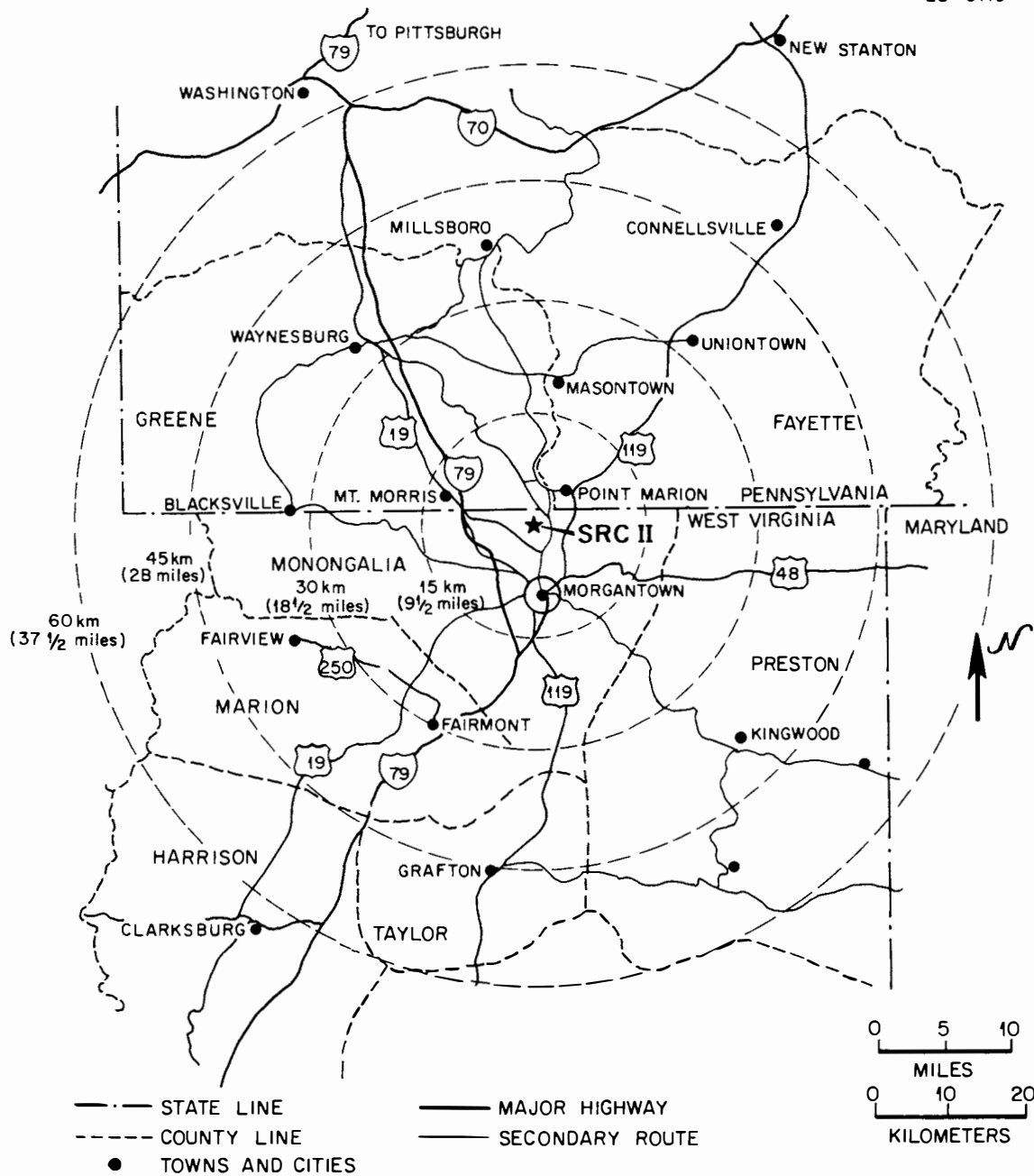


Fig. 3.1. Approximate 60-min commuting zone around the proposed SRC-II plant site. Source: ER, Vol. 2, September 30, 1979.

Land use within the five-county SRC-II study area consists primarily of agricultural, forestry, and extractive industries. Residential land use accounts for less than 5% of the total land area in each of the five counties.

Discussions of land use in each county that contains part of the locality zone are presented below.

Monongalia County, West Virginia

Most urbanized development within Monongalia County is concentrated in the Morgantown area, with surrounding small communities and strip development extending outward along major state and county roads. West Virginia University has large land holdings within the city, and growth is expected to occur either north or south of the city, principally along the Monongahela River.¹ Ample developable land exists in the central portion of the county, if the infrastructure is available.

To date, Comprehensive County Plan (1972) has had a limited impact in directing land use within the county. No subdivision ordinances are now in effect, although legislation is under consideration. There are currently no zoning ordinances to control land use in Monongalia County. Only the health department enforces regulations pertaining to sewage disposal and spatial arrangement.

Because Monongalia County currently has no control over land use, except to the extent of health department regulations, land use controls will have no bearing on the SRC-II site.

Marion County, West Virginia

Limited amounts of developable land remain within Fairmont, the major population center, which has about 26,000 residents. Future development is expected largely along the corridors of I-79 and U.S. 250 to the north and south. In the long run, the extreme southern portion of the county, near Valley Falls State Park, is an area in which major development is anticipated.

Land use controls in Marion County are only in the planning stage. Only Fairmont has a zoning ordinance.

Preston County, West Virginia

Lack of access hampers the development of Preston County. The Bruceton Mills area along U.S. 48 in north Preston County, which currently has only a few hundred residents, appears the only likely area for SRC-II project-related secondary development. Capacities in Preston County are constrained by lack of sewers and other services and amenities.

Land use controls in Preston County are nonexistent and are not likely to be instituted in the near future. Development is primarily controlled by the availability of water and sewer services.²

Greene County, Pennsylvania

In 1977, the Greene County Comprehensive Plan and Update had identified some 2227 ha (5400 acres) of prime vacant land for development, based on slopes in the 0 to 5% range.³ Cumberland Township accounts for 971 ha (2400 acres), I-79 and U.S. 19 corridors south from Waynesburg contain 162 ha (400 acres) of developable land. The dry Tavern area has 727 ha (1800 acres). However, Greene County faces developmental constraints because it lacks water and sewer facilities.

Land use controls in Greene County are still in the preliminary stages. A 1964 Comprehensive Plan (updated 1973), a 1971 Sewage Facilities Plan, and a 1973 Solid Waste Management Plan exist. Zoning controls are now limited to the borough of Waynesburg and around Ryerson Station State Park. A countywide subdivision ordinance was established in 1974, but it has been enforced only to a limited extent.

Fayette County, Pennsylvania

Land use in Fayette County is primarily rural, and settlement patterns are largely determined by the county's topography. Slopes in excess of 15% cover 80% of the county's total land area. The county's population, which is two-thirds rural nonfarm, clusters in two centers. Almost 40% of the county's population resides in Uniontown and Connellsville. Future growth is anticipated to be in North and South Union townships, on the border of the defined 30-min commuting zone from the SRC-II site.

Fayette County has the most extensive system of land use controls in effect within the five-county study area. A 1963 zoning ordinance controls development countywide, except where superseded by local ordinances in Uniontown, Connellsville, Perryopolis, Ohiopyle, and Washington Township. County subdivision regulations are in effect throughout the county. The existing comprehensive land use plan stresses new development along a corridor beside U.S. 119, with a limited amount of scattered development along the Monongahela River. Existing zoning regulations can be expected to have some effect in restricting development, although appeals have often been granted.

3.2.1.2 Geology, seismicity, and soils

Geology

The proposed site is located in the Pittsburgh Plateau section of the Appalachian Plateau physiographic province of the eastern United States and in the Northern Coal Basin of West Virginia. Sedimentary beds of the Late Pennsylvania Conemaugh and Monongahela Groups are the principal bedrock strata exposed in the project area. These beds are composed of interbedded shales, sandstones, limestones, and lesser amounts of coal and clay.⁴⁻⁶ The base of the Permian Dunkard Group, which overlies Monongahela strata, originally formed the cap rock on two hills at the far western portion of the site.⁷ Accumulations of recent, unconsolidated alluvial and colluvial deposits occur in and along tributary streams and the Monongahela River. Onsite topography is readily divided into zones: the relatively flat floodplain where some heavy-product storage is proposed, the rolling upland where the main process area is proposed, and the steep hillside (10 to 35° slopes) between them. The elevation varies from about 244 m (800 ft) at the floodplain to about 305 to 366 m (1000 to 1200 ft) at the upland area.

The major structural feature affecting the site is the northeast-southwest trending fold called the Fayette anticline, where the axis crosses the extreme southeastern portion of the project site.⁸ Under the site, rock formations generally dip at an angle of less than 5° downward toward the northwest. Depth to bedrock ranges from 2.1 to 3.6 m (7 to 11 ft) in the northeastern part of the site at the proposed slag disposal area, from 2.4 to 4.3 m (8 to 14 ft) in the central portion of the site, and 10.7 m (35 ft) at the existing power plant near the river.

Appendix H presents a more detailed description of the geology of the site. The rock types found on the site are shown in Table H.1.

Residual deposits predominate on the upland plant site and are brown silty clays to clayey silts with varying amounts of rock fragments, which usually increase in size and quantity with depth. The consistency of the residual deposits is slightly pliable to rigid, and the depth of the residual soils ranges from 2.1 to 4.0 m (7 to 13 ft).

The area in the central portion of the site has been surface-mined and contains spoil that is composed of randomly placed soil, decomposed rock, and rock fragments up to 1 m in diameter. The spoil thickness is generally 3 to 6 m (10 to 20 ft) but can be as much as 16.8 m (55 ft) in some areas. Voids were encountered in two borings in the south-central area and are related to underground mining of the Pittsburgh coal seam.

Four commercially mined coal seams exist in the region and are located geologically within the Monongahela Group or the basal portion of the overlying Dunkard Group.⁹ The seams are the Pittsburgh, Redstone, Sewickley, and Waynesburg coals (the latter corresponds to the younger and therefore stratigraphically higher unit). Surface and deep mining in the region has occurred in each of these seams at various times. The Redstone, Sewickley, and Waynesburg seams are currently being mined within or immediately adjacent to the western portion of the project site. The amount of interconnection between deep mines is not known.

The area east of the Pittsburgh seam outcrop (Fig. H.1, Appendix H), including some of the waste disposal area and all the main process area, has not been deep-mined. Information from boring logs indicate that the bedrock in the disposal area consists of fine-grained sandstone and siltstone, underlain by alternating layers of shale, siltstone, and coal. The proposed disposal area is now generally blanketed with strip-mined soils and the original silt loam soils.

Although the Pittsburgh seam has been deep-mined under the central and western portions of the site,⁹ this seam is no longer actively mined. Mining was by the room-and-pillar method on the advance with nearly full extraction of pillars on retreat. Such mining procedures occasionally resulted in subsidence of the overlying rock. Subsidence features occur in one area just over the north-central boundary of the site (Fig. H.1, Appendix H). The Waynesburg, Redstone, and Sewickley seams have been surface-mined in various portions of the site.

The West Virginia Geological and Economic Survey⁷ has located several older landslides between the floodplain and the edge of the upland. More recent slides have been identified in the bluffs above the river just north of the site boundary and in the western area of the site (Fig. H.2, Appendix H). Rock strata are not susceptible to major sliding, although weak Conemaugh shales and unconsolidated deposits that veneer steep slopes are susceptible to small, localized failures. Slumps, grading into earth flows toward the bottom, are the most common type of slope failure in this area of West Virginia. A small slump feature exists in the tributary drainage in the extreme east-central part of the site.¹⁰

Seismicity

Geologically, the SRC-II site is located in a very stable seismic area. The geologic structure of the project area is characterized by gently folded beds. No known faults occur nearby, and no natural, hazardous geologic conditions (other than landslides) that would preclude development have been observed on the site.

Historic earthquake data for West Virginia and contiguous states indicate a very low probability of future earthquakes being centered in the Morgantown area.^{11,12} Also there is a low probability that earthquakes centered elsewhere will be felt with an intensity V or greater in the Morgantown area. An intensity V earthquake is felt by nearly everyone and is characterized by the overturning of unstable objects and minor damage to windows and plaster. Only two, very small, historic earthquakes have centered in the Morgantown area,¹³ and no historic earthquakes centered elsewhere have produced a reported intensity V or greater within 50 km of Morgantown. The seismic risk in northern West Virginia is therefore considered to be very low, and earthquakes that may occur in the region are expected to cause negligible, if any, damage to industrial facilities.

Measurement of the water content and plastic limit of the unconsolidated material in several areas of the site⁵ indicates that, generally, the material would not liquefy and slump under seismic conditions near the equipment haul road and waste disposal areas.

Soils

The project site consists primarily of upland residual soils, reclaimed strip mine soils, and colluvial and alluvial soils along slopes and in drainageways, floodplains, and terraces. The dominant soil textures are silt loam, silty clay loam, and silty clay.^{8,14} Most soils have low shear strength, are subject to piping (washing out of open conduits in the structure) and seepage (reducing stability of cut faces), and are unsuitable for use as embankment material. In most cases, however, the soils are suitable to support structures that require shallow foundations. The soils in the extreme southeastern section of the site (along the Monongahela River) are subject to flooding. Distribution of the soil types present on the site and the pertinent characteristics of these soils are shown in Appendix L (Table L.8).

The soils comprise two basic groups: disturbed and undisturbed. The disturbed soils consist of coal mine waste dumps and areas surface-mined for coal. The disturbed soils occur in about 25% of the site area and occupy most of the south-central portion of the site and smaller areas in the northwest portion of the site.⁵ The disturbed soils are predominantly silty clay loam with randomly spaced rock fragments, are medium to very strongly acid (although some areas are moderately alkaline), and have fair to poor farming potential. Runoff is medium to rapid on benches and very rapid on outcrops. The erosion hazard is moderate to very severe in unprotected areas.

The undisturbed soils are predominantly silty loams with some loam and stony loam groupings. Soils of the Westmoreland and Clarksburg groupings are the most common undisturbed soils on the site. The soils are generally deep and are underlain by silty clay loam with some larger fragments of shale. The soil groups are generally well drained, except for a poorly drained soil group along the river. The permeability is generally moderately slow to slow; the runoff is slow to medium throughout the site. Areas with steep slopes (35 to 65%) exhibit very rapid runoff. With the exception of small areas near the Monongahela River and Fort Martin, the acidic nature of the soils onsite and the frequently low nutrient levels (as measured by the base saturation) are indicative of low agricultural potential.

Different companies performed laboratory analyses to determine the general soil productivity and to establish baseline data on soil chemistry, including trace element concentrations. The details of baseline information relevant to soil chemistry are presented in Appendix L. Data from different laboratories were not always comparable (for reasons outlined in Appendix L) and should be used with caution. The soils are generally acidic and silty, with wide ranges in base saturation and with normal trace element concentrations. The one unusual feature was the high level of boron in the soil (10 to 20 times the normal concentration of U.S. soils). This level may be sufficient to cause toxicity problems in plants, depending on the form of the boron.¹⁵

3.2.1.3 Terrestrial ecology

Vegetation

The natural vegetation of Monongalia County, West Virginia, is part of the Mixed Mesophytic Forest Region.¹⁶ The original vegetation of the proposed SRC-II demonstration plant site, temperate broadleaf deciduous forest,¹⁷ has been modified significantly by agriculture, lumbering, and mining. Ten plant communities, as defined in the ER, Vol. 1, Table 9-1, occur on the site: deciduous forest, scrub, shrub/tree grassland, sedge-rush meadow grassland, forested wetland, conifer plantation, cropland, mined land, and residential land (Fig. 3.2).

About 21% (205 ha) of the site is deciduous forest. Most of the forest is mesic hardwood and is characterized by a high diversity of tree species. The overstory is dominated by maple, white ash, elm, several oak species, and black cherry. The understory sapling and shrub species include spicebush, witch hazel, greenbriar, white ash, sugar maple, and viburnum (ER, Vol. 1, Sect. 9.5.2.1). A forested ravine leading from the Monongahela River up toward the proposed location of the main process area harbors a particularly diverse forest, which contains 16 plant species not observed elsewhere on the site.

The scrub communities, characterized by a mix of shrubs and small trees, cover about 23% (221 ha) of the site. These communities are a successional stage between grassland and forest. Common woody species include black cherry, crabapple, hawthorn, and blackberry. Grassland and shrub/tree grassland, which are used for cattle grazing and hay production, comprise 36% of the site (350 ha) and are dominated by nonnative grasses and forbs.

About 3% of the site (25 ha) is wetland, mostly wet meadow dominated by sedges and rushes. This community is "emergent wetland, temporarily flooded."¹⁸ Two forested wetlands on the Monongahela River floodplain are dominated by silver maple or black willow with sycamore and box elder also present. These contain three plant species not observed elsewhere on the site. Shrub wetland (too small a community to map), occurred mainly along Crooked Run. Small unmapped areas of emergent marsh occurred along the edges of ponds and in small depressions on the site.

Mined lands comprise about 15% of the site (144 ha), with less than one-third of this land active mining area. An additional 7% was reclaimed relatively well and is included in the other plant communities described. Conifer plantations along the Monongahela River, cropland on the floodplain, and residential areas along County Route 53 comprise the remaining 4% of the site (38 ha).

Site observations indicate that at least 423 plant species occur (ER, Vol. 1, Exhibit 9-1). This number represents 40% of the 1050 species known to occur in Monongalia County and about 20% of the flora listed for West Virginia.

No designated or proposed Federal endangered or threatened plant species were observed on the site (also see Appendix E). One species, *Panicum verrucosum*, an annual panic grass that had not been previously recorded in West Virginia (ER, Vol. 1, Sect. 9.5.1), was found on the site next to Garlow Cemetery. This species has a broad geographic range in the eastern United States with records from Florida to east Texas to Indiana to Massachusetts.¹⁹ The Northern water plantain, *Alisma triviale*, was found in the Crooked Run sedge-rush meadow on site. This plantain is known from only one other location in West Virginia and is considered rare in the state (ER, Vol. 1, Sect. 9.5.1) although it is distributed geographically from southern Canada to northern Mexico.¹⁹ This species is listed by the West Virginia Department of Natural Resources Heritage Trust Program²⁰ as peripheral (common elsewhere, but on the edge of its range and rare in West Virginia).

Two other species were observed on the site that had not previously been recorded in Monongalia County but are widespread in West Virginia: (1) flat-stemmed panic grass (*Panicum anceps*), located in grassland 0.91 km NNE of Garlow Cemetery, and (2) least duckweed (*Lemna minor*), located 1.37 km ESE of Garlow Cemetery (ER, Vol. 1, Sect. 9.5.1).

Wildlife

The terrestrial fauna at the proposed site appears to be typical of eastern deciduous forests and cropland. Twenty-four mammal species, 121 bird species, 4 reptile species, and 11 amphibian species were recorded on the site during the baseline survey (ER, Vol. I).

Mammal trapping was done in seven habitats on the site. The meadow vole, white-footed mouse, and short-tailed shrew were the most abundant species of small mammals, comprising 90% of the animals taken in the live-trap survey. The short-tailed shrew and the white-footed mouse were found in upland forest, scrub, forest streamside, meadow-forest border, hedgerow, and wetlands. The meadow vole was found in the more open habitats and not in forests or hedgerows.

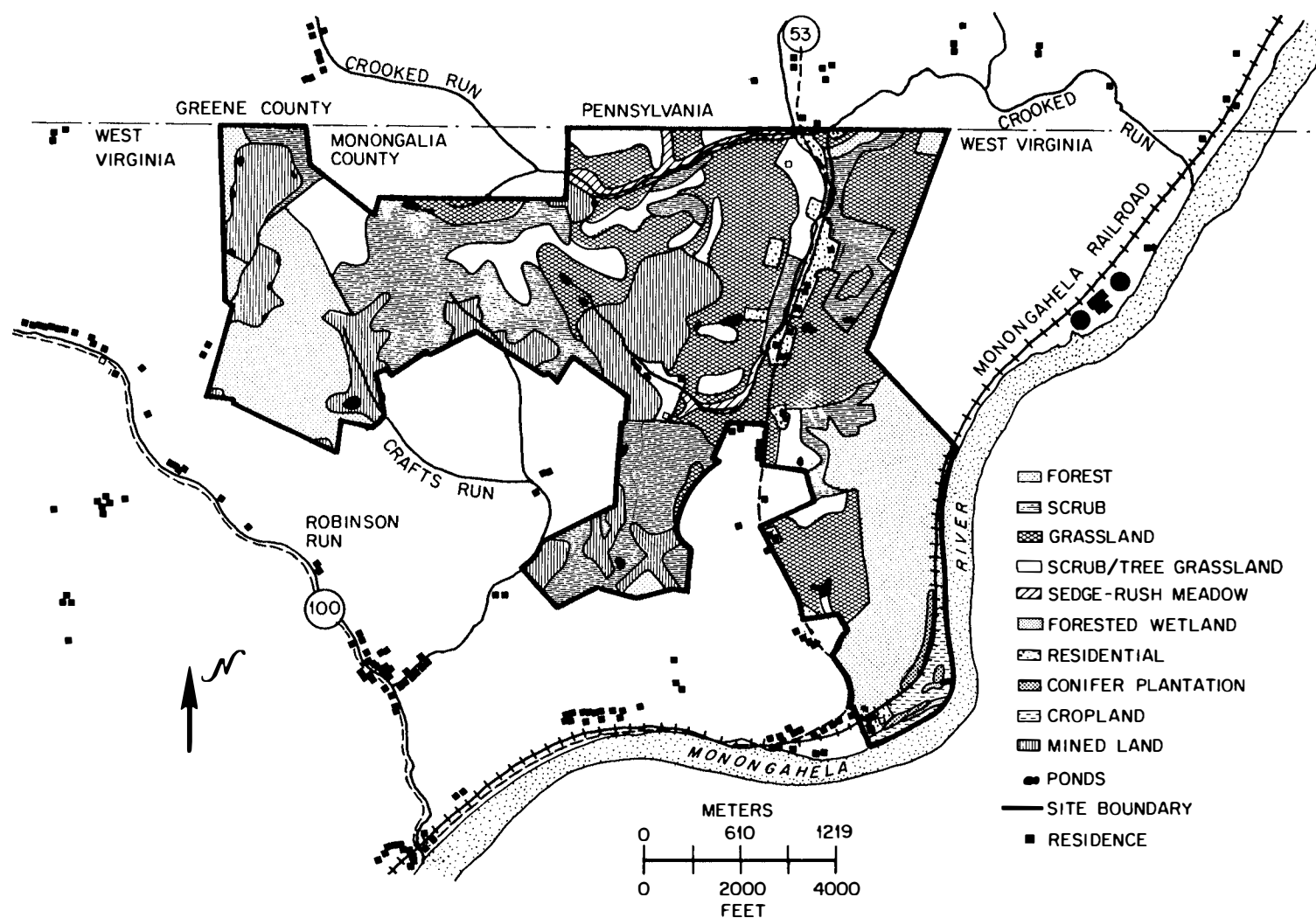


Fig. 3.2. Area vegetation map for the proposed site. Source: ER, Vol. 1, Fig. 9.2.

The white-tailed deer is an important game mammal in the area. Thirty-seven deer were counted during the aerial survey (ER, Vol. 1, Sect. 10.5.1.7), yielding a minimum density of 2.8 deer per km² (7.3 deer per sq mile). This compares with a deer density in Monongalia County of 4.6 deer per km² (11.9 deer per sq mile) (ER, Vol. 1, Sect. 10.5.1.7). This lower density is partly the result of the disproportionately large amount of grassland on the site compared with the county as a whole (grassland does not support as many deer as forest or scrub habitat). The deer were concentrated on the forested slope along the Monongahela River and in scrub and forest in the western part of the site.

Other mammals that occur on the site, as determined by tracks, sightings, burrows, or other signs, include raccoon, weasel, skunk, and fox. Raccoon occur in all forest and scrub habitats and are especially abundant near ponds and streams. Occasional evidence of long-tailed weasel and striped and spotted skunks was found. The spotted skunk had not been previously recorded in the county. Both red and gray fox occurred on the proposed site, but rabbits were scarce.

Of the 237 species of birds that regularly occur in West Virginia, 121 species were recorded on the site (ER, Vol. 1, Sect. 10.5.2). The avifauna of the site consists mostly of land birds such as passerines and raptors. Few aquatic species were recorded during the site survey (ER, Vol. 1, Sect. 10.5.2). All but one (loggerhead shrike) of the 121 species are typical of the region (ER, Vol. 1, Sect. 10.5.2).

Dominant breeding species in the forests include the American redstart, wood thrush, blue-gray gnatcatcher, Acadian flycatcher, cerulean warbler, and red-eyed vireo. The indigo bunting, American goldfinch, white-eyed vireo, and field sparrow are dominant breeders occupying the forest edge. Dominant forest-wintering species include the cardinal, brown creeper, and Carolina chickadee. Migrant passerines are common in the spring and fall. Eighty-two bird species were found in the forest habitat, which is more than double the number found in other habitats on the site. The wetland habitats had the second highest number of species (40), with the green heron, wood duck, killdeer, and American woodcock being potential breeders. The pied-billed grebe and bufflehead were migrants on the Monongahela River.

Breeding bird species that were dominant in the scrub habitat were prairie warbler, yellow-breasted chat, field sparrow, indigo bunting, and common yellowthroat. The cardinal and white-throated sparrow were dominant winter species. Thirty-three species were observed during the site survey (ER, Vol. 1, Sect. 10.5.2).

The red-winged blackbird, bobolink, killdeer, American robin, and Savannah sparrow were dominant bird species in the grassland, with the field sparrow, common yellowthroat, and red-winged blackbird dominant in shrub/tree grassland. These habitats had 21 and 19 bird species (ER, Vol. 1, Sect. 10.5.2), respectively.

The chipping sparrow, common crow, and mourning dove were recorded foraging in cropland habitat. Of the eight bird species recorded in mined-land habitat, the horned lark, Savannah sparrow, and grasshopper sparrow dominated. Residential areas had 30 bird species with the breeding bird community dominated by common grackle, house sparrow, barn swallow, red-winged blackbird, and starling.

Of the 28 reptiles and 29 amphibian species known from Monongalia County, 15 were encountered on site. The red spotted newt, northern dusty salamander, green frog, and pickerel frog were abundant in the small ponds and streams on site.

No animal species that are listed as threatened or endangered by the U.S. Fish and Wildlife Service²¹ were observed on or near the site (also see Appendix E). However, the Arctic peregrine falcon and bald eagle may occur as rare migrants in the area (ER, Vol. 1, Sect. 10), and the Indiana bat may occur as a very rare breeder in the area. The endangered Virginia big-eared bat²² is found in three separate populations, centered in eastern Kentucky, southwestern Virginia and eastern West Virginia. Therefore, it is not expected to be observed on the site.

The West Virginia Heritage Trust (WVHT) Program's list of rare species includes three mammals that occur in the site vicinity. The meadow jumping mouse was collected several hundred meters from the site, and sign of the eastern fox squirrel was observed on the site. A bat, the eastern pipistrelle, is present in Monongalia County, but was not observed.

The WVHT Program also lists the golden eagle, merlin, short-billed marsh wren, Swainson's warbler, dickcissel, Henslow's sparrow, and the lark sparrow as "species of scientific interest" in the Monongahela subbasin (Table 3.1). None of the species were observed on the site, and only Henslow's sparrow and the short-billed marsh wren have a moderate probability of occurrence on the site.

Table 3.1. Endangered, rare, and declining species occurring or potentially occurring on the proposed site

Species	Occurrence on site	Typical breeding habitat	Seasonal status ^a
USDI ^b			
Indiana myotis	Unknown	Caves, wooded areas, near water	F, W, Sp, Su
Arctic peregrine falcon	Not likely, very rare migrant	Cliffs, fields, open wetlands	F, W, Sp
Bald eagle	Not likely, very rare migrant or visitor	Fields, forest edges, open wetlands	F, W, Sp, Su
WVHT ^c			
Golden eagle	Not likely, very rare local breeder	Mountains	F, W, Sp, Su
Merlin ^d	Potential migrant	Cavities, fields, forest edges	F, W, Sp
Short-billed marsh wren ^{d,e}	Not recorded, potential breeder	Drier marshes, wet meadows	F, Sp, Su
Swainson's warbler ^e	Not likely, rare	Rhododendron thickets	F, Sp, Su
Dickcissel ^{d,e}	Not likely	Grain field edges, weedy fields	F, Sp, Su
Henslow's sparrow ^d	Not recorded, potential breeder	Wet meadows, dense weedy fields	F, Sp, Su
Lark sparrow ^e	Not recorded, potential breeder	Fields with bare ground or short grass and scattered brush	F, Sp, Su
Eastern pipitrel	Unknown	Caves, wooded areas, near water	F, W, Sp, Su
Fox squirrel	Sign recorded, rare	Open hardwood forest, in scrub onsite	F, W, Sp, Su
Southern bog lemming	Not recorded, unknown	Low damp bogs and meadows	F, W, Sp, Su
Meadow jumping mouse	Recorded adjacent to site, rare	Low meadows, various open habitats, pond margin at site	F, W, Sp, Su
Blue List ^{f,g}			
Sharp-shinned hawk	Recorded, potential breeder, uncommon	Woodland edges and shrublands	F, W, Sp, Su
Cooper's hawk	Recorded, potential breeder, uncommon	Woodlands	F, W, Sp, Su
Marsh hawk ^e	Recorded, potential breeder, uncommon	Grasslands, wet meadows, marshes	F, W, Sp, Su
Osprey	Unlikely, potential breeder	Water, water-woodland edge	F, W, Sp, Su
King rail	Unlikely	Freshwater marshes	F, Sp, Su
Upland sandpiper	Potential breeder, uncommon and local	Grasslands	F, Sp, Su
Barn owl	Uncommon, potential breeder	Farmyards, fields, grasslands	F, W, Sp, Su
Yellow-billed cuckoo	Potential breeder	Woods, brush, shrublands	F, Sp, Su
Ruby-throated hummingbird	Breeding population	Woods, shrublands, semiopen areas	F, Sp, Su
Hairy woodpecker	Breeding population	Mature deciduous or mixed woods	F, W, Sp, Su
Eastern bluebird	Breeding population	Cavities, open and semiopen country	F, W, Sp, Su
Loggerhead shrike	Potential breeder, uncommon, recorded on site	Open and semiopen country	F, W, Sp, Su
Warbling vireo	Recorded onsite, breeder	Deciduous groves	F, Sp, Su
Yellow warbler	Breeding population	Wet shrublands	F, Sp, Su
Yellow-breasted chat	Breeding population	Shrublands, scrub, forest edges	F, Sp, Su
Grasshopper sparrow	Breeding population	Mined lands and scrub/tree grasslands, on site	F, Sp, Su
Vesper sparrow	Breeding population	Mined lands on site, meadows, pastures	F, Sp, Su

Table 3.1. (continued)

Species	Occurrence on site	Typical breeding habitat	Seasonal status ^a
Red-shouldered hawk	Not recorded, potential breeder	Moist woodlands, often near fields	F, W, Sp, Su
Black-billed cuckoo	Not recorded		F, Sp, Su
Short-eared owl ^e	Not recorded	Open country	F, W, Sp, Su
Common nighthawk	Recorded, potential breeder	Open country, cities	F, Sp, Su
Red-headed woodpecker	Not recorded	Open deciduous woods	F, W, Sp, Su
Bewick's wren	Not recorded	Farmyards, brush, fence rows	F, Sp, Su
Bachman's sparrow ^e	Not recorded	Abandoned fields with scattered shrubs, pines, or oaks	F, Sp, Su

^aSeason in italics indicates season when recorded on the site.

^bU.S. Department of the Interior. "List of Endangered and Threatened Wildlife and Plants," *Fed.*

Regist. 12: 3636-53 (1979).

^cWest Virginia Heritage Trust Program.

^dAlso on *Blue List*.

^eSite is at edge of breeding range.

^f*Blue List* — R. Arbib, "The Blue List for 1979," *Am. Birds* 32: 1106-13 (1978).

^gOnly species that are breeders or potential breeders at the site.

Fourteen bird species on the 1979 National Audubon Society *Blue List*^{*} were recorded on the site (Table 3.1). All probably occur regularly on the site, and all may breed on the site. Population declines of three species (hairy woodpecker, loggerhead shrike, and yellow-breasted chat) have been noted in the Appalachian region by the ornithologist responsible for determining *Blue List* species in the region (ER, Vol. 1, Sect. 10.5.4).

3.2.2 Water

This section presents information about the proposed site in the areas of surface water hydrology, groundwater quality and hydrology, and surface water quality and aquatic ecology.

3.2.2.1 Surface water hydrology

Basin and site description

This section provides a history and description of the hydrologic characteristics of principal water bodies in the vicinity of the proposed site. Included are the Monongahela River, Robinson Run, Crafts Run, Crooked Run, and an unnamed tributary of Crooked Run (Fig. 3.3).

The Monongahela River forms at Fairmont, West Virginia, at the confluence of the Tygart and West Fork rivers (Fig. 3.3). The river flows generally northward from this point and finally contributes to the Ohio River at Pittsburgh, Pennsylvania. Between the origin and the Pennsylvania and West Virginia line, about 3.2 km (2.0 miles) downstream of the proposed location of the water intake structure, the Monongahela River drains an area of about 7000 km² (2700 sq miles). The river's 208-km (129-mile) length is broken by several navigation locks and dams, which interrupt the free flow of water (Fig. 3.4). This network of locks and dams is used primarily to maintain sufficient flow to transport coal by barge to the Pittsburgh industrial area.²³

All the locks and dams within Monongalia County are strictly navigation structures that have no flood control capability. The main flood season in the river basin is generally from December through March, with most floods resulting from heavy rain and snow melt. Large-scale floods may, however, occur at any time.²³

The March 7, 1967, flood reached an elevation of about 245 m (806 ft) mean sea level (MSL) with a discharge of 2008 m³/s (71,000 cfs) near the proposed site. This was the flood of record for this reach of the Monongahela River, but a greater historical flood is known to have occurred in July 1888. Although its exact level is not known, the 1888 flood is estimated to have reached an elevation of 249 m (817.5 ft) MSL at the site.²⁴

^{*}The *Blue List* designation indicates that the species is becoming increasingly rare. Increasing rarity of the species may result in the U.S. Department of the Interior adding this species to the "threatened" list.

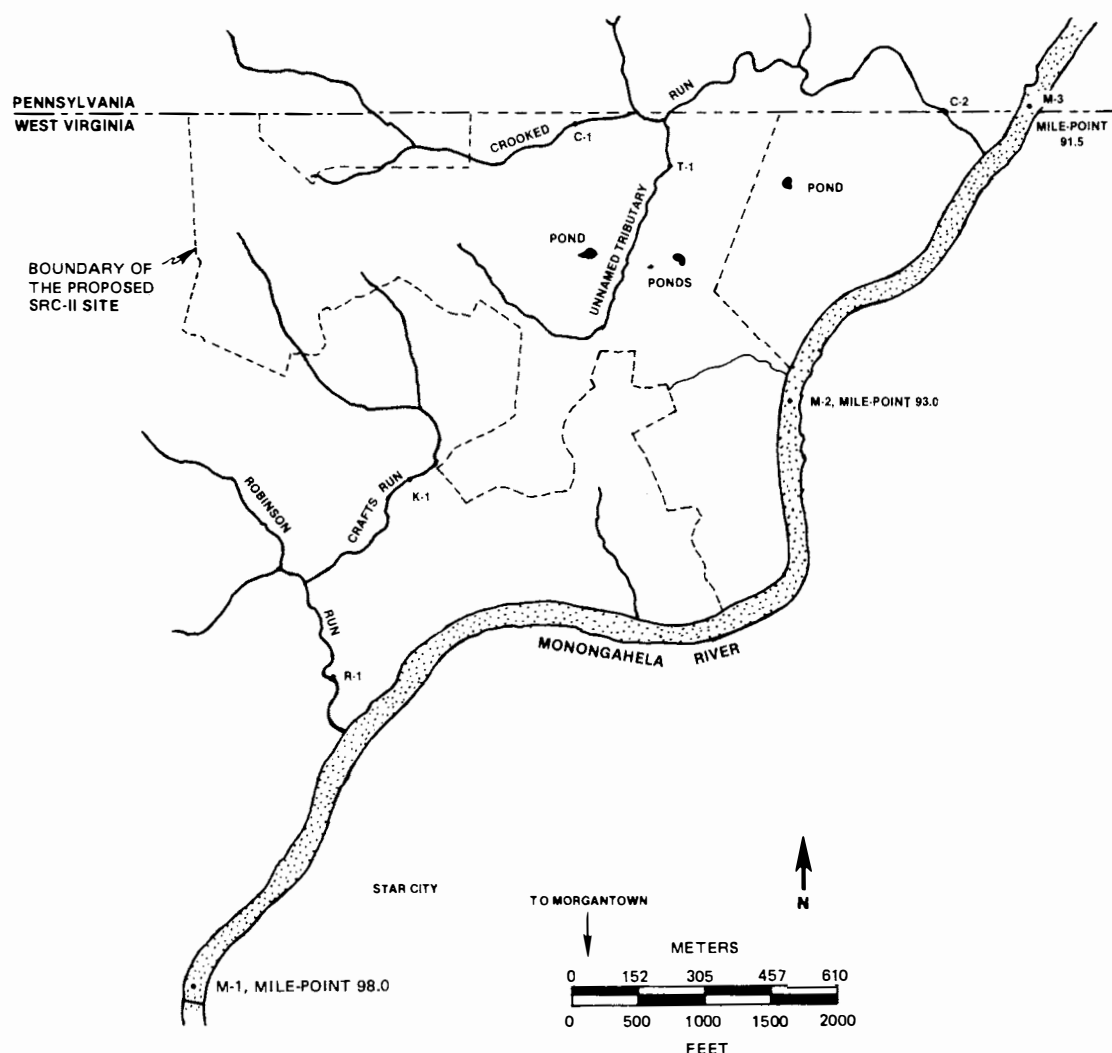


Fig. 3.3. Baseline monitoring sampling sites for surface water quality and aquatic biota of the Monongahela River and its tributaries. Source: ER, Vol. 1, Fig. 7.1.

The Tygart Dam on the Tygart River occurs 96.5 km (60 miles) upstream from the Pennsylvania state line.²⁴ The Pittsburgh District Corps of Engineers built and has operated and maintained this facility since February 1938. The dam, controlling a drainage area of 3067 km² (1184 sq miles), reduces major flood crests through Monongalia County by 4 to 6 ft. The minimum flow recorded, 6.65 m³/s (235 cfs), occurred in 1940. Low flows typically occur during late summer (July through August; see Appendix N).

All the streams that drain the site eventually flow into the Monongahela River (Fig. 3.3). Crooked Run and a major unnamed tributary drain about one-half the site. Crooked Run flows along the northern edge of the plant site in an eastward direction and drains an area of about 18.9 km² (7.3 sq miles). A small portion of the site drains southwest to Robinson Run and Crafts Run, a tributary to Robinson Run. Robinson Run drains a total of 19.7 km² (7.6 sq miles), and the Crafts Run drainage area to the west comprises 1.7% of the total area. The remainder of the site drains directly to the Monongahela River via small intermittent streams. No records were maintained of historical events on any of the small streams draining the proposed plant site although no-flow conditions would be expected during dry periods.

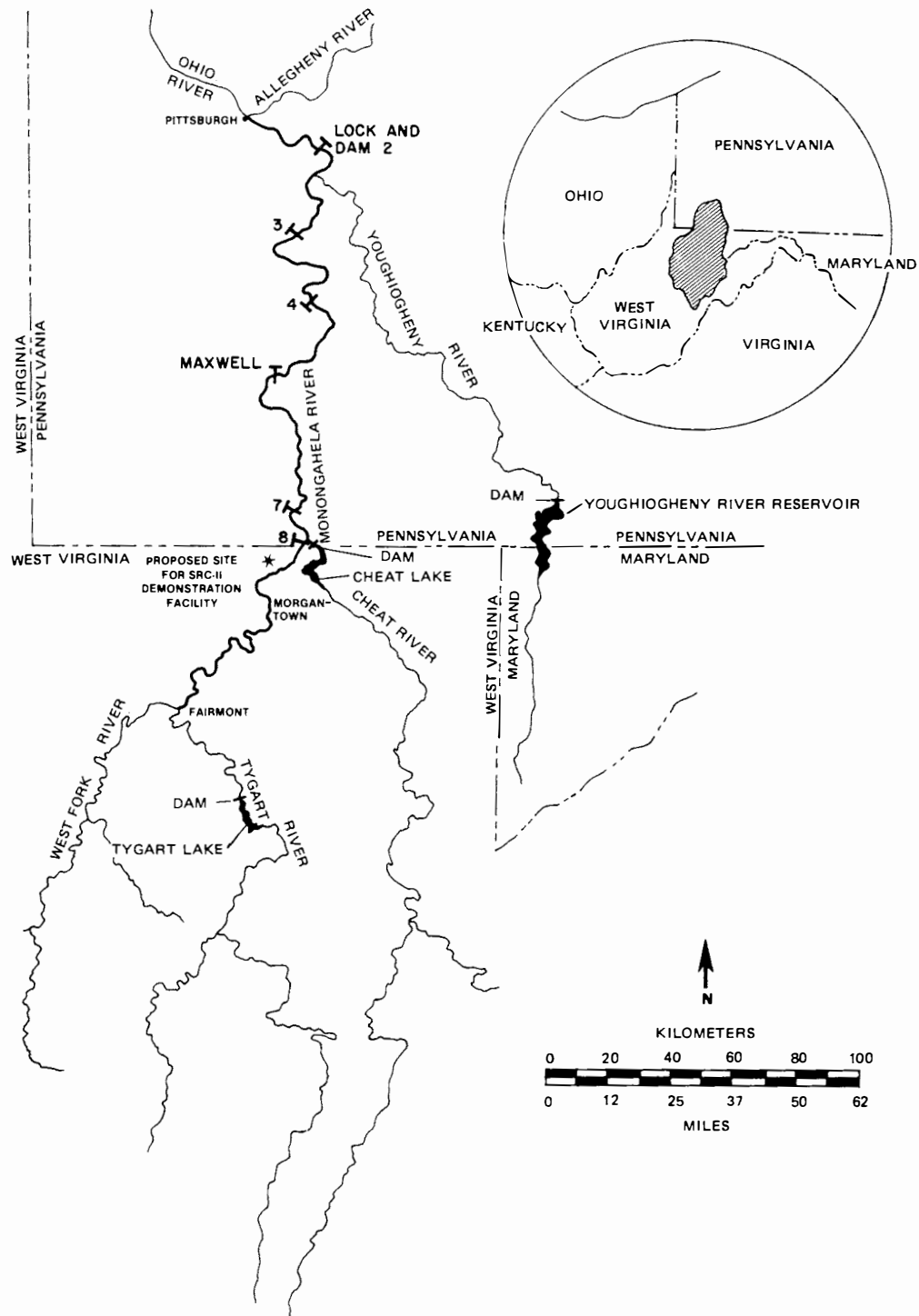


Fig. 3.4. The Monongahela River drainage basin.

Water use and availability

Water use substantially influences the hydrology of the Monongahela River. During drought periods, numerous competing demands are made on the river basin's water resources, including industrial and municipal water supply withdrawals and minimum stream flows for navigation. In addition, certain minimum streamflows are considered necessary to maintain water quality and habitat for fish and wildlife (Sect. 3.2.2.3). The Ohio River Basin Commission²⁵ (ORBC) recently assessed water availability on the Monongahela, and the ORBC's results were incorporated into the Water Resources Council's (WRC) Assessment Report.²⁶ These data on water availability and projected use form the primary information evaluated in this FEIS.

Flow frequency calculations for the Monongahela River are presented in Table 3.2. During periods of low flow, the Corps of Engineers' releases from Tygart Dam regulate streamflows from the dam downstream to the Monongahela's confluence with the Youghiogheny River. At the proposed SRC-II plant location (4 km or 2.5 miles above lock and dam number 8), the Corps of Engineers maintains minimum flow of 9627 liters/s (340 cfs). Because of the Monongahela Basin's poor natural low-flow yields, streamflows under extreme drought conditions would decrease to almost zero without low-flow augmentation from reservoirs. Among regions in the Appalachian coal basin, northern West Virginia and western Pennsylvania have been identified as having limited water supplies for energy development.²⁷

Table 3.2. Flow data for Monongahela River, ^a m³/sec^b

Lock and dam	River Mile	Mean	80% exceedance ^c	7-d 10-year	7-d 50-year	Minimum navigation flow
2	11.2	348	84.1	32.6	25.8	21.2
4	41.5	254	48.1	18.4	14.4	8.92
Maxwell	61.2	243	45.9	17.6	14.0	9.20
7	85.0	229	43.0	16.7	13.6	9.63
8	98.8	130	22.3	10.2	9.91	9.63
Opekiska	115.4	122	21.0	9.63	9.63	9.63

^aDoes not include any future low-flow augmentation.

^bTo convert to liters/sec, multiply by 1000; to convert to ft³/sec, multiply by 35.32.

^cFlow level that is exceeded 80% of the time.

Source: U.S. Water Resources Council, "Coal Liquefaction Demonstration Plant Near Morgantown, W. VA.: Water Assessment Report," *Fed. Regis.* 45(164): 55994-56003 (Aug. 21, 1980), Table 1.

The Corps of Engineers is currently acquiring land for the Stonewall Jackson Reservoir on the West Fork River. If completed, the Corps projects that releases from this reservoir would augment low flows by up to 2265 liters/s (80 cfs). Although the project is scheduled for completion in 1987, the West Fork River Watershed Association is litigating against the project, partly because of the inundation of productive farmland.

Industrial and municipal water withdrawals result in substantial consumptive use from the Monongahela River (Table 3.3). These WRC estimates of future consumptive use are projections based on past trends.²⁸ Future water consumption is uncertain and could be greater than WRC estimates. Further increases in consumptive use may result if power plants along the Monongahela attempt to use cooling towers to meet the Best Available Treatment (BAT) requirements of Section 316 of the Clean Water Act. Consumptive use along the Monongahela could be increased by 1530 liters/s (54 cfs) to meet power plant cooling requirements.²⁹ However, no definite plans to use cooling towers have been announced.

Because large quantities of wastes are discharged to the Monongahela from point sources and non-point sources, certain minimum streamflows are necessary to maintain water quality (Sect. 3.2.2.3). During drought periods, the Monongahela has insufficient flow to dilute incoming contaminants, and water quality violations result. Consequently, the Pennsylvania Department of Environmental Resources has an administrative policy requiring that water users make up consumptive use losses during low-flow conditions. West Virginia currently has no policy on makeup water during low flow.

Under the Pennsylvania policy, when the river flow drops below the streamflow necessary to meet water quality standards, offstream diversions of new or increased consumptive uses, including interbasin transfers, shall not further diminish the flow of the stream. Under such flow conditions, either consumptive uses are curtailed or compensating releases must be provided from

Table 3.3. Estimated cumulative consumptive withdrawals from the Monongahela River,^a liters/s^b

Lock and dam	1980	1990	2020
West Virginia			
8	2209	2265	2463
Pennsylvania			
7	2322	2379	2577
4	3256	3426	4078
2	4021	4191	4700

^aDoes not include SRC-II project.

^bMultiply by 0.0353 for ft³/sec.

Source: U.S. Water Resources Council, "Coal Liquefaction Demonstration Plant near Morgantown, W.VA.: Water Assessment Report," *Fed. Regist.* 45(164): 55994-56003 (Aug. 21, 1980).

storage. Streamflow requirements are specified to meet water quality standards. If streamflow criteria for various water quality standards differ, the higher streamflow may be required to: protect public health; control water quality; conserve fisheries, aquatic habitats, and recreation; and protect instream and downstream water uses. The policy for consumptive use makeup is currently enforced by Pennsylvania for municipal water supply users along the river and for all users who withdraw from reservoirs in the Monongahela River Basin. A policy that would include all water users along the Monongahela River in Pennsylvania is being reviewed.

3.2.2.2 Groundwater quality and hydrology

Groundwater quality

Several aquifers in Monongalia County supply adequate quality domestic drinking water supplies. The principal aquifer in the county is the Pottsville series, which contains fresh water to the east of the site.³⁰ Below the proposed site, however, the water in the Pottsville is saline. Wells in the eastern sections of the county also obtained water from rock units in the Allegheny series. No site-specific information is available on water quality in the Allegheny series aquifer because all wells near the site area are drilled to shallower aquifers. Flow in the Pottsville and Allegheny aquifers is expected to be down dip from the principal area of use in eastern Monongalia County toward the site.

Two aquifers (the Monongahela and Conemaugh) are used for drinking water supplies in the site area.³⁰ In the Morgantown area, the Conemaugh generally contains low levels of dissolved solids (primarily sulfate, bicarbonate, and calcium) with occasionally elevated levels of fluoride and iron. The Monongahela series generally has somewhat higher total dissolved solids than the Conemaugh has (primarily calcium, sodium, magnesium, sulfate, and bicarbonate) and may contain moderately high iron content.

Site-specific information was obtained from water quality samples taken from nearby wells and springs that tap the Monongahela and Conemaugh series (Appendix I). The Conemaugh is the primary groundwater source in the eastern section of the site and is characterized by neutral pH (neither acid nor alkaline) and normal dissolved solids content. The maximum recommended concentrations (EPA drinking water standards) that were met or exceeded at least once were: (1) the primary standards for cadmium (in one-third of the tests) and mercury (in one-fourth); and (2) the secondary standards for phenols (91.6% of the samples), iron (16.7%), and manganese (16.7%). An elevated boron concentration, which may be related to the high soil boron concentrations, was found in only one of the samples tested. Unusual seasonal fluctuations in some of the major cations (particularly magnesium) have been measured and may be related to fluctuations in the type of rock being leached. Such seasonal fluctuations should be considered in any operational monitoring program.

Water from the Monongahela series was tested in the area near the western border of the site. Total dissolved solids concentrations were somewhat higher than in the Conemaugh, exceeding secondary standards at one spring that was thought to be hydraulically unrelated to the site groundwater. Again, the concentration of major cations varied seasonally, although in a more uniform and predictable manner than in the Conemaugh samples. Standards exceeded in the tests

were those for cadmium, iron, and mercury (in the samples from the spring with high dissolved solids) and phenols (in the spring and well samples). Tables in Appendix I contain all the results from the groundwater quality testing program.

Groundwater hydrology

The local groundwater hydrologic regime at the proposed site is controlled by lithology and structure. Groundwater occurs in both unconsolidated (i.e., alluvium, soils, and mine spoils) and consolidated (bedrock) units. Local deposits of unconsolidated material are not an important source of groundwater because of limited extent and thickness, unsaturated conditions, or impermeability. Sandstone units in the Conemaugh Group are the principal sources of groundwater at the proposed site. Northwest and west of the site, sandstone and some limestone above the Sewickley coal seam are the primary sources of groundwater.

Groundwater is the primary source of domestic water supply where public water is unavailable or not used. No commercial wells exist in the proposed project area. Shallow wells and spring yields are sufficient only for domestic, stock, and possibly light industrial or commercial use. Although yields are small, the aquifers may be the only continuous source of water for residents in some areas.

All known wells in the site are less than 61 m (200 ft) deep and tap Conemaugh Group aquifers. No site-specific information is available for the water-bearing properties of the deeper Allegheny and Pottsville aquifers. The Allegheny aquifer is reported to be³⁰ a relatively unimportant aquifer because yields are normally less than 0.6 m³/h (2.5 gpm); however, the aquifer is untested in the proposed project area. The Pottsville aquifer is the most important aquifer in the central and northeastern parts of Monongalia County;³⁰ well yields range from less than 0.2 to 57.5 m³/h (1 to 250 gpm) and average about 10 m³/h (45 gpm). The Pottsville aquifer west of the Monongahela River is referred to as "salt sandstones" because it contains saline water.³⁰⁻³¹ Although the Pottsville aquifer is untested in the site area, it is expected to be unsuitable for use without pretreatment because of the high undissolved solids content. The U.S. Geological Survey has mapped the boundary of shallow potable water in the Pottsville table west of the Monongahela River. At the site, depths and salinities are assumed to be too great for drinking water uses, and yields are expected to be insufficient for heavy industrial use.

Site-specific data regarding the movement of groundwater indicate that a "perched" groundwater level exists [about 1.5 to 2.4 m (5 to 8 ft) below the ground surface] and is controlled by the topography and the thickness and physical composition of the soil cover; the deep groundwater flow is controlled by the geologic structure and stratigraphic sequence. When occurring above local drainage, groundwater moves from topographically high areas toward valleys where it is discharged to the surface water regime as seeps and springs along valley walls or directly into stream channels. Generally, the coals, sandstones, and siltstones in the alternating units of the Conemaugh Group are permeable; claystones and clay shales are impervious and inhibit the vertical movement of groundwater and confine it to lateral migration within the more permeable units. This characteristic causes numerous springs and seeps in areas where westward dipping rocks crop out on the west side of hills.

Seepage exhibited in some test pits on the site is most likely the result of infiltration of surface water that remains in the soils because of their low permeability and does not necessarily reflect a high groundwater level. In areas where a coal seam has been mined, the groundwater level is often below the mined coal. However, in the coal outcrop area, seeps and springs often consist of acid mine drainage as a result of water passing through mine spoil, refuse, and deep mine workings.

The groundwater level along the Monongahela River is controlled by the river level because of the proximity of the river and the permeable nature of the sand and gravel alluvium. Groundwater levels fluctuate because of weather conditions and changes in season.

3.2.2.3 Surface water quality and aquatic ecology

Surface water quality

The bodies of water that may be affected by the construction and operation of the proposed SRC-II facility consist of reaches of the Monongahela River in West Virginia and Pennsylvania and the streams and ponds on and near the plant site (Figs. 3.3 and 3.4). The streams include Crooked Run, an unnamed tributary of Crooked Run that drains the plant's projected main process area, Robinson Run, and Crafts Run, which flows into Robinson Run south of the projected plant site.

The Monongahela River and its tributaries are classified for all uses (supplies for water contact recreation, municipal use, industrial use, agricultural use, the propagation of fish and other aquatic life, water transport, cooling and power, and treated wastes transport and assimilation) according to the water quality regulations formulated for the State of West Virginia.³² The most stringent criteria that apply to water classified for these uses have been specified in Appendix S, Table S.1. Also included in this table are Pennsylvania water quality standards and regional (developed by the Ohio River Valley Water Sanitation Commission as uniform standards for the Ohio River's main stem) and national (developed by the U.S. Environmental Protection Agency for the Nation's navigable waters) water quality criteria.

During the 1960s, the Monongahela River was considered one of the most severely polluted rivers in the United States. Because coal mining has been so extensive in the entire river basin, acid mine drainage from active and abandoned mining operations has seriously impaired river quality. The Monongahela is estimated to have transported an annual load equivalent to 200,000 tons of sulfuric acid to its confluence with the Allegheny at Pittsburgh. About 40% (80,000 tons) of the total acid load originated in the portion of the basin within West Virginia.²³ In 1969, West Virginia's Water Resources Division began a program for controlling mine drainage. Since that time, state, regional, and Federal agencies have been committed to alleviating acid pollution in the Monongahela River Basin.³³

In addition to acid mine drainage, the Monongahela River has suffered from other sources of pollution. The combination of steep slopes, high rainfall, and a relatively large percentage of disturbed land resulting from mining activities has created significant erosion in the basin. As a result of erosion and other disturbances such as dredging and channelization, concentrations of suspended sediment in the Monongahela are high. An average load of sediment for reaches of the river near Morgantown, West Virginia, was estimated to be 3.9 kg per ha per year (0.23 tons per acre per year), about 7 times the normal rate for forested areas of the Allegheny Mountains.³⁴ In the West Virginia portion of the basin, raw sewage has frequently been discharged directly into the river or its tributaries.³⁴ However, the reaches of the river near Morgantown do not appear depleted of oxygen as a result of upstream loading of organic wastes.²³ River nutrient levels have been high enough to pose potential eutrophication problems. However, poor productivity has been attributed, at least in part, to the deleterious effects of acid mine drainage.³³

Although increased control of acid drainage has improved the Monongahela basin's water quality somewhat in the past two decades, problems remain during low-flow periods because of high concentrations of total dissolved solids (TDS) and occasional low pH and dissolved oxygen (DO) concentrations in Pennsylvania.²⁵ Of particular concern is the accumulative concentration of TDS.

Total dissolved solids are discharged by numerous active and abandoned coal mines, coal preparation plants, electrical generating stations, coking plants, steel plants, and other industrial facilities. The Monongahela River between Fairmont, West Virginia, and Pittsburgh, Pennsylvania, is one of the most heavily industrialized river reaches in the United States. Pennsylvania estimates that the Monongahela River now contains up to five times the TDS concentration expected from natural conditions.²⁶ The State projects that TDS loadings from coal mining will continue to increase, so that by year 2020, about 80% of the TDS problem will come from new mining activities and from the treatment required to satisfy discharge requirements for acid mine drainage.²⁶

Unlike many pollutants, TDS are not "assimilated" in streams, so the accumulated TDS create a loading problem downstream. This is particularly significant because the Monongahela River flow does not substantially increase except at the confluence with the Cheat and Youghiogheny rivers. Thus TDS loadings are not well diluted along significant portions of the river. In West Virginia, TDS loadings are not currently a water quality problem. Downstream in Pennsylvania, the TDS accumulation is a problem until flow from the Youghiogheny River dilutes the loadings.

The Water Resources Council assessment²⁶ indicates the minimum streamflow below which water quality violations are projected to occur (Table 3.4). West Virginia made projections for lock and dam number 8 based on State standards. For the stretch of river in Pennsylvania, streamflows that would maintain minimum quality standards were projected for lock and dam number 4. This is a location with the most available data but not necessarily the worst water quality conditions.

Future water quality of the Monongahela River may be improved by several factors. Acid drainage from abandoned mines may be reduced by abatement programs under the Surface Mining Control Act. This would decrease the acidity of mine drainage but would also increase the concentrations of sulfate discharged, thus aggravating the problems of high TDS concentrations (Doug Steele, Water Resources Department, West Virginia Department of Natural Resources, telephone conversation with R. D. Roop, ORNL, November 6, 1980). Under the Clean Water Act, increasingly stringent effluent limitations on industrial and municipal discharges may bring about more thorough waste treatment and reduce discharge of oxygen-demanding substances and other pollutants. In addition, both West Virginia and Pennsylvania have conducted planning for control of nonpoint source pollution under

Table 3.4. Streamflows specified to maintain water quality, liters/s

State and lock and dam	Constituent	Standard	1980	1990	2020
West Virginia (8)	DO, mg/liter	≥ 4	9,769	9,769	9,769
	pH	≥ 6	9,769	9,769	9,769
	TDS	None	None	None	None
Pennsylvania (4)	DO, mg/liter	≥ 5	32,280	11,326 ^a	16,990 ^a
	pH	6-9	<i>b</i>	<i>b</i>	<i>b</i>
	TDS, mg/liter				
	monthly av	< 500	47,005	63,145	79,285
	daily av	< 750	31,148	42,191	52,668

^aState recommended treatment levels would reduce flow requirement.

^bThe pH relationship to flow has not been clearly established.

Source: U.S. Water Resources Council, "Coal Liquefaction Demonstration Plant near Morgantown, W. Va., Water Assessment Report," *Fed. Regist.* 45(164): 55994-56003 (August 21, 1980), modified from Table 3.

Section 208 of the Clean Water Act (Doug Steele, W. Va. Department of Natural Resources, telephone conversation, Nov. 6, 1980, and Ann Cardinal, Southwest Pennsylvania Regional Planning Commission, telephone conversation, Oct. 10, 1980). These efforts may allow continuation of the past trend toward improved water quality in the basin.

Baseline monitoring studies were conducted to characterize the water quality of the Monongahela River and the onsite and near-site streams. Three sampling stations were established along the reaches of the Monongahela in close proximity to the proposed plant (Fig. 3.4). The upstream station, M-1, was located at the Star City bridge (Mile-Point 98.0); the intermediate station, M-2, at the proposed plant's water intake (Mile-Point 93.0); and the downstream station, M-3, on the Pennsylvania border near the confluence of Crooked Run (Mile-Point 91.5). Crooked Run was sampled at two locations: at C-1, within the proposed plant's boundary upstream from the confluence with the unnamed tributary, and at C-2, downstream from tributary inflow close to the confluence with the Monongahela. One site was chosen along each representative stretch of the unnamed tributary to Crooked Run (T-1) and Crafts Run (K-1). Robinson Run was also sampled at only one station (R-1) located near the confluence with the river. Stations were sampled on a quarterly basis during 1978 and 1979 (ER, Vol. 1, Sect. 7.3).

Water quality data for the Monongahela River from the West Virginia Division of Water Resources (1975 through 1978) and from the baseline monitoring program (1978 and 1979) are expressed as ranges in the concentrations of the different parameters in Table 3.5. The data collected at station M-1 during baseline monitoring agree with data supplied by the West Virginia Division of Water Resources for the same river location. Based on recent historical data and site-specific observations, the Monongahela River from Mile-Point 98.0 to 91.5 can be characterized as water with low alkalinity, high nutrient levels, pH values ranging on both sides of neutrality, and levels of dissolved oxygen adequate to support aquatic life. Recent sampling of this reach of the river (Table 3.5) indicated that the range of pH values (5.6 to 8.0) was higher than the range (3.3 to 6.7) recorded from 1960 to 1966 at Mile-Point 96.5,²³ suggesting that acid mine pollution is decreasing. Vertical profile measurements made during baseline monitoring showed only minor tendencies toward stratification in the river. Barge traffic may contribute to mixing in the river, which was relatively shallow (about 8 m deep at the channel's center) in the reaches investigated (ER, Vol. 1, Sect. 7.4.1).

Concentrations of individual polynuclear aromatic (PNA) compounds in river samples collected during 1978 and 1979 ranged from 0.0 to 86.0 parts per trillion (ng/liter). These results are similar to those of other investigators who reported concentrations of individual PNA compounds ranging from 19.1 to 408.3 ng/liter in samples of Monongahela River water taken at Pittsburgh.³⁵ Because surface waters generally contain concentrations of individual PNA compounds averaging from 25 to 100 ng/liter,³⁶ the Monongahela River adjacent to the proposed site does not seem to be polluted with these compounds. However, the river water contained levels of iron, manganese, and occasionally mercury in excess of water quality criteria. Alkalinity and pH values were sometimes lower than recommended, whereas sulfate, phenol, and mercury levels occasionally exceeded criteria.

Water quality data for the Monongahela tributaries that may be affected by the proposed SRC-II facility are summarized in Table 3.6. Of the onsite or near-site streams sampled during baseline monitoring, Crooked Run and its tributary had the best water quality. Like the Monongahela River, they contained high levels of iron and manganese and levels of sulfate, phenol, mercury,

Table 3.5. Water quality data for reaches of the Monongahela River near the proposed SRC-II site^a

Values are in mg/liter unless otherwise shown

Parameter	Average	Number of samples	River location, mile-point			
			Star City Bridge 98.0 ^b Range	M-1, 98.0 ^c Range	M-2, 93.0 ^c Range	M-3, 91.5 ^c Range
Temperature, °C			1.0-25.0	2.0-25.5	2.1-12.8	2.3-26.5
pH, units			5.7-8.5	5.9-7.9	5.6-7.9	5.9-8.0
Dissolved oxygen	6.7	(57)	6.2-15.8	6.7-14.0	8.2-13.9	7.1-13.9
Acidity, as CaCO ₃	4.4	(56)	1-12	0.0-16.0	9.0	0.0-9.0
Alkalinity, as CaCO ₃	22.8	(57)	<1-44	3.0-42.0	3.0-36.0	2.0-33.0
Total dissolved solids	194	(56)	110-382	162-420	164-500	174-400
Total suspended solids	38	(57)	5-532	<1-81	1-61	2-61
Biological oxygen demand, 5 day	0.9	(51)	0.1-3.6	<1.0-<5.0	<1.0	<1.0-<5.0
Chemical oxygen demand	14	(4)	8-20	<5.0-11.0	8.0-10.0	6.0-8.0
Total organic carbon			<1-22	<1.0-5.0	1.0-4.0	1.0-5.0
Chloride			<1-21	6.0-17.0	6.0-17.0	7.0-17.0
Sulfate	108	(54)	49-260	74-276	78-222	75-225
Ammonia-nitrogen				<0.10-0.56	<0.10-0.67	<0.10-1.10
Kjeldahl-nitrogen			0.17-1.12	0.23-1.0	0.23-1.1	0.10-1.0
Nitrate-nitrogen				0.30-0.8	0.40-0.50	0.40-0.70
Nitrite-nitrogen				<0.01-<0.02	<0.01-0.02	<0.01-0.02
Total phosphorus			0.027-0.387			
Orthophosphate-phosphorus			0.005-0.303	<0.01-0.09	<0.01-0.06	<0.01-0.06
Thiocyanate, µg/liter				<100-<1000	<100-300	<100-<1000
Iron, µg/liter			40-24,000	350-4200	610-4300	570-3800
Manganese, µg/liter			12-720	300-470	320-500	300-420
Aluminum, µg/liter				300-3600	300-2300	300-2200
Arsenic, µg/liter				<10	<10	<10
Cadmium, µg/liter				<10	<10	<10
Chromium, total µg/liter				<30-<50	<30	<30-<50
Lead, µg/liter				<10-<50	<50	10-<50
Mercury, µg/liter				<0.1-<0.5	<0.1-<0.2	<0.1-<0.5
Nickel, µg/liter				<20-<50	<20	<20-<50
Selenium, µg/liter				<1-<10	<10	<1-<10
Zinc, µg/liter				100-150	100-140	<50-130
Benz[a]anthracene, ng/liter				<40		<40
Benzo[a]pyrene, ng/liter				<10-63		<10-17
Benzo[e]pyrene, ng/liter				<40-86		<40
Benz[g,h,i]perylene, ng/liter				<10		<10
Benzene-soluble fraction, mg/liter				0.14-0.70		0.04-2.3
Phenol, µg/liter	2.3		<1-38	<1-4.8		<1-2.5
Cyanide, µg/liter				1-4	2-3	1-3

^a Sampling sites are shown in Fig. 3.3.

^b Data were taken in 1973-78, by West Virginia Division of Water Resources.

^c Data were taken in 1978-79 as part of SRC-II baseline environmental survey.

Source: ER, vol. 1, Sect. 7.4.1; Exhibits 7-4, -5, -6, -7, -11, -12, and -13.

**Table 3.6. Water quality data for bodies of water on or near the proposed SRC-II site
(baseline monitoring program, 1978-1979)^a**

Values are in mg/liter unless otherwise shown

Parameter	Location				
	Robinson Run, R-1	Crafts Run, K-1	Crooked Run, C-1	Crooked Run, C-2	Tributary of Crooked Run, T-1
Temperature, °C	5.9-19.7	0.1-22.4	0.1-21.6	0.1-21.4	0.4-24.5
pH, units	2.8-3.3	3.6-4.9	6.9-7.7	7.1-8.6	6.9-8.0
Dissolved oxygen	7.5-11.5	6.7-15.0	7.5-12.9	6.9-15.8	7.0-16.0
Acidity, as CaCO ₃	477-2180	92-196	0.0-7.0	0.0-5.0	0.0-5.0
Alkalinity, as CaCO ₃	0.0	0.0-11.0	112-160	60-85	7-102
Total dissolved solids	3100-5300	1510-1700	475-1560	413-500	167-190
Total suspended solids	50-165	55-116	5-54	<1-16	<2-90
Biological oxygen demand, 5 d	<1.0-16.0	<1.0-<5.0	<1.0-<5.0	<1.0-<5.0	<1.0-<5.0
Chemical oxygen demand	8.0-26.0	8.0-18.0	6.0-10.0	5.0-<10.0	6.0-30.0
Total organic carbon	2.0-5.0	1.0-4.0	<1.0-4.0	<1.0-5.0	<1.0-6.0
Chloride	1.0-6.0	2.0-5.0	2.0-5.0	5.0-15.0	6.0-12.0
Sulfate	1650-3540	850-1140	220-286	170-288	50-93
Ammonia-nitrogen	0.62-1.6	<0.05-0.45	<0.05-0.27	<0.10-0.10	<0.10-0.13
Kjeldahl-nitrogen	1.1-2.5	0.20-1.30	0.30-0.80	0.10-0.65	<0.20-1.35
Nitrate-nitrogen	1.0-2.1	0.45-0.80	<0.05-0.3	0.20	0.10-0.30
Nitrite-nitrogen	<0.01-0.08	<0.01-0.01	<0.01-0.02	<0.01	<0.01-0.02
Orthophosphate- phosphorus	<0.01-0.24	<0.01	<0.01-0.02	<0.01-0.02	<0.01
Thiocyanate, µg/liter	<300-<1000	<300-<100	<300-<1000	<300-1400	<300-<1000
Iron	75-350	10-31	0.5-2.9	0.09-1.8	0.19-3.8
Manganese	2.7-7.1	9-79	0.6-2.3	0.05-1.4	0.02-0.25
Aluminum	66-170	25-34	0.3-1.7	0.4-1.5	0.2-2.2
Arsenic, µg-liter	<10-30	<10	<10	<10	<10
Cadmium, µg-liter	<10-10	<10	<10	<10	<10
Chromium, total µg/liter	<3-50	<30-<50	<30-50	<30-<50	<30-<50
Lead	<10-90	10-<50	10-<50	10-<50	10-<50
Mercury	<0.2-<0.5	<0.2-<0.5	0.2-<0.5	<0.2-<0.5	<0.2-<0.5
Nickel	50-2200	180-250	<20-<50	<20-<50	<20-<50
Selenium	<10	<10	<2-<10	4-<10	<2-<10
Zinc	1000-4200	350-480	20-150	20-<50	<20-150
Benz[a]anthracene, ppt	<40	<40	<40	<40	
Benzo[a]pyrene, ppt	<10-40	<10	<10	<10-19	<10
Benzo[b]pyrene, ppt	<40	40	<40		
Benzo[g,h,i]perylene, ppt	<10-11		<10	<10-13	
Benzene-soluble fraction, ppm	0.005-3.8	0.65	0.59-1.4	0.08-0.5	0.07
Phenol, µg/liter	0.3-2.5	2.8	4.3-4.7	1.0-5.7	2.8
Cyanide, µg/liter	<1-<10	<1-<10	1-<10	<1-<10	<1.0-<10

^a Sampling sites are shown in Fig. 3.3.

Source: ER, vol. 1, Sects. 7.4.2, 7.4.3, 7.4.4, and 7.4.5; Exhibits 7-16, -17, -18, -19, and -20.

and bicarbonate (alkalinity) that did not always meet water quality criteria (Table 3.7). The water quality of Robinson Run and its tributary, Crafts Run, differed markedly from that of the river or Crooked Run. These two streams were severely affected by acid mine drainage and showed the well-described symptoms (low pH values, high acidity, and elevated levels of dissolved solids, particularly sulfate, iron, manganese, and aluminum) characteristic of mined areas in Monongalia County.³⁴ Increased acidity mobilized some trace elements; arsenic, lead, and fluoride exceeded state criteria in samples collected on at least two occasions in Robinson Run (Table 3.7). Both streams, but particularly Robinson Run, showed nutrient enrichment from unknown sources. Determinations of individual PAH compounds in the Monongahela tributaries were generally less than 40 ppt (ER, Vol. 1, Sect. 7.4.1).

Table 3.7. Summary of water quality criteria that were not met in baseline monitoring (1978-1979) of the Monongahela River and bodies of water on or near the site

Location of sampling station	Chemical constituent	Percentage of samples in which criterion was not met ^a	Concentration or concentration range in which criterion was not met
Monongahela River; M-1, M-2, and M-3 combined	pH	27	5.6-5.9
	Alkalinity	55	2.0-18.0 mg/liter
	Sulfate	9	276 mg/liter
	Phenol	50	1.0-4.8 µg/liter
	Iron	91	0.45-4.3 mg/liter
	Manganese	100	0.30-0.50 mg/liter
	Mercury	11 ^b	0.2 µg/liter
Robinson Run, R-1	pH	100	2.8-3.3
	Alkalinity	100	0.0 mg/liter
	Total dissolved solids	100	3100-5310 mg/liter
	Sulfate	100	1650-3540 mg/liter
	Fluoride	50	1.0, 1.7 mg/liter
	Phenol	50	2.5 µg/liter
	Arsenic	75	0.02-0.03 mg/liter
	Cadmium	75 ^b	0.01 mg/liter
	Iron	100	75.0-350.0 mg/liter
	Lead	50	0.08, 0.09 mg/liter
	Manganese	100	2.7-7.1 mg/liter
	pH	100	3.6-4.9
Crafts Run, K-1	Alkalinity	100	0.0-11.0 Mg/liter
	Total dissolved solids	100	1510-1700 mg/liter
	Sulfate	100	850-1140 mg/liter
	Phenol	100 ^c	2.8 µg/liter
	Cadmium	50 ^b	0.01 mg/liter
	Iron	100	10.0-31.0 mg/liter
	Manganese	100	8.6-79.0 mg/liter
	Alkalinity	8	7.0 mg/liter
Crooked Run and tributary; C-1, C-2, and T-1 combined	Total dissolved solids	8	1560 mg/liter
	Sulfate	42	255-288 mg/liter
	Phenol	78	1.0-5.7 µg/liter
	Chromium, total	8	0.05 mg/liter
	Iron	67	0.44-3.8 mg/liter
	Manganese	92	0.05-2.3 mg/liter
	Mercury	8 ^b	0.2 µg/liter

^aSee Table 3.2 for specific water quality criteria.

^bDetection limits for cadmium and mercury were too insensitive to evaluate the results in terms of the most stringent U.S. Environmental Protection Agency criteria; therefore, the criteria of 0.010 mg/liter and 0.2 µg/liter were used for cadmium and mercury respectively.

^cChemical data provided for only one quarter (see EAR, Sect. 7.4.3, Exhibit 7-17).

Source: EAR, Sects. 7.4.1, 7.4.2, 7.4.3, 7.4.4, and 7.4.5; Exhibits 7-11, -12, -13, -16, -17, -18, -19, and -20.

On one occasion, sediment samples were taken from river stations R-1 and C-2 during baseline monitoring. Results of chemical analyses indicated that iron, sulfate, fluoride, barium, and manganese were the dominant inorganic components of samples collected at all stations. Concentrations of most trace elements and PNA compounds in the sediment samples were generally within ranges reported in the literature for other urban areas (ER, Vol. 1, Sect. 7.4.6).

Representative onsite ponds were investigated during baseline monitoring of aquatic biota.

In summary, the Monongahela River appears to be recovering from the impact of acid mine drainage. Although the river's current pH values range around neutrality and are higher than recorded previously, some tributaries such as Robinson Run are still severely polluted by acid loads. Presently, no abatement program to alleviate acid drainage from abandoned mines is being conducted on Robinson Run or Crafts Run.³⁷ In the future, mine drainage abatement programs, more stringent effluent limitations, and control of nonpoint source pollution may allow continued improvement in water quality, although high concentrations of total dissolved solids during low flows are likely to remain a problem.

Aquatic ecology

The aquatic environments that may be affected by the construction and operation of the proposed SRC-II facility are selected reaches of the Monongahela River, onsite or near-site tributary drainages, and several onsite ponds. A baseline monitoring program was conducted to supplement existing data and site-specific information (ER, Vol. 1, Sect. 8.3). River and tributary sampling stations (Fig. 3.3) corresponded to those selected for monitoring surface water quality. Three representative ponds located in the vicinity of Keener's Knob and the Fort Martin school were also studied.

Quantitative and qualitative surveys were undertaken to characterize the aquatic biota on or near the proposed site. Components of the aquatic flora and fauna and their functional role in the ecosystem are summarized in Table 3.8. Data generated by the baseline monitoring program are summarized in Tables F.1 and F.2. All organisms that were observed or collected in the vicinity of the site are typical of similar water bodies in West Virginia. The Monongahela River and the Crooked Run drainage contained a modest number of species and appeared to be moderately productive. Robinson Run and Crafts Run, polluted by acid mine drainage, did not support diverse aquatic life. The small farm ponds on the site did not appear to provide unique aquatic resources in this area. However, based on the benthos and macrophyte beds observed (ER, Tables 8.6 and 8.9), it is assumed that these ponds could support warmwater sport fish if stocked.

Table 3.8. Aquatic flora and fauna collected or observed in the baseline monitoring program

Group of aquatic organisms	Definition of group (if needed)	Functional role in ecosystem
Phytoplankton	Plant constituents of the free-water community; consists of simple, microscopic plants capable of photosynthesis (algae)	Primary producers; food source for zooplankton
Periphytic algae	Algal portion of community that grow on or become attached to submerged substrates	Primary producers; food source for grazing animals
Macrophytes	Rooted, macroscopic aquatic plants	Primary producers; provide habitat for other aquatic organisms and stability to shorelines or stream banks
Zooplankton	Animal constituents of the free-water community; consists of simple, often microscopic invertebrates	Food sources for larger animals
Benthic macroinvertebrates Ichthyoplankton	Bottom-dwelling, larger invertebrates Larval forms of fish	Important food sources for fish Developmental stages of important consumers
Adult fish		Often the top consumers in food chains

Because fish often represent the top consumers in food chains, aquatic ecological studies have focused attention on them. In the Monongahela River Basin, acid mine drainage has most dramatically affected the base fishery resources, causing losses in about 2100 km of stream and a surface area of 14.1 km² of impounded water.³⁴ However, efforts to control and alleviate acid pollution have improved water quality sufficiently to support a sport fishery. The West Virginia Department of Natural Resources (DNR) sampled fish in pools at the Morgantown and Hildebrand Locks in September 1978. Bluntnose minnows and emerald shiners constituted 59% and 28%, respectively, of the fish collected. Nonetheless, fair numbers of sport fish were found, including green sunfish, pumpkinseed, largemouth bass, black crappie, muskellunge, white catfish, channel catfish, yellow bullhead, brown bullhead, and walleye (Table F.3). Some of these fish had not been observed in the Monongahela River in 50 years.³⁸

In the baseline monitoring program conducted at Station M-2, pumpkinseed and bluntnose minnow dominated the catch, constituting 33% and 44%, respectively, of the catch.

As in DNR's sampling, sport fish were caught, including green sunfish, bluegill, largemouth bass, carp, and yellow bullhead (Table F.3). Nests of sunfish were observed in shallow weeded areas along the shore of the river. Carp were also observed, possibly spawning, in the river. During October 1980, baseline sampling in the pool at lock and dam number 8 (4 km below the site) revealed the presence of muskellunge and walleye (Art Griffiths, Environmental Sciences Division, Stearns-Roger, Inc., telephone conversation with R. D. Roop, ORNL, November 7, 1980).

The tributary drainage of Crooked Run, also sampled for fish during baseline monitoring, contained predominantly river chub (Table F.4). Tributary streams often provide important spawning habitat for river fish. Of the drainages on or near the proposed SRC-II site, Crooked Run has the most attractive aquatic habitat. Spawning activity was observed for white sucker and Johnny darter upstream from Station C-2. Although Crooked Run may have some localized importance, it is not considered to be particularly valuable to the fishery resources of the river basin as a whole.³⁹

Ichthyoplankton (larval fish) were sampled in the Monongahela at Station M-2 between April 11 and August 14, 1979, at roughly 10-d intervals. Samples were taken during daytime and nighttime and from both the surface and the bottom. A total of 161 larvae were caught at Station M-2; carp, unidentified minnows, and sunfish larvae constituted 27%, 25%, and 24%, respectively, of the total (Table F.5). Fish larvae were present between May 14 and August 14, but the greatest densities were observed during night sampling in late June and early July (Table F.6). On June 14, carp and minnow larvae accounted for the high density; sunfish and minnow larvae accounted for the high density observed July 18. The sampling did not reveal any significant difference in larval densities between the river's surface and bottom.

Benthos that were sampled in the Monongahela consisted primarily of midge larvae (chironomids) and tubificid worms (ER, Exhibit 8-7). Both groups are pollution-tolerant and characteristic of muddy substrate.

In summary, the Monongahela River has mildly to moderately polluted water quality and limited diversity of habitat due to the shape of the channel and heavy barge traffic. Nevertheless, some sport fish are returning to the river as water quality improves. Fish in the river are probably depending on relatively undisturbed shoreline and unpolluted creeks for spawning habitat. The shoreline at the proposed SRC-II site and Crooked Run are both examples of such habitat.

Endangered species

No aquatic organisms currently included on the U.S. Fish and Wildlife Service list of endangered and threatened species³¹ were collected or observed during baseline monitoring of the Monongahela River, tributary drainages, or onsite ponds. Supplementary information on the fishery resources of the Monongahela River supplied by the West Virginia Department of Natural Resources did not contain any species considered endangered or threatened. (Also see Appendix F.)

3.2.3 Air

This section presents information about the proposed site in the areas of meteorology, air quality, and noise.

3.2.3.1 Meteorology and air quality

The climate at the proposed site is continental, with cool winters, warm and humid summers, and mild transitional seasons.

Typical summer maximum temperatures are near 30°C (86°F) with summer morning relative humidity near 90% and afternoon relative humidity slightly under 60%. Winter minimum temperatures average about -6°C (20°F). Relative humidity is typically lower in the winter, averaging about 85% in the morning and about 65% in the afternoon.

Annual precipitation is about 100 cm (40 in.) per year, with precipitation in excess of 0.03 cm (0.01 in.) occurring about 150 d per year. Precipitation is fairly uniform throughout the year; spring and summer are slightly wetter than the other seasons. Snowfall averages 125 cm (50 in.) per year and can be expected from October through April; January is the most active month. The area is dominated by clouds; about 200 d per year record cloudy weather, 110 d per year are partly cloudy, and 55 d per year are clear.

The prevailing winds are from the southwest. Winds measured at an elevation of 10 m (33 ft) average 2.4 m/s (5 mph), and the atmosphere is stable 42% of the measured hours (Table 3.9). Wind speeds measured at the monitoring location (Table 3.10) were less than 4.45 m/s (10 mph) 90% of the time. Wind speeds are highest in winter and lowest in the late fall and spring. Temperature inversions, indicative of a stable atmosphere and poor pollutant dispersion conditions, occurred 41% of the days for an average of 10 h/d, primarily during the nighttime hours (ER, Vol. 2).

Table 3.9. Wind roses (10-m level)^a

Direction	Wind speed class				Total (%)
	1 (2.2 m/s)	2 (4.5 m/s)	3 (6.7 m/s)	4 (>6.7 m/s)	
N	3.5	1.7	0.0	0.0	5.2
NNE	3.4	1.1	0.0	0.0	4.5
NE	2.1	0.5	0.0	0.0	2.6
ENE	1.1	0.2	0.0	0.0	1.4
E	1.4	0.4	0.0	0.0	1.8
ESE	1.8	1.5	0.2	0.0	3.5
SE	1.2	1.4	0.4	0.1	3.1
SSE	0.9	0.3	0.1	0.0	1.3
S	2.5	2.3	0.4	0.0	5.2
SSW	4.5	6.6	2.1	0.3	13.4
SW	3.9	5.0	1.7	0.6	11.3
WSW	3.1	3.8	1.5	0.3	8.7
W	2.1	2.7	1.1	0.4	6.3
WNW	1.6	1.3	0.3	0.0	3.1
NW	1.3	0.7	0.1	0.0	2.2
NNW	2.3	0.7	0.0	0.0	3.0
Total, %	36.8	30.2	7.9	1.9	76.8 ^a

^aWind was calm 23.2% of the time. A wind speed less than or equal to 0.89 m/s is considered calm.

Table 3.10. Wind speed frequencies

Range (m/s)	Frequency (h)	Accumulation (%)
0.0 - 0.89	1930.0	22.8
0.90 - 1.78	2167.0	48.3
1.79 - 2.67	1686.0	68.2
2.68 - 3.56	1060.0	80.7
3.57 - 4.45	804.0	90.2
4.46 - 5.34	397.0	94.8
5.35 - 6.23	193.0	97.1
6.24 - 7.12	130.0	98.6
7.13 - 8.01	48.0	99.2
8.02 - 8.90	25.0	99.5
8.91 - 9.79	13.0	99.7
9.80 - 10.68	2.0	99.7
10.69 - 11.57	1.0	99.7
11.58 - 12.46	1.0	99.7
12.47 - 13.35	2.0	99.7
13.36 - 14.24	0.0	99.7
14.25 - 15.13	0.0	99.7
15.14 - 16.02	0.0	99.7
16.03 - 16.91	0.0	99.7
16.92 - 17.80	0.0	99.7
17.81 - 18.69	0.0	99.7
18.70 - 19.58	0.0	99.7
19.59 - 20.47	0.0	99.7
20.48 - 21.36	0.0	99.7
21.37 - 22.25	0.0	99.7
22.26 - Above	23.0	100.0

Total occurrences = 8482.0

The proposed site is located in Air Quality Control Region (AQCR) 235, the North Central West Virginia AQCR. Air quality data collected at the site monitoring location are summarized in Table 3.11. These data demonstrate compliance with applicable air quality standards for criteria pollutants. Oxides of sulfur, measured as sulfur dioxide, were measured at no more than 65% of standard. Oxides of nitrogen were measured at the site; the measured mean concentration was 32% of the applicable standard. The maximum recorded 1-h carbon monoxide concentration was 7% of the applicable standard; the maximum 8-h concentration was 15% of that standard. Ozone concentrations varied widely; mean hourly concentrations were 5% of the standard, but the second maximum hourly concentration approached 76% of the standard. Total suspended particulates (TSP) were measured, and the data are presented in Table 3.11. Standards for TSP are being exceeded⁴⁰ in some urban areas of AQCR 235. At the rural location of the proposed SRC-II site, however, measured concentrations of TSP were all within the applicable standards. A listing of the air quality data measured at the monitoring site can be found in the ER, Vol. 1, Sect. 3.

Near the proposed site is the Fort Martin Power Plant of the Monongahela Power Company. This plant consists of two 560-MW-rated-capacity units which burn coal delivered by barge on the Monongahela River. The coal is a mix of low sulfur (0.5%) coal from Kentucky and higher sulfur coal (3.6%) from around Morgantown, West Virginia, blended to result in about 2% sulfur coal in firing. The plant presently has electrostatic precipitators for the removal of particulates and has currently under construction \$37 million in additional electrostatic precipitators to improve particulate control. Each 560 MW unit has a tall stack 510-ft high which locally reduces the cumulative impact on air quality.

Prevention of Significant Deterioration (PSD) increments at the proposed site are as yet completely available, and calculations predict that the SRC-II plant and other proposed PSD sources

Table 3.11. Summary of air quality data measured at the proposed site

Values are in $\mu\text{g}/\text{m}^3$ unless otherwise shown

Pollutant	Maximum concentration ($\mu\text{g}/\text{m}^3$)	Second highest concentration ($\mu\text{g}/\text{m}^3$)	Applicable standard
Sulfur dioxide			
3 h	705	617	1,300 ^a
24 h	239	174	365 ^a
Annual average	44		80
Nitrogen dioxide			
1 h	384		None
24 h	182		None
Annual average	32		100
Carbon monoxide			
1 h	2,722	2,202	40,000 ^a
8 h	1,522	1,288	10,000 ^a
Ozone, ppm			
1 h	0.115	0.091	0.120 ^a
Total suspended particulates			
24 h	142	114	260 ^a
Annual average	42		75

^aStandard applies to the second highest concentration in a calendar year.Source: ER, Vol. 2; "National Primary and Secondary Ambient Air Quality Standards," *Fed. Regist.* 36 (84): 8187 (1971).

in the area will not exceed these limitations. The commercial plant expansion is also predicted to not consume all available increments (see Table 4.11).

Existing sources near the proposed site, including the Fort Martin Power Plant and the commercial and industrial emissions from the Morgantown area, are affecting the air quality of the area. The monitoring data reflect the emissions from these existing sources and were collected at the point of predicted maximum cumulative impact of all existing sources and the proposed SRC-II facility.

3.2.3.2 Noise

Ambient noise levels were measured throughout the area surrounding the proposed site. The objective of the noise surveys was to provide comprehensive documentation of the existing baseline noise conditions at the plant site. Monitoring points included the Fort Martin and Maidsville areas near the site. Figure 3.5 shows the noise monitoring locations. Single-event noise monitoring was conducted at locations 1 through 37 for both winter (February 15 through 20, 1979) and summer (June 6 through 16, 1979) survey periods. Continuous 24-h noise measurements were made at locations 1 through 4 for both winter and summer survey periods. During the summer period, additional single-event noise monitoring was conducted at locations 38 through 55, and additional 24-h monitoring was conducted at locations 5 through 7. Detailed sound measurement data, along with methods of measurement, are included in the ER, Vol. 1, Sect. 4.

The ambient day-night equivalent noise level (L_{dn}) measurements are comparable with levels typically associated with rural areas during the winter measurement period and are comparable with noise levels generated in an urban residential area containing a major transportation artery during the summer measurement period. Figure 3.6 gives examples of typical outdoor day-night average noise levels for various locations.

Noise levels were dominated by the continuous background noise from the Fort Martin Power Plant. The magnitude of both residual and intrusive noises increased during the summer high activity period.

3.2.4 Economic, social, and cultural features

This section identifies and outlines key socioeconomic characteristics of the proposed Fort Martin site and surrounding area, including demographics, economic base, labor force characteristics, income, housing, public finance and services, transportation, and archaeological features. (This analysis is based on information contained in a detailed socioeconomic study by CONSAD Research Corporation and a supplemental analysis by HDR sciences for the SRC- II project. The complete CONSAD report is contained in the ER, vol. 2.)

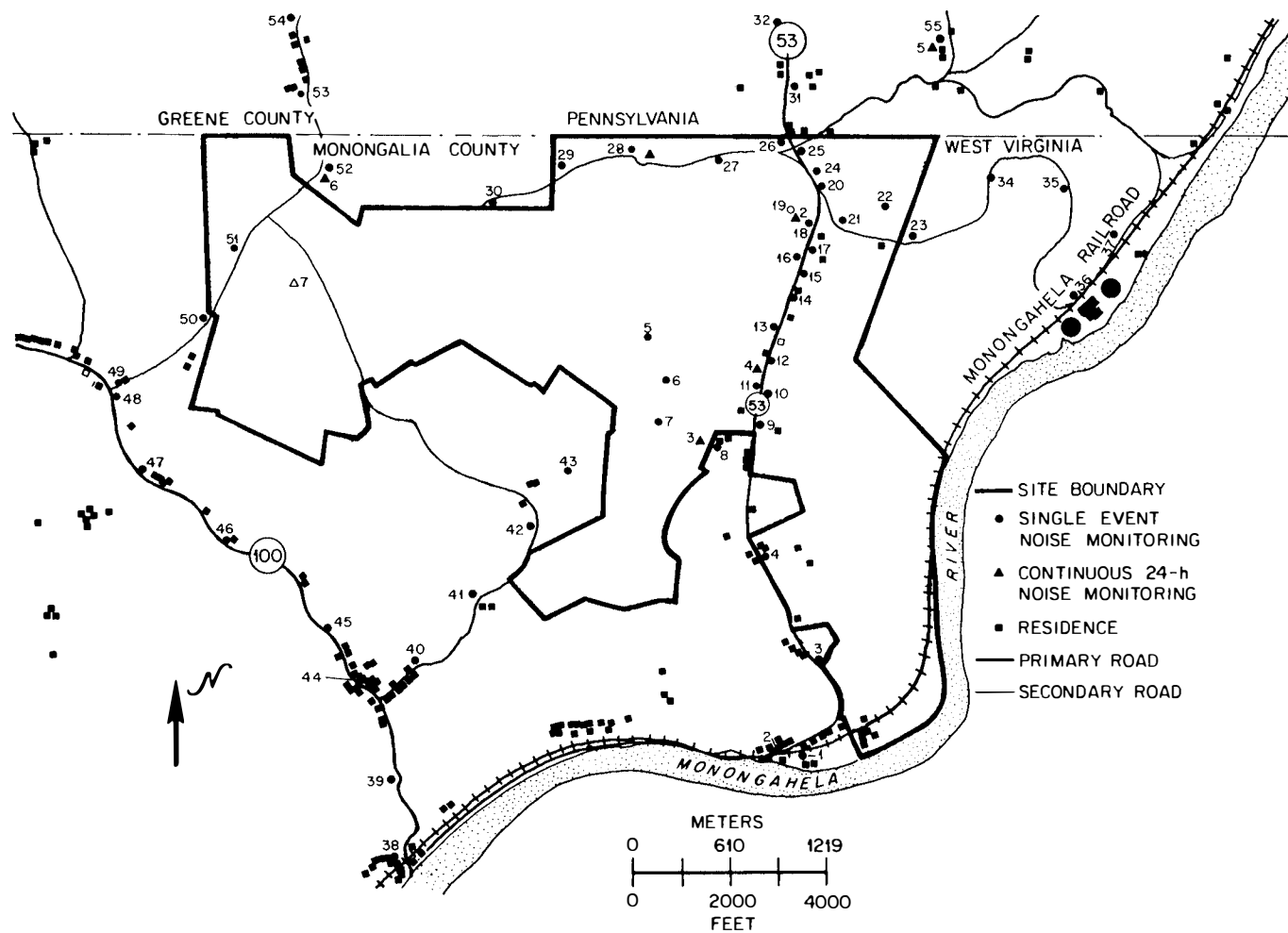


Fig. 3.5. Individual sound level readings in the vicinity of the proposed site.

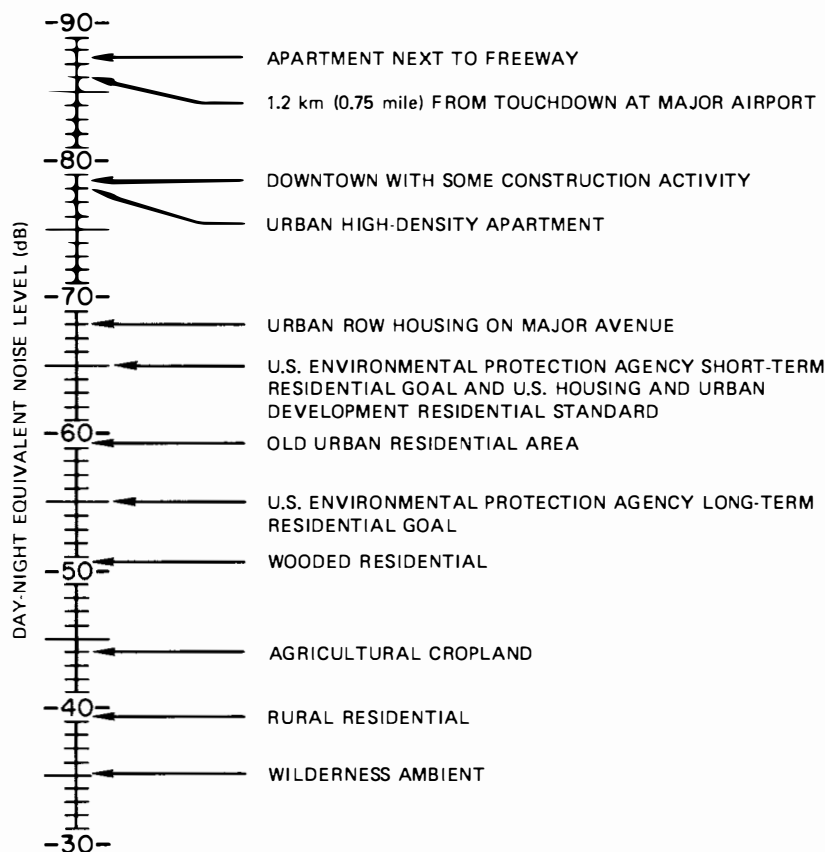


Fig. 3.6. Examples of outdoor day-night average sound levels in db measured at various locations. Source: "Protective Noise Levels - Condensed Version of EPA Levels Document," EPA 550/9-79-100, November 1978, U.S. Environmental Protection Agency, Washington, D.C. 20460.

The principal impact study area includes Marion, Monongalia, and Preston counties in West Virginia and Fayette and Greene counties in Pennsylvania (see Fig. 3.7). This area has been selected because it encompasses the expected residences of the large majority of individuals who will be employed at the SRC-II facility during its construction and operation. It also includes all communities that are anticipated to experience any measurable economic impact for the facility or its workers. Principal population centers include Waynesburg and Uniontown in Pennsylvania and Morgantown and Fairmont in West Virginia. For work-force analysis purposes, this area is divided into two commuting zones (60 and 90 min). Because most of the socioeconomic impacts are projected to occur in Monongalia County, this county receives the primary attention in the socioeconomic sections of this statement.

3.2.4.1 Demographics

The five-county impact area as a whole experienced a rapid decline in population beginning in 1950 (Table 3.12). All five counties in the impact region, however, have experienced population growth since 1970. The most substantial growth has occurred in Monongalia County, which is the only county in the impact region whose 1980 population exceeded its 1950 population. The declining population of the five-county area has been caused primarily by declining coal demand. Population growth is anticipated for all five counties over the next twenty years [see Table 3.12 and Appendix V (Table V.1 and Fig. V.1)]. The study region population of 370,591 in preliminary 1980 census figures should surpass 400,000 by the year 2000, if not by 1995. However, only Monongalia and Greene counties are expected to be markedly more populous in the year

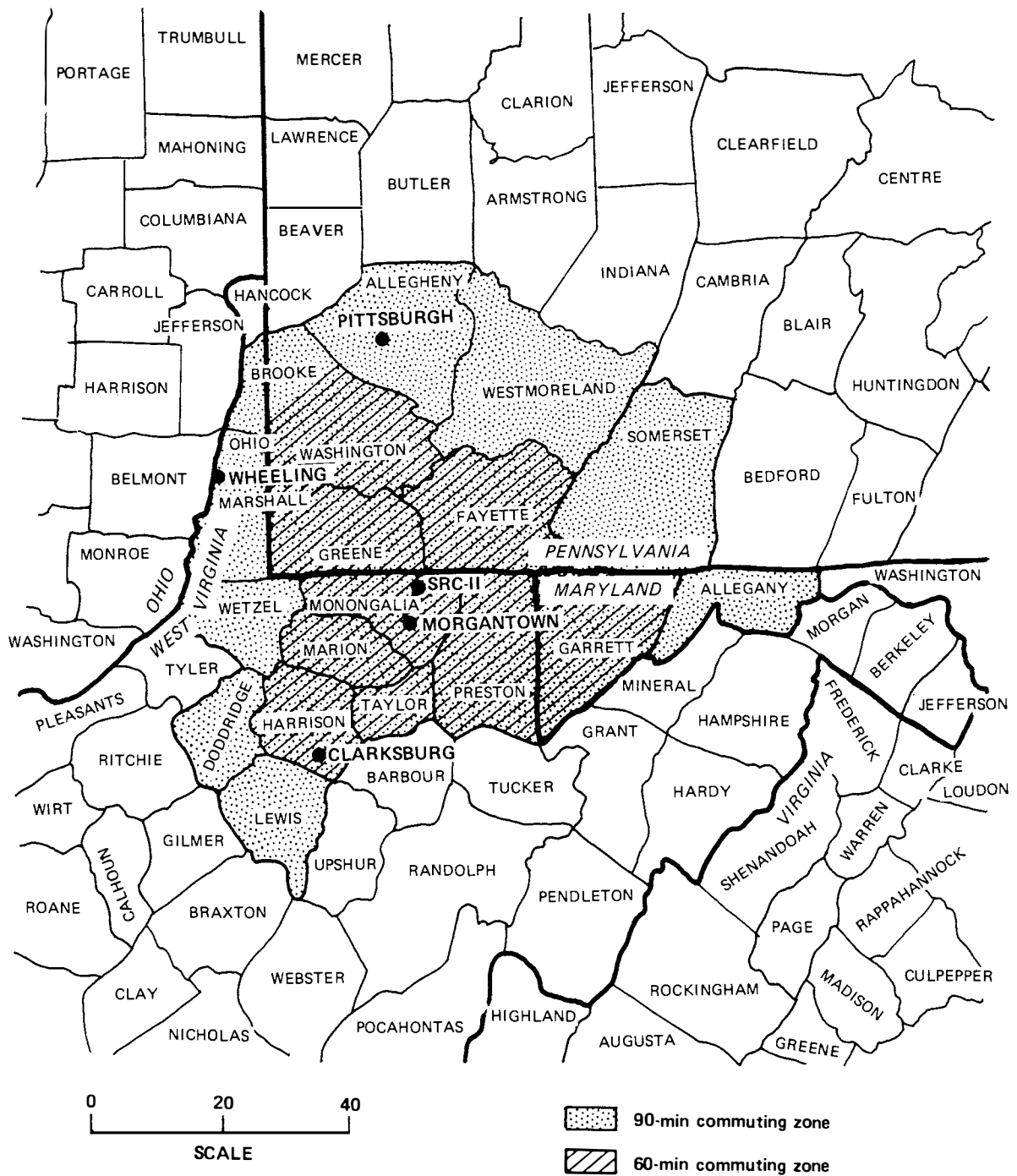


Fig. 3.7. Commuting zones within 60- and 90-min areas.

2000 than they were in 1950. Monongalia County is expected to continue to constitute over 20% of the region's population by the year 2000. Household size in each county is expected to decline throughout the remainder of the century.

Table 3.12. Comparison of population forecasts for the year 2000 with populations in 1950, study-region counties

3.2.4.2 Economic base

Regional economy

The five-county SRC-II impact area, like much of the rest of central and southern Appalachia, has been highly dependent on coal mining throughout much of its history. Four of the five counties have been major coal-producing areas. The fifth, Preston County, has always been an important agricultural area. All five counties were affected, directly or indirectly, by the technological displacement of coal mine labor after 1950. As a consequence of this deterioration of the historic economic base, population and labor force declined in the area after 1950.

County	Population			
	1950	1970	1980	2000
Fayette	189,894	154,667	158,944	165,300
Greene	45,394	36,090	40,414	55,100
Marion	71,521	61,356	65,525	73,100
Monongalia	60,797	63,714	75,240	87,900
Preston	31,399	25,455	30,468	33,600
Total	399,005	341,282	370,591	415,000

Sources: ER, Vol. 2, Baseline Socioeconomic Survey, Table 2-3, and U.S. Bureau of the Census, December 1980.

Monongalia County, unlike the remainder of the area, experienced some gains in its economic base in the 1960s as enrollment increased at West Virginia University. After 1963, this trend in the county was reinforced by an upturn in coal production and employment. The economic decline continued in the other counties until 1970.

Casual observation of the rural appearance of the five-county area might suggest that the SRC-II area is "industrially underdeveloped." Tables 3.13 and 3.14 show that this is not the case. The area as a whole has an above-average proportion of workers in occupations associated with industrialization, but there is no strongly dominant manufacturing industry. Instead, the industrial base is quite diversified, with the largest number of manufacturing workers employed in the summary category of "all other" manufacturing (Table 3.14).

Table 3.13. Occupational distribution of employed workers, 1970

Occupation	County					Area total	Percentage of total area population
	Marion	Monongalia	Preston	Fayette	Greene		
Professional, technical, and kindred workers	1,974	4,794	671	4,569	1,114	13,122	12.2
Managers and administrators (nonfarm)	1,400	1,706	427	2,843	707	7,083	6.6
Sales workers	1,223	1,087	253	2,807	540	5,910	5.5
Clerical and kindred workers	2,695	3,235	733	5,422	1,095	13,180	12.3
Craftsmen, foremen, and kindred workers	4,016	2,945	1,384	8,469	2,181	18,995	17.7
Operatives (except transportation)	5,076	2,802	1,459	9,635	2,134	21,736	20.2
Transportation equipment operatives	1,002	840	564	2,811	525	5,742	5.3
Laborers (nonfarm)	1,186	1,103	730	3,574	693	7,286	6.8
Farmers and farm managers	35	68	166	253	193	715	0.7
Farm foremen and laborers	28	87	115	292	150	672	0.6
Service workers (nonhousehold)	2,031	2,876	951	4,847	1,081	11,786	11.0
Private household workers	463	398	82	628	165	1,170	1.1
Total	21,129	21,941	7,535	46,150	10,578	107,397	100.0

Source: ER, Vol. 2, Table 2-7, p. 2-67.

Table 3.14. Nonagricultural employment, private sector, by industry group, 1976

Industry group	County					SRC-II area	Percentage of total area employment
	Marion	Monongalia	Preston	Fayette	Greene		
Mining	2,930	3,975	674	1,627	3,959	13,165	17.5
Contract construction	941	694	170	969	64	2,838	3.8
Apparel and other textiles				1,519		1,519	2.0
Lumber and wood products			236	435	93	764	1.0
Printing and publishing	216			292		508	0.7
Stone, clay, and glass		827				827	1.1
Primary metals	516			293		809	1.1
Fabricated metals				1,166		1,166	1.5
Machinery (except electric)	1,300	346		204		1,850	2.5
All other manufacturing	3,633	2,025	789	3,904 ^a	655 ^b	11,026	14.7
Transportation and public utilities	930	736	330	1,907	180	4,083	5.4
Wholesale trade	699	667	336	2,265	237	4,174	5.5
Retail trade	3,710	3,624	679	8,353	1,250	17,616	23.4
Finance, insurance, and real estate	689	563	111	1,288	224	2,875	3.8
Services	2,759	3,359	405	4,114	1,184	11,821	15.7
NEC	36 ^c	36	15	102	20	209	0.3
Total	18,329	16,852	3,745	28,438	7,866	75,230	100.0

^aIncludes 243 in food and kindred products.

^bIncludes 51 in food and kindred products.

^cIncludes 18 in agricultural services.

Source: ER, Vol. 2, Table 2-8, p. 2-69.

Industrial activity and employment

The five-county region had become quite industrialized by 1970 with more than 20% of its labor force employed as operatives and almost 18% as craftsmen, foremen, and related workers. Farmers and farm workers accounted for only slightly more than 1% of the employed labor compared with a national average of 4.4%. More than 12% were professional, technical and related workers, largely because of the influence of West Virginia University in Morgantown. In Monongalia County more than 21% were professional and technical workers, which accounts for over one-third of the area total in those categories of employment. Nevertheless, the region is still heavily dependent on coal mining, with more than 17% of all nonfarm workers in the private sector employed in mining.

More recent (1976) data are presented in Table 3.14 and indicate the industrial distribution of nonagricultural workers in the private sector. The heavy dependence of the region on coal mining, despite the moderately depressed status of the industry in 1975, is evident from data in this table. The only sectors to employ more were retail trade (23.4%) and the wide variety of activities grouped under the heading of services (15.7%). By contrast, mining employed only 1.2% of all workers in the private sector nationally, and trade and services accounted for 27 and 22% respectively.

Construction labor employment in the SRC-II area

The existing regional supply of labor according to specific types of skills necessary for SRC-II construction and operation are presented in Table 3.15. Availability of these skills is categorized by distance/commuting time between the workers' residences and the SRC-II site. The 60-min commuting region defines the maximum region for daily commuters, whereas the 90-min commuting region delineates the maximum weekly commuting zone.

Economic conditions in the SRC-II area

One of the indicators most often used to measure the economic vitality of an area is the rate of unemployment. Unemployment data for the SRC-II area for the past 20 years are shown in Table 3.16.

Unemployment rates in 1960 were at depression levels throughout the SRC-II area. All of these counties had been affected by the large-scale layoffs in coal. Despite out-migration during the 1960s, unemployment continued to range from a low of 10% in Preston County to more than 17% in Fayette. The U.S. average that year was 5.5%.

Table 3.15. Construction labor employment by craft and geographic zone, 1979

Craft	Zone	
	90 min (75 mile)	60 min (50 mile)
Insulators	435	88
Boilermakers	207	42
Carpenters	8068	1646
Concrete finishers	1782	364
Electricians	3236	660
Ironworkers	1029	210
Laborers	4450	908
Millwrights	207	42
Operating engineers	3108	634
Painters	1644	335
Pipe fitters/plumbers	2886	588
Teamsters	1400	286

Source: Oak Ridge Associated Universities, *Construction Labor Assessment for SRC-II at Phase Zero*, 1980, Tables 1-4 and 1-5, pp. 17, 19.

Table 3.16. Unemployment rates, 1960-1980

Labor market area and county	Unemployment rates (%)				
	1960	1965	1970	1975	1980
Fairmont					
Marion County	12.2	5.0	3.6	7.1	7.6
Kingwood					
Preston County	10.0	7.4	5.1	10.2	6.6
Morgantown					
Monongalia County	12.7	5.4	4.1	3.7	4.3
Uniontown-Connelsville					
Fayette County	17.1	6.6	7.2	9.1	12.3
Waynesburg					
Greene County	12.2	7.2	5.0	6.8	9.1
United States Av.	5.5	4.5	4.9	8.5	7.6

Sources: ER, Vol. 2, Table 2-11 and the West Virginia and Pennsylvania Departments of Employment Security, Dec. 3, 1980.

Area employment improved considerably by 1965, but the lowest rate (5.4% in Monongalia County) was still above the national average of 4.5%. By 1975, Fayette and Preston counties were the only ones to report an unemployment rate significantly higher than the national average. Rates in Marion, Monongalia, and Greene counties had dropped considerably below the national average.

Although 1975 was a year of national recession, it essentially bypassed Monongalia County, whose unemployment rate continued to decline to 3.7% compared with the U.S. average of 8.5%. Counties in the SRC-II impact region hardest hit by the recession were Marion and Preston where unemployment doubled the 1970 level; in Marion County, unemployment levels were still below national rates. Unemployment rose only moderately in Greene and Fayette counties.

Another national recession developed in 1980. All counties in the impact region, with the exception of Preston, reported unemployment rates above their 1975 rates. Only Greene (9.1%) and Fayette (12.3%) counties, however, reported rates above the national average (7.6%).

Area economic infrastructure: multipliers

Multipliers are a convenient way of measuring the total economic effect from the introduction of projects like SRC-II. A multiplier measures the total growth in an economic characteristic (such as employment, income, or expenditure) that results from an initial change in new capital

investment in an area. The most complete accounting of multiplier effects from changes in demand for products and labor for the SRC-II project can be made with the aid of input-output tables. Such tables measure the exchange in inputs among industry sectors resulting from the project investment.

Initial multipliers for industrial sectors in the SRC-II area were developed with the aid of the Bureau of Economic Analysis (BEA) Regional Industrial Multiplier System (RIMS) and a West Virginia input-output table. The RIMS multipliers were developed for multicounty economic areas, one of which includes the SRC-II area. The RIMS system was used to adjust West Virginia multipliers to fit economic conditions in the SRC-II area. The estimates of SRC-II area employment and income multipliers are displayed in Table 3.17.

Table 3.17. Employment and income multipliers by sector

Sector	Employment		Income	
	W. Va	SRC-II area	W. Va	SRC-II area
Mining	1.83	1.76	1.69	1.50
Apparel and textiles	1.19	1.19	1.37	1.37
Lumber and wood products	1.59	1.43	2.11	2.11
Fabricated metals	1.41	1.13	1.55	1.34
All other manufacturing	1.43	1.19	1.69	1.66
Retail trade	1.43	1.07	1.46	1.12
Contract construction	2.67	2.04	2.17	1.53
Petroleum and coal products				
Based on BEA 064	4.1	2.38	2.6	1.51
Based on BEA 066	4.1	2.76	2.6	1.18

Source: ER, Vol. 2, Table 2-14, 2-93.

Multipliers in Table 3.17 include economic effects from (1) direct purchases of materials and labor, (2) indirect effects occurring in other industries that supply inputs to SRC-II material industries, and (3) induced effects from increased consumption caused by expenditures of new income created in the materials and labor purchasing process. These multipliers include households as a sector that supplies inputs (labor) to and demands inputs (goods and services) from all other industrial sectors. Thus these multipliers can be regarded as the final outcome of all economic interactions that follow an initial injection of new investment funds into an area.

The construction and petroleum- and coal-products industries are two of the most important sectors for the SRC-II project. The employment multiplier of 2.04 for contract construction (Table 3.17) in the SRC-II area suggests that each new construction job on the project will produce an additional job in the commercial sector among firms supplying goods or services to the SRC-II facility or its workers. The income multiplier of 1.53 suggests that each dollar of initial income in contract construction will create 50% more income through secondary effects.

The multipliers are based on average economic conditions that exist in the economy in the absence of SRC-II. If the SRC-II project changes the input-output responses in local industries, some alteration in the multiplier level may occur. For example, boomtown conditions produce secondary employment and income responses in some sectors that may temporarily exceed typical input-output responses that occur in more normal settings. This situation occurs most frequently in industrial sectors that supply goods and services to the household sector in communities that are far below average with respect to the level of economic infrastructure development.

In materials supply industries, inputs are imported if they cannot be supplied by the area economy. However, the direct supply of goods and services to the household sector cannot be imported from outside the impact areas. If the site area is deficient, expansion must take place to ensure that a certain quality of life will be met. Frequently, in boomtown counties temporary expansion is quite large; multipliers ranging from 4.5 to 7.0 have been calculated. In other areas, commuting opportunities and access to a larger area economic infrastructure results in multiplier responses that are considerably lower for the site county. A set of personal consumption expenditure multipliers for counties in the SRC-II area are displayed in Table 3.18. These multipliers are associated with the expenditures by the household sector and are appropriate for estimating total expenditure impacts of SRC-II payroll expenditures in a 70-mile radius of the plant site. These multipliers were estimated with the RIMS procedure which adjusts national input-output coefficients to fit the county industry composition (Appendix V). The RIMS

Table 3.18. Adjusted RIMS personal expenditure multipliers

Region number	Region area	Expenditures multiplier
1	Monongalia County, W.Va.	2.0369
2	Marion County, W.Va.	1.8470
3	Preston County, W.Va.	1.8359
4	Harrison County, W.Va.	2.1473
5	Taylor County, W.Va.	2.0676
6	Garret County, Md.	1.7501
7	Greene County, Pa.	2.5339
8	Fayette County, Pa.	2.1337
9	Sum of regions 1-8	2.3286
10	Sum of regions 1-8 plus Grooke County, W.Va. Ohio County, W.Va. Marshall County, W.Va. Wetzel County, W.Va. Doddridge County, W.Va. Lewis County, W.Va. Barbour County, W.Va. Allegany County, Md. Somerset County, Pa.	2.3531
11	Sum of Allegheny County, Pa., Westmoreland County, Pa., and Washington County, Pa.	2.7557

regionalization procedures tend to correct overestimation of multipliers for materials supply industries that are not present in the local economy, but corrections for above average responses to changes in the household sector demands are not attempted. Thus the multipliers in Table 3.18 represent total expenditure impacts in the county economies from expenditures by the labor force households. These multipliers may be conservative relative to boomtown relationships, but the SRC-II site is located in an area in which boomtown responses are very unlikely. Substantial population and well-developed community infrastructure exist in the SRC-II area. Consequently, the multipliers in Table 3.18 are deemed more appropriate for use in the impact sector of this statement (Sect. 4.2.4.1) for estimating total expenditure impacts by county during the SRC-II construction phase. Although these multipliers may not state the actual multiplier effect, it is expected that these estimates will be much closer to the actual multiplier than the somewhat more crude multipliers calculated from boomtown studies.

The advantage of using multipliers such as those in Table 3.17 and 3.18 is that the complete range of multiplier impacts from material as well as labor purchases can be estimated. By including households as a sector, the total direct, indirect, and induced employment effects can be calculated for the SRC-II project. However, it is important to recognize that the multipliers are not additive. One cannot, for example, add the mining multiplier in Table 3.17 to the petroleum-coal multiplier to get the total employment and income impact in the region. A total regional multiplier can be obtained only by comparing the sum of gross output effects across all sectors with the initial expenditure in all sectors of the area.

3.2.4.3 Income

Average annual payrolls per employee for the five-county area are given in Table 3.19. The two Pennsylvania counties represent the extremes, with Greene at the top and Fayette at the bottom. The less diversified economy of Greene County was heavily weighted by the relatively high earnings in mining. Lower-paying activities such as retail trade helped pull down the average for Fayette.

The high earnings for coal — almost 64% above the area average — stand out in comparison with earnings in other employment categories. Contract construction and the primary and fabricated metals sectors were also well above the average. Transportation, public utilities, and other manufacturing, including nonelectrical machinery, also reported higher than average payrolls. Apparel, textiles, and the trades and services were at the low end of the scale with payrolls in retail trade averaging only 60% of the area average.

County data on per capita income and comparable data for the United States are given in Appendix V, (Table V.8). Per capita income increased more rapidly in the SRC-II area than the national average between 1969 and 1975 (the last year for which data are available). At the end of the period, even the most prosperous county, Monongalia, stood at only 83% of the U.S. average. Preston, the

Table 3.19. Average annual payrolls, private nonagricultural sector, 1976

Industry Group	County					SRC-II area	Percent of total area population
	Marion	Monongalia	Preston	Fayette	Greene		
Mining	16,133	15,577	16,215	16,289	16,264	16,027	163.7
Contract construction	12,620	10,526	10,176	13,250	8,484	12,083	123.4
Apparel and other textiles				6,028		6,028	61.6
Lumber and wood products			8,636	8,361	5,699	8,122	83.0
Printing and publishing	10,204			8,805		9,400	96.0
Stone, clay and glass		8,187				8,187	83.6
Primary metals	12,225			11,973		12,133	123.9
Fabricated metals				12,679		12,679	129.5
Machinery (except elec)	11,182	11,393		12,191		11,333	115.8
All other manufacturing	12,431	9,045	8,004	11,929	6,947	10,966	112.0
Transportation and public utilities	12,762	12,090	11,758	10,880	10,589	11,585	118.3
Wholesale trade	9,889	10,060	13,699	10,779	7,768	10,583	108.1
Retail trade	6,044	5,875	6,346	5,735	5,935	5,891	60.2
Finance, ins., real estate	7,618	8,064	10,649	8,700	7,804	8,321	85.0
Service	6,742	6,365	5,420	6,641	6,128	6,493	66.3
NEC	9,333	12,139	6,000	7,755	7,200	8,603	87.9
Total	10,500	9,609	9,952	8,948	11,482	9,789	100.0

Source: U.S. Department of Commerce, Bureau of the Census, *County Business Patterns, 1976*, Pennsylvania (May 1978) and West Virginia (June 1978).

most rural county in the area, registered the largest relative increase. But while per capita income in this county nearly doubled in six years, it was still only 69% of the U.S. average in 1975.

3.2.4.4 Housing⁴¹

Monongalia County's 1980 housing stock consists of an estimated total of 29,192 single-family, multifamily, and mobile home units (Table 3.20). About 37% of these housing units are located in Morgantown.

The county's housing stock has increased by an average of 825 new units per year since 1976. This includes 845 new units being added to the base per year and 20 units being lost. A breakdown by year and type of housing unit is shown in Table 3.21.

Table 3.20. Estimates of housing, 1980

	Nonrental units ^a	Rental units	Total
Single family	13,826	3,674	17,500
Multifamily	677	6,468	7,145
Mobile homes	3,592	955	4,547
Total	18,095	11,097	29,192

^aNote that nonrental units are always potentially available for rental purposes.

Table 3.21. Housing inventory by year and type

Year	Single family	Multifamily	Mobile homes	Total
1976	351	66	236	653
1977	397	222	375	994
1978	440	277	268	985
1979	307	215	226	748
1980 ^a	103	95	81	279
Total	1598	875	1186	3659

^aPartial data only.

Source: *Housing Analysis for the Monongalia County Area of West Virginia*, Region VI and Development Council and the Morgantown Chamber of Commerce, Sept. 15, 1980.

Of the total housing stock of 29,192 units, about 1,158 units were classified as vacant and not habitable in April 1980. Should the demand for housing increase significantly in Monongalia County, the Region VI Development Council estimates that about 868 of these units (75%) could be rehabilitated.

Based on available information, it appears that about 3% of the county's owner-occupied housing stock (514 units) are available for sale at any given point in time. Table 3.22 gives an indication of the price range of currently available housing stock based on information made available by the Morgantown area Multiple Listing Service (MLS). Because the MLS does not include all available homes for sale, this table provides only an indication of price range, not total number of units for sale.

Table 3.22. Number of MLS listings by price range

Date	Below \$40,000	\$40,000-60,000	Above \$60,000	Total
June 1979	45 (20%)	87 (38%)	97 (42%)	229
June 1980	54 (23%)	85 (37%)	93 (40%)	232

Available rental units in Monongalia County are more difficult to assess because of the fluctuating market demand resulting from transient West Virginia University students. Using Region VI Housing Analysis estimates, rental vacancy rates are as follows:

<u>Vacancy rates</u>			
<u>September–November</u>	<u>December–February</u>	<u>March–May</u>	<u>June–August</u>
2%	3-5%	5-7%	10+%

Assuming an average vacancy rate of 4% for the academic year, when rental housing is in greatest demand, an estimated 402 single and multifamily rental units in the county are vacant. In addition, an estimated 800 motel and hotel rooms are available, many of which could be used by workers during the week who would return to their homes on weekends. Some mobile home rental units would also be available.

3.2.4.5 Government services and finance

Schools

Information for this section was provided by Monongalia Board of Education in July 1980.

As is true for all of West Virginia, the Monongalia County Board of Education controls all schools in the county including those located in incorporated areas. Monongalia County has a total of 45 public schools with a total 1980-1981 capacity of 13,368 students and a projected enrollment of 10,983 students (Table 3.23). The excess capacity of 2,385 openings consists of 1,935 primary grade spaces, 422 junior high school spaces, and 28 high school spaces. Six of the 38 primary schools are above capacity in enrollment, none of the junior high schools is above capacity, and two of the four high schools are above capacity. The major overcrowding occurs at the high school level, with only the Vo-Tech Center able to absorb a sizeable number of extra students (see Table 3.23). Morgantown and University high schools exceed capacity by an average of 95 students each, and Clay Battelle High School is at capacity.

Although excess student capacity exists below the high school level, physical improvements are needed at some schools and additional capacity is needed at other schools. To meet these needs, a Comprehensive Facilities Plan for Monongalia Schools was developed by the Board of Education and approved by the West Virginia Department of Education. Fulfillment of these needs is dependent on the outcome of local bond referenda. Monongalia County residents will, therefore, determine if county school needs are met.

Police and fire

The Morgantown City Police Force numbers 48 sworn personnel with an authorized strength of 50. The 1980-1981 budget is \$1,440,800. In the county, the Monongalia Sheriff's Department has 18 deputies plus the sheriff. The West Virginia State Police has 10 troopers stationed in Monongalia County. Fire protection in Morgantown consists of 44 firemen with all necessary equipment; the county relies on volunteer fire fighters. Currently, 13 squads serve the county with about 25-30 volunteers per squad.

Table 3.23. Monongalia County Schools roster, 1980-1981

	Current enrollment	Grade level ^a	Building capacity		Current enrollment	Grade level	Building capacity
Elementary							
Arnettville	114	K-5	128	Sabraton	170	1-6	425
Blacksville	93	3-6	101	Second Ward	348	K-6	418
Brookhaven	180	K-6	210	Smithtown	42	1-6	81
Brown's Chapel	73	4-6	81	Star City	88	K-6	156
Cass District	283	K-5	332	Summers	149	K-6	126
Central	178	K-6	224	Suncrest	186	K-4	303
Cheat Lake	590	K-9	621	Wadestown	142	K-6	141
Cool Springs	44	1-6	54	Waitman Barbe	175	1-6	108
Core	65	1-6	81	Westover	195	K-6	216
Daybrook	84	K-6	175	Wiles Hill	129	K-6	197
Dorsey	63	1-3	81	Woodburn	195	K-6	239
Easton	227	K-4	225	Total	6,057		7,992
First Ward	319	K-6	330	Junior high schools			
Goff	29	1-6	42	Cass District	192	6-9	324
Granville	120	K-6	128	South	907	7-9	1,000
Jakes Run	96	1-6	108	Suncrest Flatts	397	7-9	400
Jerome Park	86	K-6	162	Waitman Barbe	139	7-9	202
Lazelle Union	101	1-6	116	Westover	292	7-9	423
Morgan Heights	56	1-3	81	Total	1,927		2,349
Mt. Pleasant	108	1-4	108	High schools			
National	34	K-3	116	Clay Battelle	409	7-12	427
North	630	K-6	800	Morgantown	1,500	10-12	1,400
Oak Grove	118	K-4	128	University	590	10-12	500
Pentress	101	K-2	74	Vo-Tech Center	500	10-12	700
G. W. Phillips	107	K-6	128	Total	2,999		3,027
Ridgedale	166	K-3	160	Total	10,983		13,368
Riverside	173	1-6	458				

^aK = kindergarten.

Source: Monongalia Board of Education, July 1980.

Emergency ambulance service is provided by Monongalia County Emergency Medical Services. Both paid and volunteer manpower are used. Currently, there are 7 full-time and 1 part-time paramedics and about 100 volunteers. Local officials feel that the service is efficient and adequate for current needs.

Health care

Monongalia County contains two hospitals with a total bed space of 695. West Virginia University Hospital, located in Morgantown, is the largest with 460 beds, and Monongalia Hospital has 235 beds. This results in a bed space population to ratio of 1:108 or about 10 beds for every 1000 persons. Occupancy rates for both hospitals is about 85%. The hospitals are staffed by 200 faculty members from West Virginia University Medical School and 180 residents. This results in a doctor to population of 1:198 on about 5 doctors for every 1000 persons.

Public finance

Information for this section was provided by the West Virginia State Tax Department in October 1980.

Taxing authorities in Monongalia County and Morgantown have the potential to receive substantial additional revenues from taxes on existing property. Mandated maximum state tax levy rates are low compared with those in most states. Property assessed valuations are also low at about 30 to 35% of market value. Property taxes levied by Monongalia County are based on 50% of assessed valuation. Within the municipalities of Morgantown, Westover, Star City, Osage, Granville, and Blacksville, this rate is \$15.88 per \$1000. The primary source for school funding within the county is from the county property tax. The remaining school revenues, about 65%, comes from the state. Table 3.24 illustrates the Monongalia County's school operating budget.

Table 3.24. Monongalia County School operating budget, \$

	Budgeted revenue 1979-1980	Estimated revenue 1980-1981	Gain or loss
State aid	11,262,608	11,788,284	525,676
Local revenue			
Current year local taxes	5,876,085	6,191,849	315,764
Interest on investments	140,000	210,000	70,000
Indirect costs transfer	10,000	12,000	2,000
Total	6,026,085	6,413,849	387,764
Total revenue	17,288,693	18,202,133	913,440
Estimated treasure's net balance June 30, 1980	175,000	260,000	85,000
Grand total, receipts plus net balance	17,463,693	18,462,133	988,440

Source: Monongalia County Board of Education, Morgantown, W. Va. (July 1980).

The average per pupil expenditure in Monongalia County was \$1,613.61 for the 1979-1980 school year and is projected to be \$1,786.36 for the 1980-1981 school year. Of this amount, the state will provide \$1,161.14 in the 1980-1981 school year.

The State of West Virginia receives revenue from several tax sources. West Virginia has a state sales tax of 3%. This tax covers all retail sales with the exception of food, which is taxed at 1%. Next year the sales tax on food will be dropped completely. West Virginia also has a state income tax, which ranges from 2.1 to 9.6% of taxable income. Correspondence with the state tax office in Charleston, West Virginia, however, indicates that the effective tax rate on all taxable incomes in the state is 1.9%.

The West Virginia sales tax is not imposed on purchasers, contractors, manufacturing plants, and other such businesses that do not sell their products at the retail level. In addition, the State of West Virginia has exempted new technologies, such as synfuels plants, from paying sales taxes on purchases.

About 40% of the state's revenue comes from a Business and Occupation Tax (B&O Tax). It is levied for the privilege of doing business in the state. The tax is determined by applying different rates against an annual base that has been generated in the classification of business activity in which the taxpayer does business. This base may consist of the value of products, the gross proceeds of sales, or the gross income of the business. This tax is about 88¢ per \$100 of the gross commercial sales of industries. To encourage new coal-related industries to locate in the state, pilot and demonstration plants are exempted from this tax. Once a pilot or demonstration plant is determined to be in a commercial operational phase, the B&O Tax is assessed.

During the early years of the commercial phase, however, the effective B&O tax rate can be reduced to 44¢/\$100 by an industrial expansion credit. This credit equals 1% per year of qualified capital investment to be used to offset or reduce the B&O tax bill of an industry. Even with all of the exclusion and credits applied to the B&O tax, West Virginia collected about \$400 million in B&O taxes last year.

Other taxes levied by the State of West Virginia include a 6% Corporate Net Income Tax and a Corporate Charter Tax. These taxes, however, do not account for a significant portion of total state tax revenues.

Utility services

With the recently completed water treatment facility on South University Avenue, water treatment capacity for Monongalia County is 16 million gallons per day (gpd). Currently, 70,000 people are serviced with water. Average usage is 6.5 million gpd, with peak loads reaching 8 million gpd. Current demand is about 50% of capacity. The current average per capita usage rates are 115 gpd during peak demand and 93 gpd average demand.

A network of water lines is in place along both the east and west banks of the Monongalia River. Service is supplied to Morgantown, areas to the east and west, and as far north as Mount Morris, Pennsylvania. A trunkline with excess capacity is available to serve the immediate vicinity of the project site.

Service to new dwellings involves a tap charge of \$180 if a line is available. Otherwise, the cost of extending service lines is borne by the customer who is reimbursed as others tap the new line. The cost of extension and tap is \$237.

Sewage treatment capacity for Monongalia County is 6 million gpd. Currently, 3.5 million gpd is processed. Repairs to an interceptor sewer are scheduled for completion by September 1981. This interceptor sewer has a 1.5 million gpd capacity and will raise to 5 million gal the sewage treated per day. Upon repair of the interceptor sewer, 30,000 people will be serviced by the sewer system. This indicates an average per capita utilization of 167 gpd. The Morgantown Sanitary Board is under court order to upgrade the system to include secondary treatment by March 1983. Upgrading will increase capacity to 9 million gpd.

Increased demand for sewage capacity could result if the neighboring communities of Westover and Grandville should enter the system. Currently, these communities are discharging raw sewage directly into the Monongahela River. The planned upgrading of the Morgantown system will provide sufficient capacity to accommodate these communities and, in addition, allow for significant future demand.

The charge for sewer taps for individual residences is \$175 when a sewer line is available. If a sewer is not available, the property owner is required to pay the cost of extending existing lines and is then reimbursed as others tap the new line. Under this method, the cost of lines and taps necessitated by new construction is borne entirely by the owner. Inasmuch as new service is paid for by the individual and use of excess capacity ensures lower rates by reducing per unit costs, the Morgantown Sanitary Board is eager to commit any excess capacity.

3.2.4.6 Transportation

Morgantown is 7 miles south of the proposed SRC-II site and is the major population center in the area (Fig. 3.1). It is linked with the site by Routes 19, 100, and 53. Little commuting is expected from Fairmont, about 22 miles from the site, because of the delays in bypassing the Morgantown area. On the Pennsylvania side, the city of Point Marion experienced increased economic activity because of the construction of the Fort Martin Generating Facility, which neighbors the proposed site. Pennsylvania is connected to the site via Routes 19 and 119 and Interstate 79.

The major roads in the area, such as Interstate 79, U.S. 48, and U.S. 119, are high-density structures expected to be able to accommodate additional traffic. Interstate 79, with a 1978 average daily traffic volume of 12,000 vehicles, is a major north-south connector. However, there are three identified points of potential traffic congestion where delays could be encountered by SRC-II related traffic. These congestion gateways are: (1) Osage Interchange, (2) Star City Bridge, and (3) Point Marion Bridge in Pennsylvania. These congestion points occur at the point of transition in flow capacity between connecting routes.

Around the plant site, the most likely access roads are lower capacity state and county roads including West Virginia 100, with an average daily traffic volume of 1300, and County Route 53, with an average daily traffic volume of 950. These are rural country roads and are not designed to handle appreciable volumes of traffic. Structurally, these roads cannot handle heavy loads such as cement and gravel trucks.

The State of West Virginia is planning to upgrade access roads from Interstate 79 to the proposed site. Detailed planning for this road upgrading is underway, and results will not be available until the first quarter of 1981 (see Sect. 4.2.4 - Transportation).

One scheduled airline and two commuter airlines provide air access to Morgantown. Two railroads serve the area for rail freight, and a large barge freight system on the Monongahela that has a 9-ft-deep channel to the Ohio River at Pittsburgh is accessible.

3.2.4.7 Archaeological, historical, and paleontological resources

Archaeological sites

Seven archaeological sites were discovered during an archaeological ground survey of the proposed project site by the West Virginia Geological and Economic Survey. They are Fort Martin (46-MG-72), Fort Harrison (46-MG-73), the Garlow farm (46-MG-74), Belldina's Bottom (46-MG-75), Ridgetop Mound (46-MG-76), the Van Voorhis farm (46-MG-77), and the Stone Circle (46-MG-8).

The Ridgetop Mound is not to be affected by the project and needs no further discussion. The Fort Harrison site will be fenced and protected from further impacts. The remaining five sites were investigated because of their proximity to the proposed facility.

Archaeological investigations were conducted in two stages. The first stage was to determine what was actually there and whether any subsurface features were present that would indicate the integrity of the site. This stage was conducted by plowing and disking the area, followed by a ground surface collection. Where concentrations of artifacts were found, test pits were dug to determine if any subsurface features (post molds, hearths, etc.) existed. When subsurface features were uncovered, the second stage was implemented which involved more test pits to better identify the cultural remains. In some cases, the second step was expanded by more intensive excavation because of the complexity of the site.

The following is a summary of the archaeological testing program for each of the five sites that could conceivably be affected by the SRC-II project.

The Van Voorhis site (46-MG-77). The site, located on a prominent ridge top, is a 10-acre pasture enclosed by a barbed wire fence. The site was investigated by Mid-Atlantic Archaeological Research, Inc. in May and August of 1980 to determine its archaeological significance.

The field was plowed and disked, then the plowed surface was systematically surveyed to determine the distribution of artifacts. During the reconnaissance, artifacts were collected and their positions "flagged" to identify the loci of concentrations. The recovery of 474 artifacts identified the site as an Amerindian settlement area. During the first stage of investigation, a red ocher feature was exposed that established the integrity of the site. Consequently, the second stage of investigation was instigated. The second stage involved the stripping of the topsoil in transects; these transects were aligned north and south at intervals of 17.5 m. Evidence of a structure, post molds, fire hearths, a possible burial, and various artifacts were unearthed. Artifacts collected in the area (both stages 1 and 2) totaled 1225; artifacts included projectile points, net weights, blades, scrapers, hammerstones, celts, drills, nutting stones, pestles, and sundry other items. Also abundant was lithic material such as chippage and core fragments. Firecracked rock was also abundant. Evidence of charred hickory and chestnut fragments was uncovered at the site. Analysis of subfeatures, flora, and functional analysis of artifacts indicates the area was probably a seasonal campsite where lithics were produced, nuts were harvested, and possibly other foods were gathered and processed. The projectile chronology suggests the site was inhabited as early as 7000 B.C. and as recently as about A.D. 1250. The Van Voorhis site was divided into three loci according to artifact concentration. Current analyses suggest that each of these three areas may have had a different economic function.

The site's cultural record is unique and represents an important cultural resource to the archaeological discipline. Consequently, the site is eligible for nomination to the National Register of Historic Places. In consultation with the West Virginia Historical Officer, the State Archaeologist, and the National Register, a data recovery program has been scheduled for the 1981 summer field season.

Fort Martin (76-MG-72). Fort Martin is an historical site located about 1 mile northwest of the Monongahela River. Mid-Atlantic Archaeological Research, Inc., was subcontracted to do initial investigations of the fort area in the summer of 1980. A controlled surface collection and an excavation of test units were completed in the first stage of research. The fort proved to be intact despite being in a farmed field. A total of 4082 historic artifacts were recovered; these ranged from domestic items such as pewter utensils and ceramics to such items as tobacco pipes and weaponry. The ceramic inventory suggests the fort was occupied from around 1770 until the 19th century. A second stage of testing was implemented in August 1980. Test excavations of the site revealed the foundation of a forge, a cellar, and a domestic area. Artifacts from these test units date the occupation of the fort more precisely: 1776 to 1840. Because the site retains its integrity and very few forts in West Virginia have been excavated, the site has potential to shed light on West Virginia's early frontier history. As a result, the fort is eligible for nomination to the National Register of Historic Places. In consultation with the State Historical Preservation Officer, the State Archaeologist, and the National Register, a data recovery program has been planned for the field season of 1981.

Belldina's Bottom (46-MG-75). Belldina's Bottom is located on the west bank of the Monongahela River in Monongalia County, West Virginia, about 8 km downstream from Morgantown. The site occupies a two-terrace floodplain.

The first stage of investigation was carried out by GAI Consultants, Inc. (GAI); it consisted of an archaeological survey (plowing, disking, and controlled surface collection) and testing program. Results of the first stage of work discovered an archaeological site on the lower bottom and several sparse artifact concentrations on the upper terrace. More intensive excavation was carried out on the lower bottom. As a result of this testing, GAI uncovered a Monongahela Village Hamlet (circa 500 B.C. to A.D. 1000) and possibly another specialized activity

area associated with Monongahela Village or a completely independent site. The Monongahela Village has been identified as 46-MG-75 A1; its artifact distribution appears to be a typical Monongahela Village plan with houses surrounding an open central plaza or courtyard. Evidence of a stockade around the village has not been found. The smaller site has been identified as 46-MG-75 A2; it does not fit the pattern of a Monongahela Village. Artifacts are interspersed over the entire area of 46-MG-75 A2. The temporal relationship between the two loci is unclear. Potsherds are the most common artifact type, but projectile points and lithic debris have also been recovered. Bone is present but not well preserved; mussel shells are better preserved than the bone. Thirty-seven features were identified; these include lenses of compact red silty clay — which was produced by firing the ground surface — postholes, trash pits, and midden accumulations.

Belldina's has been sealed by 0.5 to 0.7 m of sterile alluvium, which has protected the cultural remains from recent disturbance. Because this surface is still intact, house loci with associated features are preserved and can provide detailed information on intrasite variability in architecture, artifact distribution, subsistence techniques, and village organization. The amount of knowledge the Belldina site can provide the archaeological discipline is important and, as a result, makes the site eligible for nomination to the National Register of Historic Places. In consultation with the State Historical Preservation Officer, the State Archaeologist, and the National Register, a data recovery program has been drawn up for the 1981 field season.

Garlow farm (47-MG-74). Archaeological research was conducted on the site during June 1980 by WAPORA, Inc. The surface collection of the site revealed substantial artifacts in the disturbed plow zone; about 1100 artifacts were uncovered. Tools, projectile points, and nutting stones were present in fairly large numbers. Artifacts ranged from 700 B.C. to A.D. 1000. The majority of artifacts were debitage-waste flakes produced in the manufacturing and retouching of tools. Testing of the area did not reveal any subsurface features.

Data from the site appear to be out of context, and no features were present; consequently, the site appears not to be significant. Because of the high yield of artifacts, however, some further testing, such as moving more of the top soil with machinery to expose subsoil and search for any subfeatures that may be present, has been recommended.

The Stone Circle (46-MG-8). The site was investigated by WAPORA, Inc. Cultural resource work on the site produced nothing of significance; consequently, no restrictions or further investigations are required.

Historical buildings

Five potentially historic buildings were identified on the proposed SRC-II site in 1979. They were Maple Place, Fort Martin Church, the Garlow farmhouse, the Gingrich house, and Fort Martin School/Community Center. Three of the structures, Fort Martin School/Community Center, Fort Martin Church, and the Gingrich house, are considered to be affected by the project, and two of them, the Fort Martin School/Community Center and the Gingrich house, are eligible for the National Register of Historic Places. The other two structures were not to be affected by the project and consequently needed no further work.

The Gingrich House. The Gingrich house was built by Marshall J. Garlow sometime before 1880. The home is accompanied by a guest house, barns, and a crib as well as a one-horse work sleigh. The tupelo or widow's watch is a distinctive feature of the home and may be a design Marshall Garlow remembered from travels to the east. The family cemetery is one-half mile due west on the hillside; tombstones date back to the 1700s for the first Garlow family members.

Samuel Gingrich purchased the house in 1974 with the intent of restoring the interior and exterior of the house as close to the original condition as possible. Great care was taken of the chestnut wood tupelo, cherry wood fireplaces, stair railings, and the poplar woodworkings. The exterior poplar siding is now covered with aluminum siding for protection. The home was run down but was in good structural condition on river stone foundation with a solid chestnut main beam. The attention to detail during restoration and the details built in by Marshall Garlow make this home a fine example of 19th century self-sufficient farming operations.

The Gingrich house had old ties to the farming community (the Garlows were among the first settlers). Because of its historic ties with the farming tradition of the area, the excellent interior wood craftsmanship such as the fireplace and stairway, and the unusual architecture typified by the widow's watch, the house is eligible for nomination to the National Register of Historic Places. In consultation with the West Virginia State Historical Preservation Officer, the house is tentatively planned to be used as a visitor center for the SRC-II project.

Fort Martin School. Fort Martin School in the Cass District is one of three frame, one-room schoolhouses in West Virginia. The school building now standing was built around 1898. It is a frame building with fieldstone foundation; since 1966, it has been used as a community center. The building sits on the site of the original schoolhouse built in the early 1830s. The school

is eligible for nomination to the National Register of Historic Places. In consultation with the West Virginia State Historical Preservation Officer, the schoolhouse is tentatively scheduled to be moved to the Gingrich House complex and to be integrated into the visitor center plans.

Fort Martin Methodist Church. The beginnings of the Fort Martin Church lay with Charles Martin encouraging Methodist circuit riders to preach at his fort. Entries in "Bishop Francis Asbury's Journal" provide original documentation of his visits to Fort Martin: "Thursday, July 14, 1785, . . . I preached at Colonel Martin's Fort . . . , and Tuesday, July 15, 1778, . . . I preached at a new chapel near Colonel Martin's and felt much life, love, and power." A quote in "Robert Ayres Journal" states that Bishop Asbury also preached at Martin's in 1784 and 1786.

The land grant of one acre and logs for the church provided one of the first chapels on the old Redstone Circuit. The land grant site is across the road, directly west of the current Fort Martin Church. The original chapel was not completed until the mid 1790s and was a balconied, log structure. A manuscript written for the West Virginia Conference of the Methodist Church by Reverend W. W. Sutton and entitled "The Veterans Cane" (1955) refers to the building as a "small, old log church with a gallery." He states that the building was still standing in 1840 and that, sometime afterward, Fort Martin residents decided to "take down the old log structure." A decision was made to retain one of the best logs and "make it up into canes" to be presented to prominent Methodist church leaders.

A frame building was raised in 1840 between the road and the existing church. The building served the congregation until 1910 when the current brick church was constructed. The use of brick for construction at this early date was not common.

The church has had a continuous, active congregation since Colonel Martin's time, and it has been an integral part in the growth of Methodism to the west of the Appalachians via the various Methodist circuits. The awarding of canes to "men of age and long years of Methodist service" still continues. The unmarked graves in the churchyard cemetery may be those of Colonel Martin and his family.

Ordinarily, churches are not nominated to the National Register of Historic Places unless the structure has unique architecture or unless some significant event has happened there. Although the Fort Martin Church has strong historical ties to the area, it does not meet the standards set for the National Register of Historic Places. The architecture is not unique, and no significant event took place in the current building. Thus, it is ineligible.

Paleontology

The paleontology of the area was investigated in 1979. Nothing of significance was found; consequently, no further research was required.

3.3 ALTERNATIVE SITE 1 — EQUALITY, OHIO COUNTY, KENTUCKY

The Equality, Kentucky, site (Fig. 3.8) is one of two alternative sites selected for comparison with the proposed Fort Martin site (Fig. 2.6, Sect. 2.3.2.2). Alternative sites for the proposed SRC-II project were evaluated, using reconnaissance-level data. The site selection methodology is discussed in Appendix B.

3.3.1 Land

3.3.1.1 Location

The alternative Equality site consists of over 400 ha (1000 acres) located on the Green River, about 1.6 km (1 mile) west of the town of Equality in northwestern Kentucky. The entire site is within the boundaries of Ohio County, about 21 km (13 miles) west of the county seat of Hartford on the two-lane Equality access road (see Fig. 3.9). The county's largest population center, Beaver Dam, is located 25.6 km (16 miles) east of the site. Other local towns of consequence are Central City and Greenville, 32 km (20 miles) and 45 km (28 miles) west, respectively, in Muhlenberg County, and Livermore, 43 km (27 miles) north in McLean County. The major trade center for the area is Owensboro, 64 km (40 miles) north in Daviess County (personal communication from David Doctor, Green River Area Development District, to Jeff Rexhausen, November 24, 1980). All of these distances are road miles. The relative sizes of the towns in the Equality site impact area are presented in Table 3.25.

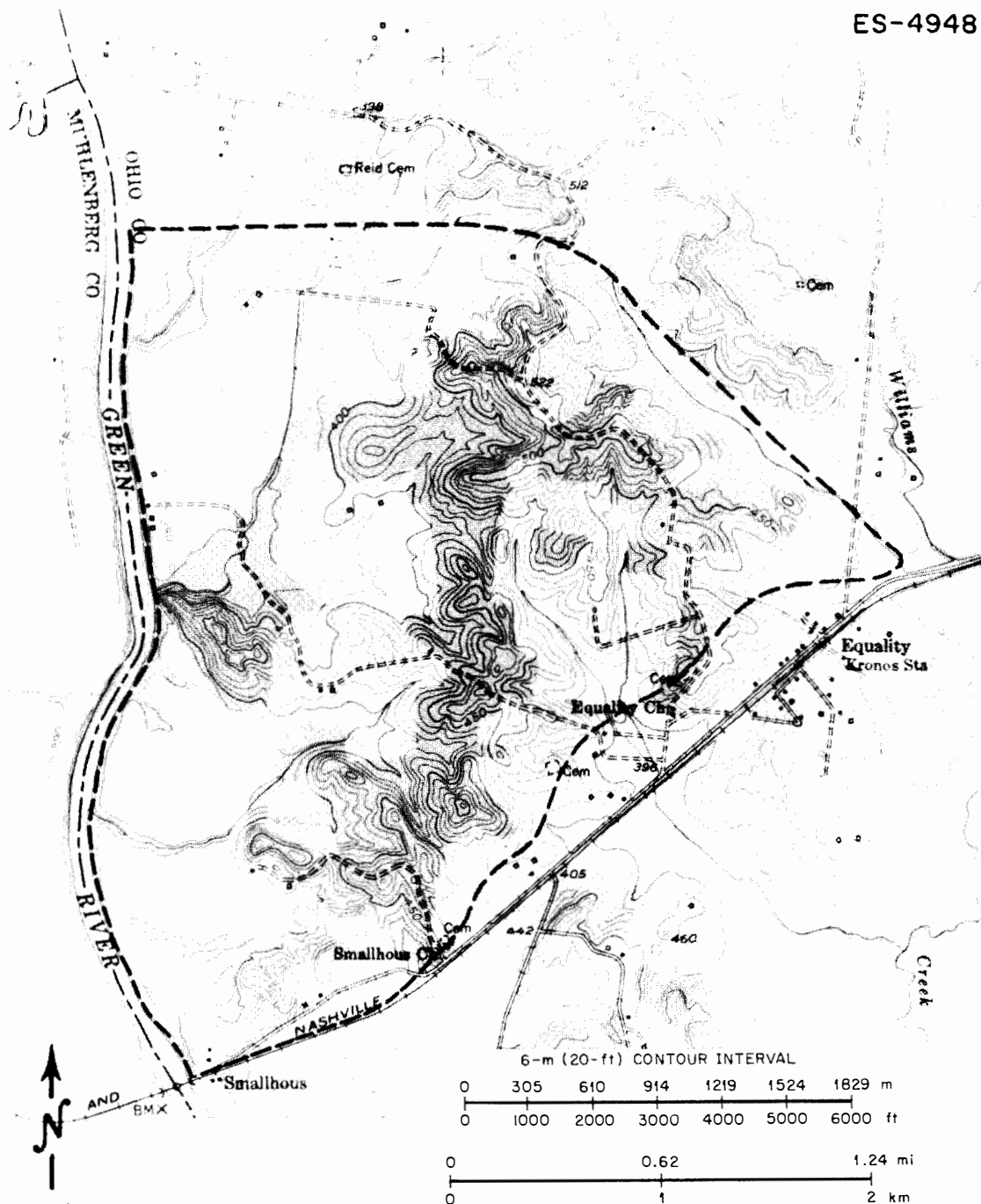


Fig. 3.8. Location map of the Equality site. (The exact site boundary has not been determined.)

3.3.1.2 Land use and development

The Equality site is located in a predominantly rural setting. About 50% of the site is located in the Green River floodplain, and the other 50% is in the hills east of the river. About half of the floodplain is cultivated for corn production, and less than half of the hilly land is used for pastureland. Most of the remainder of the site is wooded but is not actively logged. About 320 ha (800 acres) of the entire 405-ha (1000-acre) site are classified as prime farmland, and 70 ha (175 acres) are additional soils of statewide importance. The underlying coal deposits are not currently being mined. About 10 residences are currently located in the hilly portion of the site area.

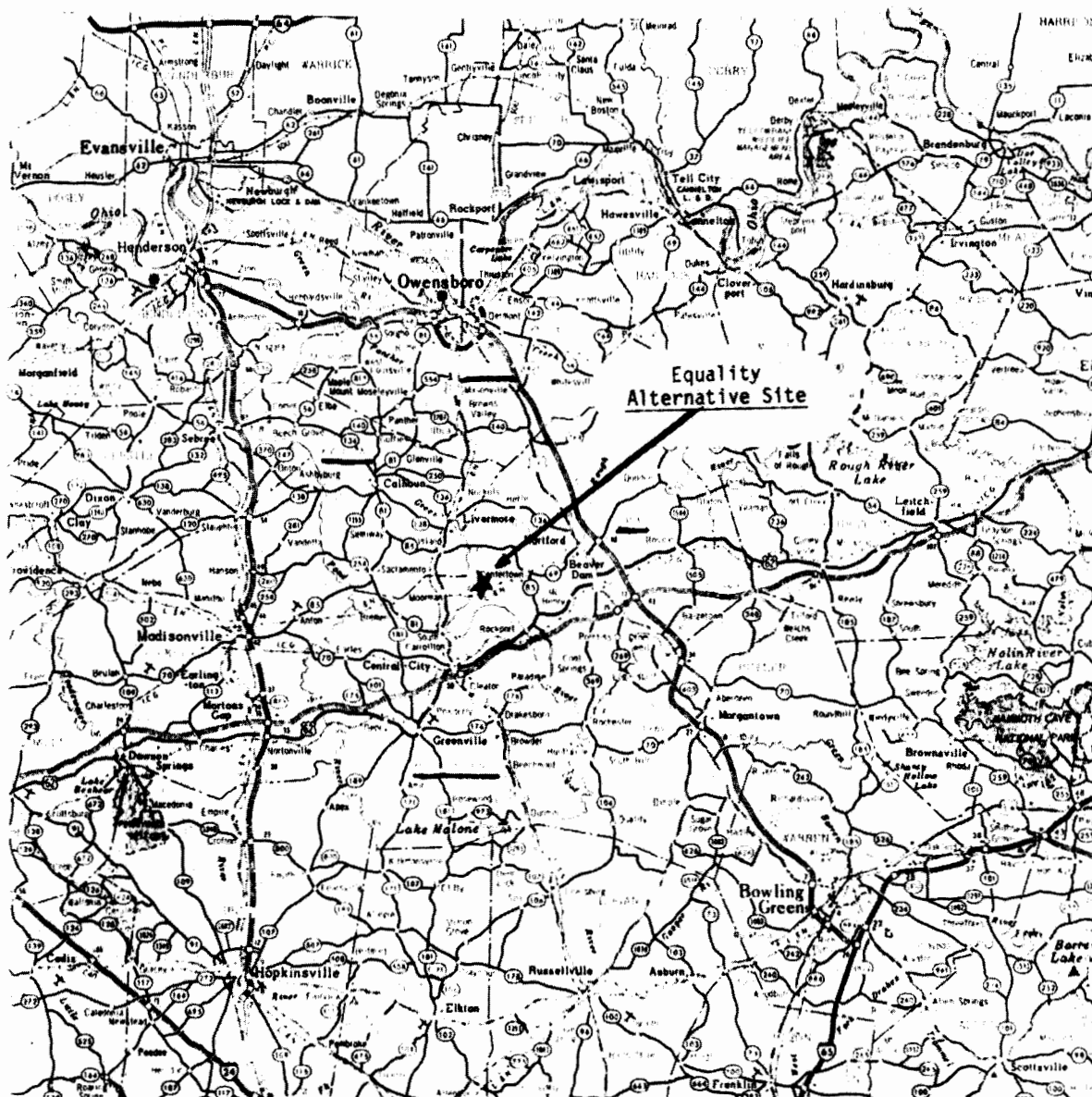


Fig. 3.9. Regional location of the Equality alternative site.

Although the facility would be located in one relatively small section of Ohio County, a much larger area would receive land use and socioeconomic impacts as a result of this project. This larger area will be referred to as the socioeconomic impact region and consists of Ohio, Muhlenberg, McLean, and Daviess counties, those jurisdictions that are expected to absorb the great majority of project-related workers and the accompanying impacts (Sect. 4.3.4.1).

Table 3.26 presents a picture of current land use in the impact region. Varying intensities of agricultural and mining activity are present throughout the four-county impact area. Prime farmland on the floodplain to the north and west has produced larger-scale farming; coal stripping activities are located throughout the region.

Ohio County remains primarily active in agricultural production, with some significant coal activity, although employment in this industry has been declining in recent years (personal communication from Rick Hiten, Pennyryle Area Development District to Martin Schweitzer, November 26, 1980). Land uses in the more metropolitan county of Daviess to the north are characteristic of that area's greater industrialization, especially in and around Owensboro. McLean County is

Table 3.25. Population of counties and towns in the Equality, Kentucky, impact area, 1980

Ohio County	21,845
Equality	50
Hartford (and rural area)	3,752
Beaver Dam (and rural area)	6,867
Daviess County	81,941
Owensboro	57,862
McLean County	11,058
Livermore (and rural area)	3,424
Muhlenberg County	32,315
Central City (and rural area)	3,816
Greenville	5,215

Sources: Mohammed Tauqi, Kentucky State Planning Office, personal communication, Nov. 25, 1980; U.S. Census Bureau, personal communication based on preliminary figures from the 1980 census of population, Nov. 25, 1980.

Table 3.26. Percentage of current land use in Equality, Kentucky, impact region

	County			
	Ohio	Daviess	McLean	Muhlenberg
Urban/built up		3.73		a
Agricultural	33.77	65.85	72.71	a
Forest	64.60	26.63	25.76	a
Other	1.63	3.79	1.33	a

^aNot available because land use surveys have not been conducted in Muhlenberg County.

still predominately agricultural, with small amounts of coal mining activity. Muhlenberg County is experiencing an increase in mining, whereas its agricultural base remains for the most part unchanged. The overall region is in the process of seeking industrial activity.⁴²

Ohio, Daviess, and McLean Counties all have county-wide land use planning, zoning ordinances, and subdivision regulations under the regional coordination of the Green River Area Development District. The District has policies favorable to industrial growth in these counties.⁴³ Muhlenberg County, a part of the Pennyryle Area, also practices zoning, subdivision regulation, and building and housing code enforcement and is favorable to industrial growth.⁴²

3.3.1.3 Geology and soils

Major topographic features of the site include the Green River floodplain with three slough wetland areas, making up about one-half the site, with low hills in the remainder of the area. Most tillable floodplain area is used for farming; the hills and low-lying areas are wooded. Topographic relief between the floodplain and the hills is 30 to 45 m (100 to 150 ft), and hill-sides are moderately to steeply sloping.

Soils

Two major soil associations have developed on the Equality site: Willston-Zanesville-Frondorf in the upland areas and Newark-Upside-Melvin in the floodplain area. The Willston-Zanesville-Frondorf association is developed over siltstone and sandstone bedrock, and ranges from clayey to sandy silt, is moderately to well drained, and contains residual bedrock fragments. Hydrous oxides of iron and manganese may accumulate in the upper foot of soil. Loess caps some hilltops in the area. Surface horizons on hillsides are sandy to pebbly soils.

The Newark-Upside-Melvin association soils on the floodplain are generally medium to dark-brown sandy silt loams, in contrast to upland soils, which are reddish- to yellowish-brown with moderate clay content. Floodplain soils are characterized by 0.3 to 0.7 m (12 to 30 in.) of medium- to dark-brown, silty to sandy loam, overlying light- to medium-brown, fine to medium sand of the alluvium. Iron and manganese nodules form in the lower portion of the surface soils. Floodplain soils are excellent agricultural soils; about 75% qualify as prime farmland.

Geology

The alternative Equality site, located in the western Kentucky coalfield, is underlain by bedrock of the Pennsylvanian Lisman and Carbondale formations. Coal is mined on adjacent tracts, and mineable reserves of No. 14 coal may exist on the site. Some gas and oil are produced in the area; however, no known oil or gas reserves are on the site. Pennsylvanian strata beneath the site are interbedded sandstone, siltstone, shale, limestone, and coal. Soil development over bedrock is thin in the hilly portion of the site, but as much as 30 m (95 ft) of alluvium covers the bedrock surface near the Green River.

The site is located in seismic risk zone 2 near the zone 3 border. The Rough Creek Fault Zone, a major structural element of the region, is about 16 km (10 miles) north of the site; a zone of smaller east-west trending faults is 19 km (12 miles) to the south. It is not possible to assess subsidence or liquefaction potential of alluvium because of the lack of information on physical character of the material.

3.3.1.4 Terrestrial ecology

The alternative Equality site consists of approximately equal areas of Green River floodplain and hills, which rise 30 to 40 m above the floodplain. Riparian forest occupies about one-half the floodplain. Three streams that enter the Green River on the site support hardwood swamp forest. Excellent habitat exists for wood duck, raccoon, mink, and other species typical of wooded swamps. Vegetation in these areas is mature but has been disturbed by selective cutting. The remainder of the floodplain consists of prime farmland and is primarily devoted to the cultivation of corn.

Hedgerows dominated by black oak divide the small fields, making them particularly accessible to wildlife and providing corridors between the wooded areas. The hills are mostly covered with oak-hickory forest. The presence of a few very large trees with typical open-field growth lends evidence that most of this area was once pasture. The recently abandoned farmland succession has progressed to the small tree stage.

The bald eagle and arctic peregrine falcon, Federally designated as endangered, may rarely pass through the area during migration, and gray and Indiana bats may use the site during the summer. The State of Kentucky recognizes but does not protect certain species that are rare within the State but not listed in the *Federal Register*.⁴⁴ Those species that may be found in the floodplain wetlands include the masked or common shrew, southeastern or Bachman's shrew, swamp rabbit, western lesser siren, three-toed salamander, and four-toed salamander. The entire site might be used by the rare bobcat, southeastern bat, and small-footed myotis.

3.3.2 Water

3.3.2.1 Surface water hydrology

The alternative Equality site, located at approximately Green River Mile 756, is about 13 km (8 miles) south of the confluence of the Rough and Green rivers. The floodplain at the site is about 2.5 km (1.5 miles) wide but widens considerably a few miles downstream. One unnamed creek drains the bedrock hills and flows westward to the Green River through the center of the site. In addition, one very small lake is located within the site area boundaries, northwest of Smallhouse Church.

The site is located between two U.S. Geological Survey stream gaging stations. One station at Green River Mile 100, near Paradise, Kentucky, indicated an average river discharge of 260,572 liter/s (9201 cfs). The maximum discharge corresponding to a flood elevation of 120 m (394 ft) mean sea level was indicated as 3,030,240 liters/s (107,000 cfs) on March 5, 1962. A discharge of 7080 liter/s (250 cfs) from October 23 to October 24, 1940, was the minimum flow recorded.⁴⁵ The 7-d ten-year low flow was calculated as 9544 liter/s (337 cfs).⁴⁶

In the event of a 100-year flood, the floodplain in the Equality site area would be completely covered. The expected river elevation of such a flood would be 120 m (394 ft) mean sea level,⁴⁷ which would cover the floodplain to the base of the bedrock hills east of the river (see Fig. 3.10 and Appendix D).

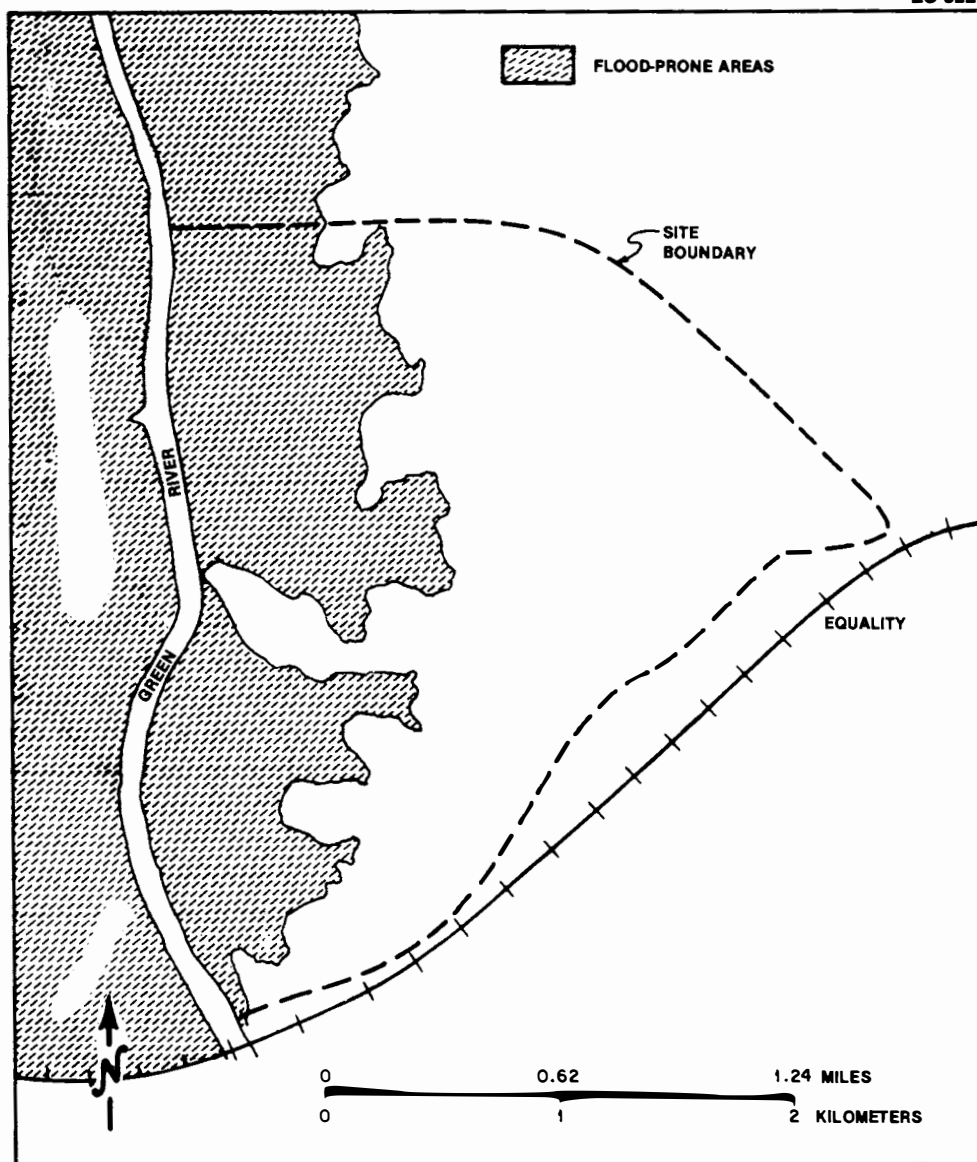


Fig. 3.10. One-hundred-year floodplain areas of the Equality, Ky., site.

3.3.2.2 Groundwater

Water wells in the sand and gravel of the Green River alluvium near the site can yield more than 500 gpd. Although the silt and shale beds of the onsite bedrock hills will not yield water to wells in quantities large enough for domestic supplies, sandstone beds may yield large quantities of water provided sandstones are not well cemented. The groundwater is usually hard and may contain objectionable quantities of iron. In addition, the saline water/fresh-water interface occurs within 61 m (200 ft) of the surface.

3.3.2.3 Surface water quality and aquatic ecology

High levels of suspended sediments from runoff and erosion, especially from surface-mined areas in Ohio, McLean, and Muhlenberg counties, and from barge traffic pose a serious water quality problem in the Green River. Other pollutants in the Green River include acid mine drainage; municipal, industrial, and agricultural wastes; and oil production effluents. Table 3.27 presents data for the Green River downstream from the Equality site, regional water quality data, and water quality criteria for drinking water and for the protection of aquatic biota. These data indicate that total dissolved solids (TDS) in the region approach the drinking water standard.

Table 3.27. Water quality and flow in the vicinity of the Equality site

Concentrations are in mg/liter unless otherwise shown

Parameter	Green River ^a	Regional ^b	Drinking water standard	Aquatic biota protection limit
Flow, m ³ /s	46–1736			
pH, units	6.6–0.3		6.5–8.5 ^c	6.5–9.0 ^d
Temperature, °C	1.5–30.1			
Total suspended solids	11–230	270–1900		
Dissolved oxygen	6.4–15.0			5.0 ^d
Hardness, as CaCO ₃	95–220	60–120		
Sulfate	16–120		250 ^e	
Chloride	3.2–14.0		250 ^e	
Fluoride	0.0–0.4		1.4–2.4 ^e	
Total dissolved solids	104–319	120–350	500 ^e	
Arsenic	0.000–<0.010		0.05 ^e	0.3 ^f
Barium	<0.200		1.0 ^e	104 ^f
Cadmium	0.000–0.004		0.010 ^e	0.0012–0.0120 ^d
Chromium	0.000–0.001		0.05 ^e	0.100 ^d
Cobalt	0.000–0.006			6.25 ^f
Copper	0.006–0.014		1 ^c	0.0009 ^g
Iron	0.000–3.720		0.3 ^c	1.0 ^d
Lead	0.000–0.075		0.05 ^e	0.003 ^g
Manganese	0.020–0.470		0.05 ^e	0.35 ^f
Mercury	0.0001–0.0002		0.002 ^e	0.00005 ^d
Selenium	0.000–0.001		0.01 ^e	0.02 ^g
Silver	<0.030		0.05 ^e	0.0001 ^g
Zinc	0.000–0.060		5 ^c	0.0004 ^d

^aData for the Green River represent the range of values reported at Sebrec in 1977 by the Ohio River Valley Water Sanitation Commission (1978) and at Beech Grove in Water Year 1975 by the U. S. Geological Survey (1977).

^bData from J. J. Geraghty, D. W. Miller, F. Van der Leeden, and F. L. Troise, *Water Atlas of the United States*, 3d ed., Water Information Center, Inc., Port Washington, N.Y., 1973.

^cData from U. S. Environmental Protection Agency, 1977.

^dData from U. S. Environmental Protection Agency, 1976.

^eData from U. S. Environmental Protection Agency, 1975.

^fLowest concentration lethal to fish. Data from R. M. Gushman, S. G. Hildebrand, R. H. Strand, and R. M. Anderson, *The Toxicity of 35 Trace Elements in Coal to Freshwater Biota: A Data Base with Automated Retrieval Capabilities*, ORNL/TM-5793, Oak Ridge National Laboratory, Oak Ridge, Tenn., 1977.

^gApplication factor recommended in ref. d multiplied by the lowest concentration reported as the 96-h LC90, the concentration lethal to 50% of the test organisms in 96 h, in ref. f.

Surface waters in the region are generally moderately hard, with reported values for the Green River ranging to extremely hard and with some trace elements (cadmium, copper, iron, lead, manganese, mercury, and zinc) reaching concentrations in excess of criteria.

Although the Green River fishery is characterized by low productivity and a pollution-tolerant biota, the river supports a mixed warmwater fishery, including carp, largemouth bass, smallmouth bass, bluegill and other sunfish, crappie, muskellunge, white perch, buffalo, and white bass. Dominant plankton include diatoms, green and blue-green algae, rotifers, copepods, and cladocerans. Tubificids, chironomids, and oligochaetes dominate the benthic invertebrates. Few macrophytes are found in the channelized portion of the Green River.⁴⁸ Williams Creek, fed by a small stream at the eastern boundary of the site, contains river carpsucker, highfin carpsucker, and bluegill. Gizzard shad, freshwater drum, black crappie, and largemouth bass have been collected from the slough of the stream, which enters the site from the north and flows into the Green River midway between the northern and southern limits of the site.

Impoundment and pollution of the Green River has resulted in the loss of a once-diverse assemblage of mussels.⁴⁹ Kentucky contains five mussels Federally designated as endangered.⁵⁰ Of these, only the pink mucket pearly mussel (*Lampsilis orbiculata orbiculata*) and the rough pigtoe pearly mussel (*Pleurobema plenum*) are reported for the Green River between locks 4 and 5 in Butler County. The pink mucket distribution in the Green River is reported for only the reach above Mammoth Cave. Thus, neither would be expected in the vicinity of the Equality site.

The Kentucky list for threatened and endangered species is limited to those species on the Federal list. Occurrence of these species at the Equality site is unlikely. The mud darter (*Etheostoma asprigens*) and the longhead darter (*Percina macrocephala*), which are considered rare or threatened fish species in Kentucky but are more abundant elsewhere, are also restricted to upper reaches of the Green River system in Kentucky.⁴⁴

3.3.3 Air

Northwestern Kentucky's climate is continental: the area is subject to wide extremes of temperatures and precipitation. Mean monthly temperatures range from 1°C (33°F) in January to 26°C

(78°F) in July. Annual precipitation averages around 100 cm (40 in.); March is the wettest month, and October is the driest. Mean annual snowfall is about 30 cm (12 in.). Winds are moderate in the area, averaging about 3.5 m/s (8 mph), with a predominant direction of south to southwest. Northern Kentucky is subject to a variety of storms. Winter storms with high winds, low temperatures, and heavy snowfall occur infrequently. Ice storms or sleet can occur from October through April and present major hazards to utility wires and transportation.

The alternative Equality site is in the Evansville-Henderson-Owensboro Interstate Air Quality Control Region (AQCR 77). Data are being collected in Ohio County about 29 km (18 miles) south-east of the site area. The Ohio County site is representative of conditions at the Equality site because of its rural nature, location away from major pollution sources, and general meteorological and topographic similarity. All measured SO₂ concentrations in Ohio County are within Kentucky standards. Concentrations of total suspended particulates (TSP) exceeded the secondary annual standard of 60 µg/m³; TSP levels were measured to be 63 µg/m³ at two sites. One site exceeded the secondary 24-h standard of 150 µg/m³, with a single measurement of 156 µg/m³ (ref. 51). Fugitive generation of particles from agricultural activities, mining, or transportation is the most likely source of TSP concentrations in the area.

The Tennessee Valley Authority's Paradise Steam Plant, located near the Equality, Kentucky, site, has sulfur dioxide (SO₂) monitors to the north of the plant that show SO₂ concentrations to also be in compliance.⁵² Monitoring site No. 23 of Paradise Steam Plant recorded an annual average of 23 µg/m³, a second highest 3-h reading of 950 µg/m³, and second highest of the 24-h reading recorded at 275 µg/m³. Although these currently do not violate National Ambient Air Quality Standards, levels at the Equality site are higher than at the proposed site at Fort Martin, West Virginia, for the 3-h and 24-h averages.

3.3.4 Economic, social, and cultural

3.3.4.1 Population

The Equality site and its immediate surrounding area is sparsely populated. The site area of approximately 400 ha (1000 acres) contains ten residences, most of which are located in the hills. The average population density of all Ohio County is only 37 persons per square mile. In 1970, only 14% of the county's total population was classified as urban, compared with a statewide average of 52%. Table 3.28 indicates that Ohio County's population grew by 6% from 1960 to 1970 and that McLean and Muhlenberg Counties experienced slight declines in population during the same period, while the more urbanized county of Daviess experienced a sizeable increase. The 1970 to 1980 period showed an overall growth rate for the entire impact region of 14%, with 16% growth in Ohio County during that same period. The rapid urbanization of the Owensboro area, which occurred between 1960 and 1970, has leveled off substantially in the last ten years, and the remaining impact area is predicted to remain essentially rural for the foreseeable future.

Table 3.28. Impact area population growth from 1960-1980

County	1960	1970	1980	Change from 1960-80 (%)
Ohio	17,840	18,790	21,845	+22
Daviess	70,708	79,486	85,702	+21
McLean	9,382	9,062	11,058	+18
Muhlenberg	27,791	27,537	32,315	+16

Sources: Mohammed Tauqi, Kentucky State Planning Office, personal communication, Nov. 25, 1980; U.S. Census Bureau, personal communication based on preliminary figures from the 1980 census of population, Nov. 25, 1980.

3.3.4.2 Housing

Table 3.29 presents data on the housing stock in the Equality impact area. Between 1970 and 1980, growth in the number of housing units varied from a low of around 10% in rural McLean and Ohio counties to a high of 26% in more metropolitan Daviess County.

Sources from the Green River Area Development District and the Hartford city offices indicate that there is currently a shortage of housing in the four-county impact area. Available housing is relatively expensive, and the construction labor force is inadequate to handle existing

Table 3.29. Housing stock and vacancies in the Equality, Kentucky, impact area

	Total housing		Percentage of change
	1970	1980	
Ohio County	6,103	6,753	10
Hartford	1,142	1,248	9
Beaver Dam	1,764	2,216	26
Daviess County	24,011	31,631	32
McLean County	3,055	3,316	9
Muhlenberg County	8,862	10,142	14

Sources: Mohammed Tauqi, Kentucky State Planning Office, personal communication, Nov. 25, 1980; Cindy Martz, Green River Development District, personal communication, Nov. 25, 1980; U.S. Census Bureau, personal communication based on preliminary figures from the 1980 census of population, Nov. 25, 1980.

demand (personal communications, Katherine Maddox, City Clerk of Hartford, Kentucky, to Elaine Llewellyn, November 25, 1980; Cindy Martz, Green River Area Development District to Elaine Llewellyn, November 25, 1980). Statistics from the 1970 Census that attest to the rural character of the impact area include the high rate of overcrowding (10.4% of all housing units), and the large number of dwellings with inadequate plumbing facilities (21.9% for the entire area and 34.5% for Ohio County).⁵³

3.3.4.3 Public services

Water and sewer. Table 3.30 lists water and sewerage statistics for the four counties in the Equality impact area. Water supplies in Ohio County are close to being fully used by current customers. The same is true of the sewerage system where average daily flow nearly meets the system's design capacity level. Muhlenberg and Daviess Counties appear to have greater additional capacity for new customers for their water systems; however, Muhlenberg County's sewer system is in need of additional capacity. McLean County is in the safest position in terms of available capacity for both water and sewerage. As for future additions, ten miles of pipeline have recently been added to the Central City water plant in Muhlenberg County to serve an additional 180 customers. McLean County has planned expansions at its Calhoun Water Works and at its sewerage plant in the Island Water Department System.

Schools. The Equality impact area's school systems have experienced fairly stable enrollment over the past decade with the exception of substantial increases in the Owensboro/Daviess County districts. Unused capacity in all Daviess County School districts currently totals more than 4500 seats. Concerning the other counties of the impact area, there are unused capacities of 225 spaces in Ohio County, 800 in McLean, and 950 in Muhlenberg. Minor additions and general upgrading work are planned for several facilities (Earl Russell, Lloyd Tarter, Mildred Cole, and Earl Devine, personal communications, December 1, 1980).

3.3.4.4 Transportation

One U.S. highway (U.S. 231), two state routes (69 and 85), and a local access road (the Equality road) serve the immediate Equality site area. U.S. 231 is a two-lane paved road, varying in total width from 6.2 m (20 ft) to 7.4 m (24 ft), that carries 10% truck traffic. State Route 69 has a 6.2 m (20 ft) bituminous surface and supported 2087 vehicles during an average 24-h period in 1979. State Route 85 has a 5.5 m (18 ft) bituminous surface and supported 1728 vehicles in a similar 24-h period in 1979. The Equality site access road also has a 5.5 m (18 ft) surface. All of these roads are without shoulders and run over rolling terrain with little area for passing. Six percent of the traffic on the latter three roads is truck traffic (David Doctor, Green River Area Development District, personal communication, November 24, 1980).

Figure 3.11 gives the hourly capacities and peak hour counts for selected road sections at the Equality site. Currently, the road system does not experience heavy use.

A branch rail line runs between Hartford and Moorman, a hamlet just east of the Equality site. The section has 24 km (15 miles) of single track and is operated under track orders at a maximum speed of 25 mph. On a Federal Class scale of I (worst) to IV, the track is rated as Class II. Fewer than six trains per week run on the track, which carries about 1 million gross tons per year. There are no weight or height limitations on the section, and abandonment of the eastern-most part of the section is being considered.⁵⁴

Table 3.30. Water and sewerage statistics for the Equality, Kentucky, impact region10³ gpd

	Water			Sewerage	
	Average daily consumption	Peak daily consumption	Plant capacity	Average daily flow	Design capacity
Ohio County					
Beaver Dam Municipal Water and Sewer System	450	550	a	400	For pop. of 6000
Hartford Municipal Water and Sewer System	325	375	500	275	300
Ohio County Water District	780	1,137	1,500		
Daviess County					
Owensboro Municipal Utility	10,000	13,524	20,000		
Owensboro Sewer Commission				8,500	12,000
McLean County					
Calhoun Water Works	250	a	430	130	200
Island Water Department	66	80	288	150	200
City of Livermore Utilities	200	250	500	Individual septic tanks	
Muhlenberg County					
Greenville Utilities Commission	339	397	750	300	500
Muhlenberg County Water District	750	a	a		
Plant No. 1	70	a	72		
Plant No. 3	233	a			
Central City Municipal Water and Sewer Commission	1,460	1,599	2,000	At capacity	600

^aNot available.

Source: Kentucky Department of Commerce, 1979.

The Green River is navigable and has locks at Calhoun and Spottsville to the north of the site. Tonnage carried on the river has declined from 16.9 million in 1970 to 10 million in 1978. The Green River system capacity is 60 million tons (Al Chandler, Cincinnati Corps of Engineers, personal communications, November 24, 1980).

3.3.4.5 Economic base

The economy of the overall impact area depends largely on agricultural and mining activities. Table 3.31 presents data on jobs by type of activity for the four counties. Ohio County's economic base is depending more heavily on high sulfur coal in recent years, and agricultural activities remain strong. Figures from the Kentucky State Planning Office indicate that agricultural employment has declined from 16% to 4% in the past years, but the market value of agricultural products in Ohio County reached \$15,388,000 in 1978 (Pam Riley, Kentucky Department of Commerce, personal communication, December 4, 1980).

The metropolitan area of Daviess County contains a broad industrial base, and the rest of the county maintains some agricultural activities. In McLean County, the economy remains primarily agricultural, with mining activities providing the second largest employment and with a small amount of industrial activity. Muhlenberg County remains predominantly in the coal mining business, with some agricultural activity and an expanding industrial sector.

Wholesale and retail total sales for 1977 are presented in Table 3.32. Statistics from the Bureau of the Census indicate that trade volumes have increased by 28% in retail trade and by 72% in wholesale trade in Ohio County in the past five years.⁵⁵ Other counties in the impact area have experienced from 50 to more than 150% increases in trade.

3.3.4.6 Labor and income

Table 3.33 lists selected statistics on labor and income for the impact region. Ohio County, where the SRC-II facility may be located, has the lowest median income of the four county region, and experienced a negligible 4% growth in employment over the past decade. Employment is expected

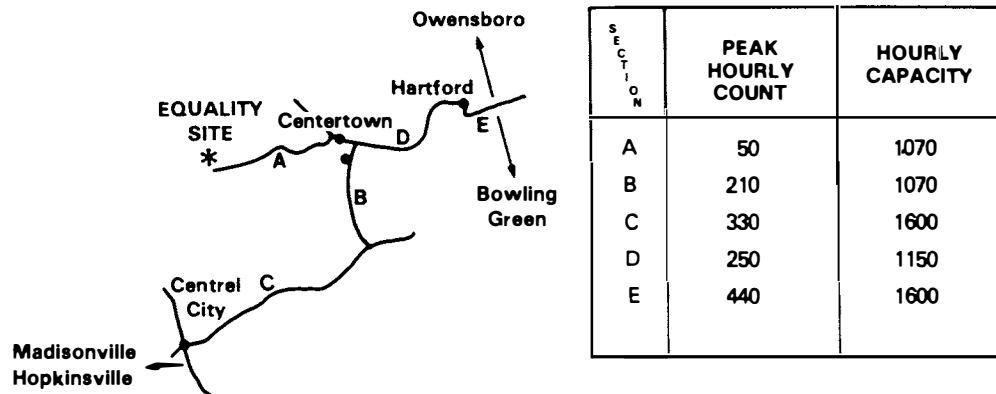


Fig. 3.11. Current peak hourly traffic and hourly capacity for major roads in the Equality, Kentucky, impact region.

Table 3.31. Number of jobs by type of employment in the Equality, Kentucky, impact area, 1979

	Ohio	Daviess	McLean	Muhlenberg
Mining and quarrying	2,343 ^a	812	Unavailable	3,175
Manufacturing	998	6,816	317	698
Wholesale/retail trade	753	7,315	385	1,655
Transportation and utilities	155	2,470	21	336
Finance, insurance, and real estate	141	1,172	54	208
Contract construction	136	2,151	52	391
Service/state and local government	1,185	8,485	446	1,742
Other	5	150	7	65
All industrial ^b	8,176	29,371	1,320 ^c	8,270
Agricultural ^d	537	1,332	473	388
Total	8,713	30,703	1,793	8,658

^aThis figure is for mining only and is therefore a low estimate for this sector.

^bFigures are 1979 average annual number of jobs by place of employment.

^cThis total does not include undisclosed mining employment and is therefore lower than the actual total.

^dAgricultural figures are 1979 employment by residence.

Source: Pam Riley, Kentucky Department of Commerce, personal communication, Dec. 4, 1980.

Table 3.32. Wholesale and retail trade volumes for the Equality, Kentucky, impact area
10⁶ \$

	County			
	Ohio	Daviess	McLean	Muhlenberg
Total 1977 sales				
Wholesale trade	13.3	360.4	25.8	120.3
Retail trade	46.7	302.1	19.1	94.1

Table 3.33. Labor and income statistics for the Equality impact area

County	Employment in 1980	Percentage of unemployed 1980	Per capita family income in 1980 (\$)
Ohio	8,713	7.8	6,070
Daviess	30,703	7.2	7,647
McLean	1,793	8.5	5,510
Muhlenberg	8,658	9.6	6,648

Source: Pam Riley, Kentucky Department of Commerce, December 4, 1980.

to rise over the next decade, however, with the Kentucky Planning Office predicting a 24% growth rate. Daviess County has experienced the largest gain in employment in conjunction with its increased urbanization over the same period. McLean County showed a decrease in employment, but it is predicted to grow at a high rate similar to that predicted for Ohio County in the next ten years. Muhlenberg County has increased its employment primarily through an increase in mining activity.

3.3.4.7 Local government taxation

All property in Kentucky is assessed at 100% of fair cash value. State and local tax rates for 1978 are provided in Table 3.34 for the Equality site area and the immediate vicinity.

Table 3.34. Combined State and local rates per \$100 valuation

	Inside city of Beaver Dam	Inside city of Hartford	Outside city*
Land and buildings	\$0.864	\$0.944	\$0.564
Manufacturing machinery, raw materials, goods in process, pollution control equipment	0.150	0.150	0.150
Finished goods, office equipment, vehicles, other tangibles	0.999	1.079	0.699
Intangibles (accounts, records, bonds, notes, etc.)	0.250	0.250	0.250
Leaseholds in I. R. bond financed plants	0.015	0.015	0.015

Source: *Industrial Resources, Ohio County*, Kentucky Department of Commerce, 1979.

In addition to the general property tax, a 3% tax is levied by the county on utility bills. All areas may exempt new manufacturing from municipal property taxes for a period of 5 years.

3.3.4.8 Historical and archaeological resources

A group of private citizens in Ohio County maintains a local Survey of Historic Places that currently lists nine sites of local significance, all submitted by volunteers. To date, the state of Kentucky has conducted no comprehensive historic site survey in the area, and no Ohio County sites are currently on the National Register of Historic Places (Marsha Richmond, Kentucky Heritage Commission, personal communication, December 2, 1980).

Initial archaeological surveys of the bottomlands along the Green River indicate that further reconnaissance in the immediate site area could uncover up to 25 or 30 sites of some archaeological

significance. Portions of the Ohio County bottomlands are known to have been prehistorically occupied. Evidence of this has been found in a site north of the Equality area where surveys have produced large middens (shell mounds) dating back to 2500 B.C. to 1500 A.D. Two sites east of Equality near Williams Creek are listed with the state as archaeologically significant. One or two of the midden sites are sufficiently unique to warrant consideration for the National Register (Dr. Burley Clay, State Archaeologist, personal communication, December 2, 1980).

3.4 ALTERNATIVE SITE 2: RAVENSWOOD, JACKSON COUNTY, WEST VIRGINIA

Selection of the Ravenswood site (see Fig. 3.12) for comparison with the Fort Martin site for the proposed SRC-II project was based on the evaluation of reconnaissance-level data (Fig. 2.5, Sect. 2.3.2.2). The site selection methodology used is discussed in Appendix B.

3.4.1 Land

3.4.1.1 Location

The alternative Ravenswood site is 641 ha (1585 acres) located adjacent to the Ohio River in Jackson County, West Virginia, on State Route 2. Meigs County, Ohio, is directly across the Ohio River to the west of the site, and the town of Ravenswood, West Virginia, is about 8 km (5 miles) to the northeast. Seventy-five km (47 miles) to the south, on Interstate 77, lies Charleston, West Virginia. Parkersburg, West Virginia, is 65 km (41 miles) to the north, also on I-77 (Fig. 3.13). The Ohio River forms the western boundary of the site, and the Kaiser Aluminum and Chemical Company's Ravenswood Works lies on an adjacent tract to the north. The site consists of gently sloping alluvial river terrace deposits with hills forming the eastern half of the area. A wooded small-stream valley, which carries site runoff as well as runoff originating in the hills, crosses the site. A Chesapeake and Ohio rail line parallels the Ohio River along the western edge of the site.

3.4.1.2. Land use and development

The Ravenswood site, not currently zoned, includes four parcels: Kaiser Aluminum and Chemical, 405 ha (1000 acres); McCoy, 30 ha (74 acres); Pinned, 59 ha (146 acres); and Eastern Star, 147 ha (363 acres). The site consists of a narrow floodplain rising gently to a broad river terrace and then into hills at the eastern edge of the site. Ravines are present in the hilly eastern part of the site. Nearly half of the site is woodland; the rest is used for agricultural purposes. Slightly more than half of the site is mapped as prime farmland (determination based on material provided to G. W. Suter, Oak Ridge National Laboratory, by W. F. Hatfield, U.S. Soil Conservation Service, Morgantown, W. Va., Dec. 12, 1979). Most of the remainder of the site appears to be good quality farmland or pasture. Primary crops are corn and soybeans. The Keraland Recreation Area in the eastern portion of the site is a small facility operated by Kaiser Aluminum and used by the immediate population. The Kera Lakes area, located about 0.8 km (0.5 miles) northeast of the site, may also be used for recreational purposes. The small community of Ripley Landing, immediately south of the site, consists of several dozen residences.

In addition to the immediate site, a much broader area will receive land use and socioeconomic impacts resulting from construction and operation of the SRC-II facility. This larger area is generally referred to as the socioeconomic impact region and consists of those jurisdictions that will house the facility itself and the bulk of the workers required to build and operate it. Jackson, Mason, Kanawha, and Wood counties in West Virginia and Gallia and Meigs counties in Ohio will absorb most of the population growth engendered by the SRC-II project. Because of their large existing populations and the relatively small number of in-moving workers they are likely to house, project-related impacts in Kanawha County, where Charleston is located, and Wood County, which surrounds Parkersburg, are expected to be minor (Sect. 4.4.4.1). For this reason, the socioeconomic impact region will include only the rural counties of Jackson, Mason, Gallia, and Meigs.

As can be seen from Table 3.35, the four counties that will be most directly affected by the SRC-II plant are all predominantly rural; relatively small amounts of land are urban, and large amounts are devoted to forests and agriculture. Jackson County, one of the three fastest growing counties in West Virginia, is expected to increase its use of land for residential and commercial purposes in the decade ahead (Dick Kennedy, Jackson County-Chamber Development Authority, personal communication, November 26, 1980). Although Mason County, West Virginia, is not growing as quickly, it is also likely to expand its residential sector. In Gallia County, Ohio, residential developments in the 1970s moved away from the urban center of Gallipolis into the outlying area, and this trend will probably continue (John Clark, Ohio Valley Regional Development District,

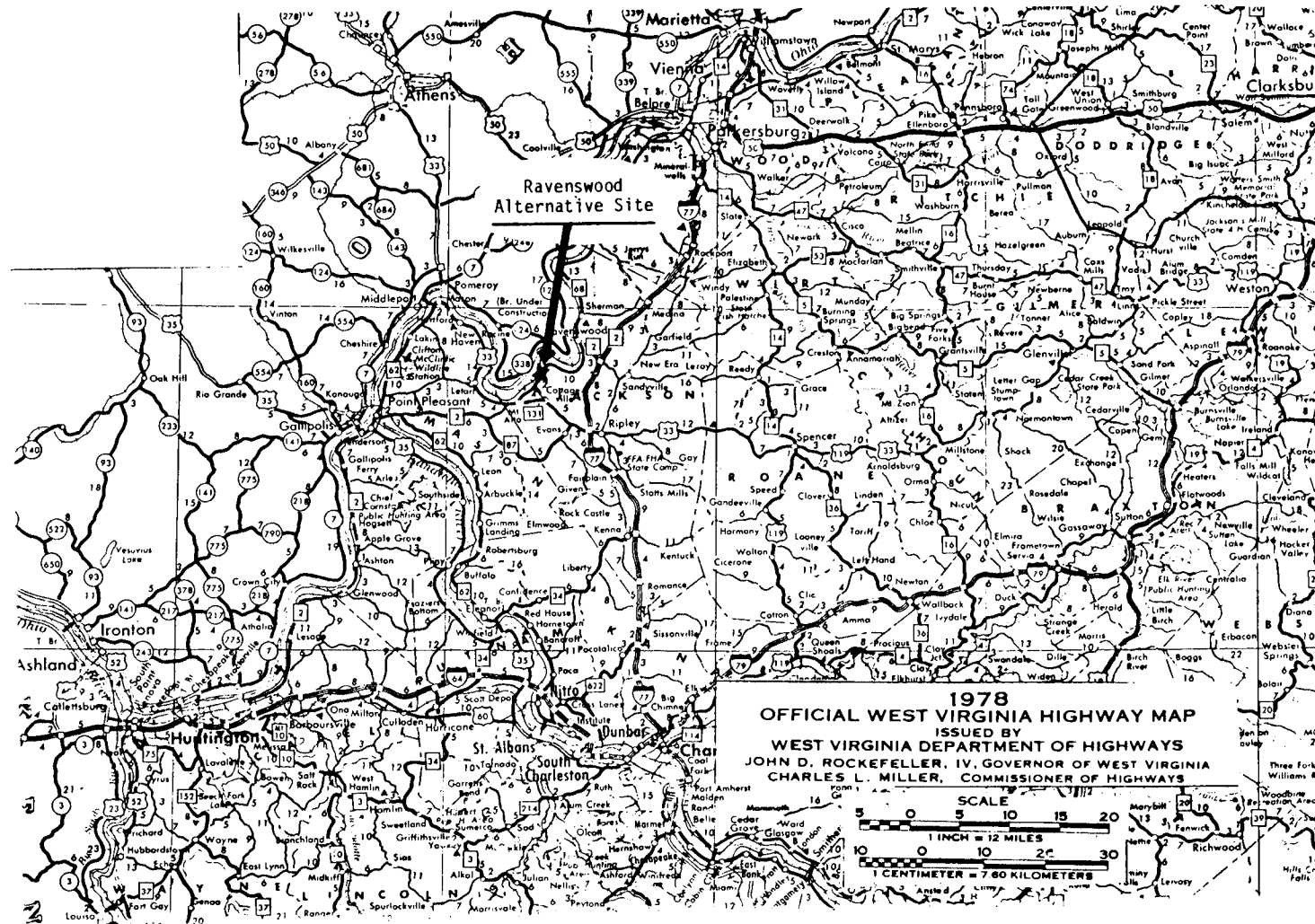


Fig. 3.13. Regional location of the Ravenswood alternative site.

Table 3.35. Current land use in socioeconomic impact region

	Jackson County, West Virginia ^a	Mason County, West Virginia ^b	Gallia County, Ohio ^c	Meigs County, Ohio ^d
Urban/built-up	1.8%	0.9%	3.9%	3.5%
Agricultural	26.0%	35.4%	40.1%	25.8%
Forest	71.0%	57.2%	53.4%	58.2%
Other	1.1%	6.0%	2.6%	12.7%

^aRichard Kennedy, Jackson County Chamber Development Authority, personal communication, Nov. 26, 1980.

^bFloyd Mays, Virginia Region 2 Planning and Development Council, personal communication, Nov. 26, 1980.

^cJohn Clark, Ohio Valley Regional Development District, personal communication, Nov. 26, 1980.

^dGail Reinhardt, Ohio Department of Economic and Community Development, personal communication, Nov. 26, 1980.

personal communication, November 26, 1980). Finally, Meigs County also expects an expansion in its residential and industrial land use sectors, with a corresponding drop in agricultural acreage.⁵⁶

Neither Jackson nor Mason counties in West Virginia have county-wide land use controls, but the town of Ravenswood in Jackson County does have zoning and subdivision regulations (Dick Kennedy, Jackson County-Chamber Development Authority, personal communication, November 26, 1980), and Mason County's Point Pleasant has a local zoning ordinance (Floyd Mays, West Virginia Region 2 Planning and Development Council, personal communication, November 25, 1980). In Ohio, both Gallia and Meigs counties have county-wide subdivision regulations, and the town of Gallipolis has a zoning ordinance (John Clark, Ohio Valley Regional Development District, personal communication, November 26, 1980; Greg Keller, Buckeye Hills-Hocking Valley Regional Development District, personal communication, November 25, 1980).

3.4.1.3 Geology and soils

The site consists of gently sloping alluvial river terrace deposits; hills form the eastern half of the area, and a small wooded stream valley carries site runoff as well as runoff originating in the hills surrounding the site.

Soils

Site soils are classified in the Ashton-Wheeling-Laken association, and soils mapped on the site are predominantly of the Wheeling series. These soils are silty, sandy loams to gravelly loams and have formed on the Ohio River sand and gravel alluvium. Soils are good for agriculture in level and gently sloping parts of the site (slightly more than half the site is mapped as prime farmland). Slopes lacking vegetative support are subject to erosion. A small area near the northern site boundary has been excavated for sand and gravel.

Geology

The site is underlain by 18 to 21 m (60 to 70 ft) of alluvium that fills the incised Ohio River valley. Bedrock beneath the alluvium is interbedded sandstone, siltstone, and shale of the Permian Age Dunkard Group. Bedrock crops out in the hills east of the site. The site lies on the western limb of the north-trending Parkersburg syncline. No evidence exists to indicate faulting in the immediate area. Seismic risk in the area is low; the site lies in seismic risk zone 1. Mineral resources of the site include sand and gravel deposits in the alluvium. The region has gas and oil reserves, but these are not developed on the site.

3.4.1.4 Terrestrial ecology

About one-third of the Ravenswood site is forested. Most of the forest land is mature bottomland mesophytic forest associated with Spring Creek. This 52-ha (128-acre) woodland, unusual in its maturity, lack of disturbance, and composition, should be avoided during construction and operation. However, without site plans, final determination is not possible. The herbaceous flora of

this woodland includes the false rue-anemone, which is rare in West Virginia and which has an unofficial State classification of "scientific interest." A backwater pond near the mouth of Spring Creek creates habitat for waterfowl, amphibians, and other semiaquatic animals. A narrow strip of riparian floodplain forest lies between the railroad tracks and the Ohio River. Most of the remainder of the site consists of cropland. Although no formal biological survey has been performed at this site, the unusual qualities of the Spring Creek forest have attracted the attention of members of local conservation organizations and universities. This interest has led to requests that Kaiser Aluminum preserve the site and to listing of the site by the West Virginia Heritage Trust Program.⁵⁷

The Ravenswood site does not constitute "critical habitat" for any species Federally listed as threatened or endangered, although the bald eagle and arctic peregrine falcon may make casual use of the site during migration, and the Indiana bat may use the site during the summer.

3.4.2 Water

3.4.2.1 Surface water hydrology

The site is located on alluvial terrace deposits adjacent to the Ohio River. Spring Creek carries surface runoff from the northern and central portions of the site and also drains a small watershed in the hills east of the site. A backwater embayment forms a pond and wetland area at the mouth of the creek. The southern and eastern parts of the site are drained by overland flow into Lick Run and directly to the Ohio River. During periods of high flow, flooding occurs in the Spring Creek and Lick Run areas. Flood elevations at Ohio river mile 230 were provided by the Corps of Engineers, Huntington, West Virginia, District. Flood frequency and stage elevation at the site are:

Flood frequency (year)	Stage elevations	
	m	ft
100	180.9	588.0
50	180.0	585.1
20	178.8	581.2
10	177.9	578.0
5	176.9	575.0
2	175.5	570.4
1	174.5	567.0

During a 100-year frequency flood, a large backwater would form in the Spring Creek and Lick Run valleys, and water table elevations in the alluvium would be expected to rise significantly. Flooding would affect tributary valleys and the western edge of the site adjacent to the river (Fig. 3.14 and Appendix D).

3.4.2.2 Groundwater

Water is available from the Ohio River, from the alluvial aquifer, and from bedrock aquifers. Based on data from similar aquifers, groundwater yields of the alluvium range from 3×10^{-4} to $0.01 \text{ m}^3/\text{s}$ (5 to 105 gpm), and yields from bedrock are 6.3×10^{-5} to $0.02 \text{ m}^3/\text{s}$ (1 to 300 gpm). Specific data on groundwater quality and availability are not currently available.

3.4.2.3 Surface water quality and aquatic ecology

Table 3.36 presents a range of flow and water quality values reported from Ohio River stations upstream (mile point 204) and downstream (mile point 260) from the Ravenswood site. The table also presents water quality data for the region in which the Ravenswood site is located. For comparison, drinking water standards and criteria for the protection of aquatic biota are also listed. Surface waters in the region are generally moderately hard; the Ohio River in the Ravenswood area is moderately to very hard. Some trace element concentrations in the Ohio River (cadmium, copper, iron, lead, manganese, mercury, and zinc) exceed drinking water and/or aquatic biota criteria. Additionally, sulfate levels in the Ohio River and regional total dissolved solids (TDS) levels may approach drinking water standards.

Dominant fish (by weight or numerical abundance) in the Ohio River in the region of the Ravenswood site (mile point 200 to mile point 300) include emerald shiner, mimic shiner, channel catfish, carp, and gizzard shad. Sunfish, crappie, white bass, largemouth bass,

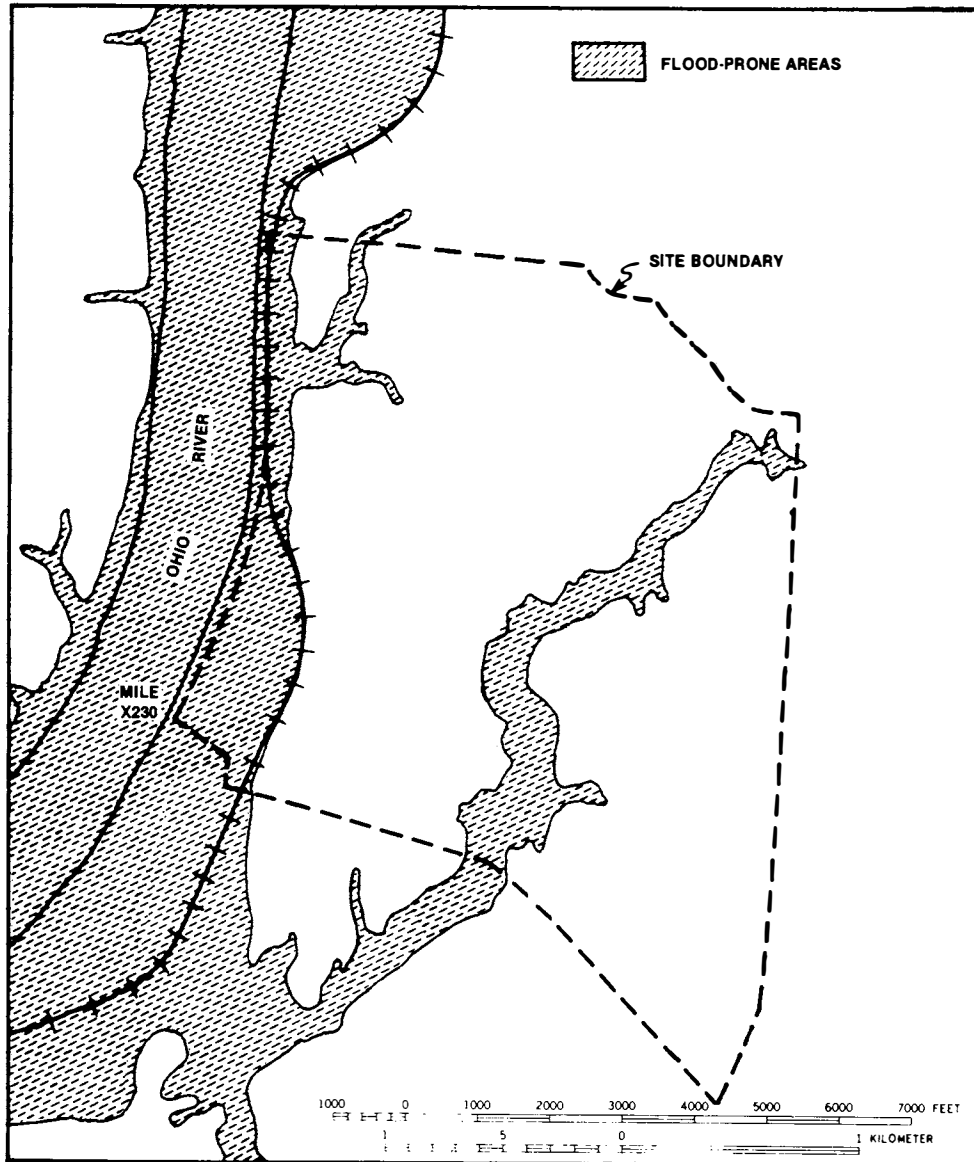


Fig. 3.14. One-hundred-year floodplain areas of the Ravenswood, W. Va., site.

and smallmouth bass, although not numerically abundant, are important sport fishes.⁵⁸ During a November 1979 site visit by ORNL staff, Spring Creek appeared to be moderately sedimented, a result of runoff from the cleared areas in the upper part of its watershed (off site) and the low gradient drainage onsite, with isolated riffle areas. On the Ravenswood site, Spring Creek has a wooded riparian zone about 200 m wide.

Aquatic species Federally designated as endangered or threatened are not expected to occur at the Ravenswood site. The only Federally designated aquatic species reported from West Virginia,⁵⁰ the endangered pink mucket pearly mussel (*Lampsilis orbiculata orbiculata*) and tubercled-pearly mussel (*Dysnomia tourlosa*) within West Virginia are found only in the Kanawha River.⁵⁹ The State does not maintain its own endangered species list but rather considers the Federal list applicable (James Rawson, Division of Wildlife Resources, personal communication to Kurt Philipp, Roy R. Weston Co., Oct. 23, 1979).

3.4.3 Air

West Virginia's climate is continental with warm humid summers and cool winters. Average daily maximum temperatures range from near 6°C in January to near 30°C in July. Annual precipitation

Table 3.36. Water quality and flow in the vicinity of the Ravenswood site

Concentrations are in mg/liter unless otherwise shown

Variable	Ohio River ^a	Regional ^b	Drinking water standard	Aquatic biota protection limit
Flow, m ³ /s	300–6646			
pH, units	6.5–8.3		6.5–8.5 ^c	6.5–9.0 ^d
Temperature, °C	0.0–28.7			
Total suspended solids	5–306	<270		
Dissolved oxygen	6.1–14.0		5.0 ^d	
Hardness, as CaCO ₃	86–230	60–120		
Alkalinity, as CaCO ₃	27–72			>20 ^d
Sulfate	48–213		250 ^c	
Chloride	14–70		250 ^c	
Total dissolved solids		120–350	500 ^c	
Arsenic	<0.001–<0.010		0.05 ^e	0.3 ^f
Barium	0.010–0.110		1 ^e	104 ^f
Cadmium	0.001–0.007		0.010 ^e	0.0012–0.120 ^d
Chromium	<0.004–0.016		0.05 ^e	0.100 ^d
Copper	0.006–0.062		1 ^c	0.0009 ^g
Iron	0.100–9.000		0.3 ^c	1.0 ^d
Lead	0.010–0.050		0.05 ^e	0.003 ^g
Manganese	0.040–0.620		0.05 ^c	0.35 ^f
Mercury	<0.0005–0.0008		0.002 ^e	0.00005 ^d
Selenium	<0.001–<0.005		0.01 ^e	0.02 ^g
Silver	<0.001		0.05 ^e	0.00001 ^g
Zinc	0.020–0.190		5 ^c	0.0004 ^g

^aData for Ohio River are the range of values reported for 1977 at Belleville (RM 203.9) and Kyger Creek (RM 260.0) by the Ohio River Valley Water Sanitation Commission (1978).

^bData from J. J. Geraghty, D. W. Miller, F. Van der Leeden, and F. L. Troise, *Water Atlas of the United States*, 3d ed., Water Information Center, Inc., Port Washington, N.Y., 1973.

^cData from U. S. Environmental Protection Agency, 1977.

^dData from U. S. Environmental Protection Agency, 1976.

^eData from U. S. Environmental Protection Agency, 1975.

^fLowest concentration lethal to fish. Data from R. M. Cushman, S. G. Hildebrand, R. H. Strand, and R. M. Anderson, *The Toxicity of 35 Trace Elements in Coal to Freshwater Biota: A Data Base with Automated Retrieval Capabilities*, Report ORNL/TM-5793, Oak Ridge National Laboratory, Oak Ridge, Tenn., 1977.

^gApplication factor recommended in ref. in *c* multiplied by the lowest concentration reported as the 96-h LC90, the concentration lethal to 50% of the test organisms in 96 h, in ref. in *f*.

averages 101 cm and occurs 211 days per year; snowfall averages 58 cm per year. Fog restricting visibility to less than 11 km (7 miles) averages 204 days per year; for 46 of those days, visibility is restricted to less than 400 m (0.25 mile). Thunderstorms can be expected 46 times annually; hail is rarely (twice per year) noted. Wind speeds are light, averaging less than 3 m/s.⁶⁰ Wind direction is largely from the south, but local variations in terrain effectively channel the wind. The alternative Ravenswood site area, located in AQCR 179, has been judged by the State to be attaining all ambient air quality standards, but no monitors are sited in the area.⁴⁰ However, emissions from the neighboring Kaiser Aluminum Company facility may be adversely affecting the air quality of the site.

3.4.4 Economic, social, and cultural resources

As discussed in Sect. 3.4.1.2., the socioeconomic impact region consists of Jackson and Mason counties in West Virginia and Gallia and Meigs counties in Ohio. The bulk of the project-induced impacts can be expected in these counties; for this reason, these counties will be the focus of the following discussion.

3.4.4.1 Population

The past and current populations of Jackson, Mason, Gallia, and Meigs counties and the major urban centers for each are presented in Table 3.37. Although all four counties have experienced some population growth since 1960, Jackson County's rate of increase has been both

Table 3.37. Population for counties and major municipalities in socioeconomic impact region, 1960-1980

County	Municipality	Population			Change 1960-1980 (%)
		1960	1970	1980	
Jackson, West Virginia		18,541	20,903	25,597	38.1
	Ripley	2,756	3,244	3,424	24.2
	Ravenswood	3,410	4,240	4,126	21.0
Mason, West Virginia		24,349	24,306	26,763	9.4
	Pt. Pleasant	5,785	6,122	5,662	-2.2
Gallia, Ohio		26,120	25,239	30,152	15.4
	Gallipolis	8,775	7,490	5,601	-36.2
Meigs, Ohio		22,159	19,799	23,641	6.6
	Pomeroy	3,345	2,672	2,718	-18.7
	Middleport	3,373	2,784	2,967	-12.0

Source: U.S. Department of Commerce, Bureau of the Census, *Census of Population*, 1960, 1970, 1980 (Preliminary).

larger and more constant than that of the others, which all experienced some degree of decline before the onset of new growth in the 1970s. As mentioned earlier, Jackson County is one of three fastest growing counties in West Virginia.

3.4.4.2 Housing

The growth in the number of housing units in the four-county impact region during the last decade is shown in Table 3.38, as is the estimated magnitude of current vacancies. All four counties have increased their housing stock at a rapid rate in the last ten years.

Table 3.38. Housing stock and vacancies in socioeconomic impact region, 1970-1980

County	Total number of housing units ^a		Change 1970-1980 (%)	Vacancies in 1980 (%)
	1970	1980		
Jackson, West Virginia	6,898	9,342	35.4	3-5 ^b
Mason, West Virginia	8,193	10,224	24.8	"above average" ^c
Gallia, Ohio	8,201	11,480	39.9	3-5 ^{d,e}
Meigs, Ohio	7,278	9,290	27.6	<1 ^{f,g}

^aU.S. Department of Commerce, Bureau of the Census, *Census of Housing*, 1970, 1980 (Preliminary).

^bRichard Kennedy, Jackson County Chamber Development Authority, personal communication, Nov. 26, 1980.

^cCharles Conrad, West Virginia Housing Development Authority, personal communication, Dec. 4, 1980.

^dRalph Klein, Ohio Valley Regional Planning District, personal communication, Dec. 4, 1980.

^eBuckeye Hills—Hocking Valley Regional Development District, *Energy Impact Investment Strategy*, Draft, November 1980.

^fMeigs County Regional Planning Commission, *Housing Plan*, June 1979.

^gBased on figures from the municipalities of Pomeroy and Middleport.

In Jackson County, where the estimated vacancy rate is 3 to 5%, housing stock has increased by 35% in the last ten years. About 20% of all dwelling units are mobile homes, and 50% of the total housing stock is less than 20 years old. A current high level of residential construction indicated that growth in this area is likely to continue (Dick Kennedy, Jackson County-Chamber Development Authority, personal communication, November 26, 1980). In Mason County, the numbers of vacancies in both the rental and the buyer markets are substantial.

Although the number of multifamily units here has increased some in recent years, the overwhelming majority of local residents live in single-family homes. The mobile home market is currently very small, comprising about 3% of total housing stock (Tom Baldwin, West Virginia Region 2 Planning and Development Council, personal communication, December 4, 1980).

In Gallia County, Ohio, the vacancy rate for owner-occupied units is about 3%, and the vacancy rate for rentals is 5%, allowing some capacity for absorbing new growth. Residential construction has been substantial in recent years, and local housing authorities believe that the local market could respond to new growth in housing demand. In addition to traditional single-family units, mobile homes also form a viable component of the housing stock, particularly in the more rural areas of the county (Ralph Klein, Ohio Valley Regional Planning District, personal communication, December 4, 1980). Finally, in Meigs County, the growth in housing stock during the last ten years has barely kept pace with demand, resulting in an extremely tight local housing market. Traditional single-family dwellings are still by far the most popular, but mobile home use has increased rapidly in the last two decades because of the lower cost and the ease of placement on dispersed rural sites along major roads.⁶¹

3.4.4.3 Public services

Water and sewer. Table 3.39 shows current use and system capacity for the major water and sewer districts in the four-county impact region. The figures presented in Table 3.39 indicate that each of the four counties is currently approaching or exceeding design capacity in at least one of their major service districts for water, sewer, or both. In Jackson County, the Ravenswood water treatment facility is operating above design capacity, while in Ripley the average daily flow at the sewage treatment plant is right at the design figure. Improvements are being planned for the Ravenswood plant and are under consideration in Ripley.

Estimates of water use and capacity in Mason County are not available, but the current water supply is assumed to be adequate. The major sewage treatment facility in the area, however, has an average daily flow that nearly equals capacity, indicating that peak flow will routinely exceed plant design limits. Improvements are planned, but construction is not expected to begin until 1982, at the very earliest (Eric Hissom, West Virginia Region 2 Planning and Development Council, personal communication, December 4, 1980).

In Gallia County, Ohio, the average demand for water in the city of Gallipolis is less than the design capacity of the water supply system, but peak demand is currently equal to that capacity. The peak flow at the sewage treatment facility, 0.85 million gpd, is less than the 1 million gpd design capacity, but the quality of the effluent discharged from this primary treatment facility is extremely low, consistently violating EPA water quality standards. In addition, the facility has frequent pump station failures and is generally considered obsolete.⁶²

In Meigs County, problems have been identified with both the water and sewer systems. In the municipality of Pomeroy, the existing sewage treatment facility is currently pushed beyond its design capacity during peak flow periods. The ability of existing water and sewer lines to accommodate new housing units is also severely strained. In Middleport, the village's excess water storage capacity has been eliminated by past growth, and one of the village's sewage treatment lagoons is beginning to show signs of deterioration.⁶¹

Schools. In Jackson County, local schools currently seem able to absorb new growth. Recent school construction has created the capacity to accommodate almost 1000 additional students, and more improvements are planned. In Mason County, local officials feel that existing elementary schools could accommodate 300 more students and secondary schools could handle 400 more. In addition, planned improvements would increase this capability (Table 3.39).

In Gallia and Meigs counties, however, the situation is much different. Gallia County schools are currently at capacity, but planned improvements will change this condition if a school bond is approved by local voters. In Gallipolis, some room is available for growth in the school system as a whole, but conditions vary from school to school. No spare classrooms exist (Jack Moskovitz, Gallipolis School District, personal communication, December 4, 1980). In Meigs County, capacity also varies from school to school. Five of 19 county schools are currently at or over design capacity (Greg Keller, Buckeye Hills-Hocking Valley Regional Development District, personal communication, November 25, 1980).

3.4.4.4 Transportation

The Ravenswood site is served by road, rail, and water facilities. As shown in Fig. 3.15, the site is located on State Route 2. Travelling west from Ravenswood to the site and beyond to Point Pleasant, State Route 2 is a two-lane paved road, with 3.4-m (11-ft) lanes and 2.8-m (9-ft) shoulders. Heading east from Ravenswood to Interstate 77, State Route 2 widens to

Table 3.39. Essential public services in socioeconomic impact region

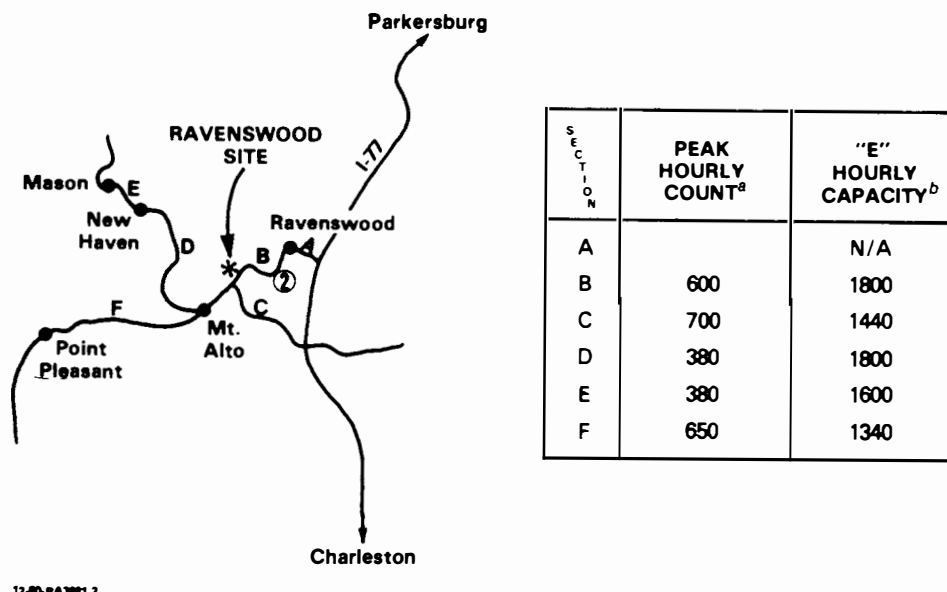
County/Service District	Water ^a			Sewer ^a			Schools		
	Current average use	Current treatment capacity	Planned improvement	Current average use	Current capacity	Planned improvements	Current use	Current capacity	Planned improvements
Jackson Co. W.Va.									
Ravenswood	0.58 Mgd ^b	0.5 Mgd	Yes	0.38 Mgd	0.75 Mgd		5633	6660	Yes
Ripley	0.3 Mgd	0.72 Mgd	Under con- sideration	0.25 Mgd	0.25 Mgd	Under con- sideration			
Mason Co., W.Va.									
Pt. Pleasant	c	c		0.52 Mgd	0.55 Mgd	Yes, may start in 1982.	5569	6269	Yes
Gallia Co., Ohio									
Gallipolis	1.75 Mgd	2.5 Mgd	Yes	c	1.0 Mgd		3271	3271	Yes (If tax is passed.)
Gallia Co. Water	0.4 Mgd	1.0 Mgd					2953	3250	
Meigs County, Ohio									
Pomeroy	0.3 Mgd	c		0.2 Mgd	0.27 Mgd		4789	c	
Middleport	c	c		c	c				

^a Figures are for major service districts in county.

^b Mgd = million gallons per day.

^c Information is not available.

Sources: Dick Kennedy, Jackson County Chamber Development Authority, Nov. 26, 1980; Ernie Hisson, West Virginia Region 2 Planning and Development Council, Dec. 4, 1980; Ohio Valley Regional Development Commission, *Energy Impact Assistance Plan and Supplemental Community Facilities Study*, 1980; and Buckeye Hills - Hocking Valley Regional Development District, *Energy Impact Investment Strategy*, November 1980.



12-85-PA3881.2

^a Level of Service "E" represents the peak number of vehicles traveling in both directions that can be accommodated by a given section of road. At this level of service, the smooth flow of traffic is subject to breakdown because vehicles are at minimum spacing. Because there is no room for error, this is *not* a desirable design load.

^b 1979–1980 actual traffic counts. The peak hour for Section B is 3:00–4:00 PM; for all other sections it is 4:00–5:00 PM.

Fig. 3.15. Current peak hourly traffic and hourly capacity for major roads in the Ravenswood, West Virginia, impact region.

four lanes. The other major road in the immediate area (in addition to the Interstate) is U.S. Route 33, which intersects State Route 2 1.6 km (1 mile) south of the proposed site. U.S. 33 is also a two-lane paved road, with lane width varying from 3.7 m (12 ft) near the site to 3.2 m (10.5 ft) near the town of Mason at the Ohio state line (Dan Rice, West Virginia Department of Highways, personal communication, November 24, 1980). Figure 3.15 shows current peak hourly traffic counts and peak hourly capacity for the major sections of road surrounding the site.

In addition to the highways described above, the Ravenswood site can also be serviced by barges because of its location on the Ohio River. According to the U.S. Army Corps of Engineers, there should be no problem in instituting barge service due to the existence of a firm bank and the lack of sand bars in the area (Bill Eiger, U.S. Army Corps of Engineers, personal communication, November 25, 1980). Rail access is also available. Currently, the site is served by a single track with passing sidings, which would allow for the delivery of feedstocks and the export of processed materials (Jim Hale, Chessie Railroad System, personal communication, November 25, 1980).

3.4.4.5 Economic base

Current employment by major job category for each of the four counties in the socioeconomic impact region is presented in Table 3.40. Jackson County, West Virginia, with more than half its total jobs in manufacturing, has far more activity in this sector than any of the other counties; the Kaiser Aluminum and Chemical Company's Ravenswood Works provides the largest share of these industrial jobs. On the other end of the scale, only one out of every ten jobs in Meigs County is in manufacturing, but mining is much more important here than in the other counties of the impact region and accounts for more than one-third of total employment. In Mason County, West Virginia, construction, manufacturing, transportation and utilities, and government are all important to the local economy, accounting for roughly equal shares of local employment. In Gallia County, Ohio, nearly half of all employment is in the government

Table 3.40. Number of jobs by type of employment in the socioeconomic impact region, 1979

Jobs	Jackson County, West Virginia	Mason, West Virginia	Gallia, Ohio	Meigs, Ohio
Mining	80	50	300	1713
Construction	460	1980	696	298
Manufacturing	4210	1630	1207	402
Transportation and utilities	220	1550	1314	144
Wholesale/retail trade	1250	960	1793	825
Finance, insurance and real estate	170	160	234	133
Services	540	840	1906	287
Government	1020	1430	2364	802
Agriculture, forestry, and fishing	133	257	^a	^a
Total	8093	8857	9827	4608

^aData not available because there are fewer than 3 employees in this sector.

Sources: Jerry Reveal, West Virginia Employment Security Commission, personal communication, Dec. 8, 1980; and State of Ohio, Bureau of Employment Services, Division of Research and Statistics.

and service sectors, but significant numbers of jobs are also found in the trade, transportation, utilities, and manufacturing sectors. Although the total number of people employed in agriculture is relatively small in all four counties, local activity in this area is substantial. The total value of agricultural products in 1978 was nearly \$3 million in Jackson County, roughly \$8 million in Mason and Meigs Counties, and more than \$10 million in Gallia County (Betsy Stevenson, West Virginia Department of Employment Security, personal communication, Dec. 2, 1980; Gail Reinhardt, Ohio Department of Economic and Community Development, personal communication, Dec. 1, 1980).

Total volumes of wholesale and retail trade for each county in the impact region are shown in Table 3.41. In both the wholesale and retail sectors, Gallia County has far more activity than any of the other impact counties.

Table 3.41. Wholesale and retail trade volumes for the socioeconomic impact region, 1977

	Wholesale trade (in \$ millions)	Retail trade (in \$ millions)
Jackson County, West Virginia	17.6	62.4
Marion County, West Virginia	31.2	50.3
Gallia County, Ohio	54	85.3
Meigs County, Ohio	12	54.9

Source: U.S. Department of Commerce, *Census of Wholesale and Retail Trade*.

3.4.4.6 Labor and income

Table 3.42 shows the rate of unemployment and per capita income within the socioeconomic impact region. Jackson County, West Virginia, has both the highest rate of unemployment (7.2%) and the highest per capita income (\$6990) of all four impact counties. Gallia County Ohio, has the lowest unemployment rate (5.2%), and Meigs County, Ohio, has the lowest per capita income (\$5976). Both Ohio counties are well under Ohio's statewide per capita income of \$7858, and the two West Virginia counties fall on either side of their state's average of \$6629. Gallia and Mason counties enjoy lower unemployment rates than do their respective states as a whole, while Meigs and Jackson counties' unemployment figures fall on the high side of their state averages.

3.4.4.7 Local government taxation

Although the primary impacts from the SRC-II project would extend over a four-county region, any property tax paid by the facility would go only to Jackson County as the jurisdiction in which

Table 3.42. Labor and income statistics for the socioeconomic impact region

Location	1979 employment ^a	Unemployed 1979 (%)	1978 per capita income (%)
Jackson County, West Virginia	8093	7.2	6990
Mason County, West Virginia	8857	5.4	6242
State of West Virginia		5.6	6629
Gallia County, Ohio	9827	5.2	6195
Meigs County, Ohio	4608	6.3	5976
State of Ohio		5.9	7857

^aWorkers employed in county.

Sources: Jerry Reveal, W. Virginia Employment Security Commission, personal communication, Dec. 8, 1980; State of Ohio, Bureau of Employment Services, Division of Research and Statistics; and U.S. Department of Commerce, Bureau of Economic Analysis, *Surveys of Current Business*, April, 1980.

the facility will actually be located. Neither the neighboring municipalities of Ravenswood and Ripley nor the other three impact counties would be empowered to tax the project. The following discussion, therefore, will focus solely on Jackson County. The reader should bear in mind, however, that no taxes will be levied on the facility by any jurisdiction until full ownership is transferred from the Federal government to the private sector at the end of the demonstration phase, should the decision be made to proceed with commercialization.

The 1980 total assessed value for all taxable property in Jackson County is \$211 million. Over 75% of this property is located in the rural taxing districts of the county where the proposed facility is to be sited; the remainder is in the municipalities of Ravenswood and Ripley. The \$211 million figure is arrived at by assessing all taxable property at 50% of "true value," yielding an assessed value equal to about one-third of market value. In the nonmunicipal districts, personal property such as farm equipment and livestock (Class I) is taxed at a rate of \$0.631 per \$100 of assessed value, owner-occupied residential dwellings (Class II) are taxed at \$1.268 per \$100 of assessed value, and commercial and industrial property (Class III) is taxed at \$2.52 per \$100 of assessed value (W. A. Riggs, Jackson County Tax Assessor, personal communication, December 1980). Total property tax revenues collected in the nonmunicipal districts of Jackson County amounted to \$2.68 million in 1979, with about 60% coming from personal property and the rest coming from real estate (Mrs. Wilson, Jackson County Tax Department, personal communication, December 1980).

No tax is currently levied on construction work in progress (CWIP) in Jackson County; no cooperative arrangements exist whereby taxes collected from property located in the rural districts is shared with the county's municipal governments. Tax reductions or exemptions are generally not offered to induce industrial facilities to locate in Jackson County, as is sometimes done by other local governments (W. A. Riggs, Jackson County Tax Assessor, personal communication, December 1980). New industry can receive favorable treatment from the State government, however, which offers a Business and Occupation Tax credit and a seven-year tax exemption on demonstration facilities. In addition, new State-level tax incentives are being considered for the purpose of attracting new energy-related industrial facilities to the state (Beth Hoyt, West Virginia Industrial Development Board, personal communication, December 1980).

3.4.4.8 Historical and archaeological resources

In the immediate vicinity of the Ravenswood site, five archaeological sites have been identified by the West Virginia Historic Preservation Office. In addition, Kaiser Corporation's Ravenswood Works is reported to be built over a later prehistoric village. Another archaeological site elsewhere in Jackson County is currently being considered for inclusion in the National Register of Historic Places. According to the State Historic Preservation Office, this entire area is rich in archaeological sites because of the widespread presence of prehistoric Indian settlements. Any additional disturbance in the site area may uncover additional archaeological information, and for this reason, a thorough archaeological survey of the site would be required before project construction could begin (Roger Wise, West Virginia State Archaeologist, personal communication, December 1980).

Turning to the subject of historic resources, four sites in Jackson County are listed in the National Register: one residence, one school, and two covered bridges. The State Historic Preservation Office has judged that other sites in the county are probably eligible for the

National Register as well, but none of these are in the immediate vicinity of the proposed site. Additionally, the town of Ravenswood is thought to be eligible as a Historic District. Other significant sites may turn up as the result of a state historic survey, but such an effort has not been undertaken (Michael Pauley, West Virginia State Historic Preservation Office, personal communication, December 1980).

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4. ENVIRONMENTAL CONSEQUENCES AND MITIGATION MEASURES

Section 4 presents an analysis of the predicted impacts from constructing and operating the proposed SRC-II demonstration plant at the Fort Martin, West Virginia, site (Sect. 4.2) and the alternative sites of Equality, Kentucky (Sect. 4.3), and Ravenswood, West Virginia (Sect. 4.4). These sections also discuss the issues that are likely to arise should the plant be commercialized at an expanded capacity, mothballed, or decommissioned. Section 4.1 discusses the occupational and public health effects of producing and using SRC products. Sections 4.5 and 4.6 present recommended monitoring and mitigation programs. Section 4.7 discusses the relationship of the project to the carbon dioxide issue, and Sect. 4.8 presents a summary of the floodplain/wetlands review.

4.1 OCCUPATIONAL AND PUBLIC HEALTH EFFECTS

The public scoping process (see Foreword) revealed that occupational and public health effects were principal concerns in the development of a synfuel industry. This section discusses the currently available data base for assessment of the health effects of coal conversion facilities, the materials of concern, sources of exposure, and control plans for the proposed SRC-II demonstration plant. A program of data collection, research, and assessment for the SRC-II demonstration plant is in progress and will continue to be necessary to better quantify impacts. The health and environmental research program for SRC-II is summarized in this section, and the detailed plan is given in Appendix Y.

4.1.1 Basis of occupational health concerns

Because of the lack of studies about specific commercial-scale coal conversion facilities, health concerns arise primarily from studies about related processes and from measurements on process streams of bench- or pilot-scale facilities supporting coal conversion technology.¹⁻³ The most direct experience applicable to SRC-II comes from operation of the Fort Lewis pilot plant. Experience from petroleum refineries (see Appendix Y) and related petrochemical industries also aids in planning and implementing occupational and public health protection programs. The application of information gained from these processes to SRC-II is discussed in the following sections and in Appendix Y. The first general discussion concerns the historical basis of occupational and public health concerns that may be unique to coal conversion systems.

As early as the late 18th century, scrotal cancer was associated with exposure to soot.⁴ Coal carbonization workers exposed to complex mixtures of soots, tars, ashes, smokes, and pitch have experienced higher cancer rates than the general population. The National Institute of Occupational Safety and Health (NIOSH) found that workers exposed to coal carbonization products experienced higher rates of skin, lung, bladder, and kidney cancer.⁵ In addition, Doll et al.⁶ studied the mortality rate of gas workers in Great Britain over a 12-year period and found significant increases in lung, bladder, skin, and scrotal cancer among coal carbonizing workers. Concentrations of benzo[a]pyrene (BaP) and several other polynuclear aromatic hydrocarbons (PNAs) were higher in worker atmospheres.⁷ Another study shows that workers with the highest exposures to these tarry fumes exhibited the greatest risk of dying from lung, liver, and scrotal cancer.⁷ In humans, many exogenous and endogenous factors affect cancer of the bladder, but bladder cancers have been associated with coal tar occupations since 1931.⁸ Induction of lung cancer has been known since 1936 when Kuroda and Kawahata⁹ reported higher rates of this disease for coal gas workers in Japan. Kennaway and Kennaway¹⁰ found a lung cancer mortality rate in coke oven charger workers that was three times that of the average population.

These studies may be interpreted to indicate increased potential for a variety of cancers associated with coal conversion systems. Although elevated exposures to carcinogenic PNAs (e.g., BaP) have been measured,⁷ coal conversion processes generally contain complex mixtures of many hundreds of organic compounds as well as many inorganic materials (e.g., sulfur compounds, trace metals and their compounds, and radioactive materials — in short, anything in coal plus anything produced in the process). Also, the metabolic detoxification-toxification mechanisms convert many fugitive agents into carcinogens and/or carcinogenic potentiators.

Certain SRC process intermediates, products, by-products, and wastes will contain heavy metals and organometallic compounds and a broad range of complex organic materials, including PNAs, aromatic amines, and heterocyclic sulfur compounds that are known or suspected to be (1) mutagenic in microbial systems or (2) carcinogenic, teratogenic, or toxic in laboratory animals.¹¹ In an SRC plant, these complex organic compounds result primarily from the hydrogenation reaction.

Although current and projected environmental quality standards and emission limitations require application of state-of-the-art pollution control techniques, standards and limitations do not yet exist for most of the classes of compounds that are of concern. For example, many agents may not be carcinogenic but may act as potent potentiators of carcinogenesis through hyperplastic or cytotoxic activities that cause deviations in the normal homeostatic control mechanism.¹²⁻¹⁴ These toxic but noncarcinogenic and/or nonmutagenic agents are addressed by the Toxic Substances Control Act (TSCA) and that act's applicability to SRC materials is discussed in Appendix T. But, compliance with existing environmental requirements alone will not ensure complete protection of workers, the public, or the environment. For this reason, the design of the SRC-II demonstration plant focuses particular attention on minimizing (1) the release of such materials and (2) the exposure of workers and the public. Section 4.1.3 discusses the steps proposed for accomplishing this.

Furthermore, pilot plant studies have shown that the compositions of SRC process streams, products, and wastes may vary and are sensitive to changes in coal feedstock and process conditions such as temperature, hydrogen pressure, and residence time. This variability, combined with the fact that only a conceptual SRC plant design exists at this time, reduces the ability to predict the specific compounds and exact concentrations of such compounds that will be present in products, intermediate streams, wastes, and occupational environments. This, in turn, limits the ability to quantitatively predict occupational and public health consequences of altered plant operating conditions.

Chemical and biological screening analyses of available SRC pilot plant materials by Battelle Pacific Northwest Laboratory indicate that selected materials are active in certain toxicological tests.¹¹ However, an extensive industrial hygiene program has been in place since startup of the Fort Lewis SRC pilot plant (5 years) and there have been no increases of skin cancer traceable to chemicals found in the workers' environment. This is in distinct contrast to experiences in previous coal hydrogenation plants where equivalent industrial hygiene practices were not employed. In one particular case (Institute, West Virginia), an increased incidence of skin tumors (about fivefold) was found in the work force of 359 individuals after exposure times as short as 11 months to as long as 7 years.^{15,16} However, follow-up studies on 50 workers have not yet revealed an increase in systemic cancers or in cancer mortalities in that work force.¹⁷ Often this study is used to argue for the absence of systemic cancers. Rather, the age of the workers, the longer latency for systemic tumors, and the small number in the study population are not conducive to such detail. In principle, systemic cancers are expected and might be found in larger populations studied over longer periods of time. Laboratory studies in oncology also support the concern that systemic cancers should not be completely dismissed from future consideration. Because there has been no epidemiologically significant population of workers employed in direct coal liquefaction technologies, little is known at this time about health consequences of long-term work in such plants.

Given the implementation of worker education, clothing, medical, and monitoring programs at the initiation of SRC-II operations, work-related illnesses would be expected to be substantially less than those observed in existing industries in which exposure to complex hydrocarbons might occur. The accumulated evidence does suggest that if exposures are reduced⁵ as measured by PNA content, coal tar pitch volatiles, or benzene-soluble particulates, cancer incidence may be also reduced. Of course, the evidence is predominant from high exposure levels where the agent induces a significant amount of "cancer potentiation" through processes of hyperplasia, necrosis, cytotoxicity, inflammation, etc.¹²⁻¹⁴ At very low exposure levels, potentiation stems primarily from endogenous mechanisms, and the dose-response curve may even become flat,¹⁸ as illustrated by the typical "hockey-stick" response.¹⁹ This behavior is most common for low doses given intermittently, with sufficient separation in time. However, there is no current scientific basis for selecting among possible dose response relationships. Also, it is clear that the best worker (or general population) health protection is to give priority to efforts to minimize exposure to relevant toxic materials. In addition to minimizing exposure through emission controls, plant design, and maintenance procedures, a vigorous industrial hygiene program that will monitor and assess potential occupational health problems is essential. Exposures in modern coal conversion facilities are expected to be, at worst, much lower than was the case for the coal utilization technologies previously discussed since exposures will be monitored and controlled in adherence to current and future occupational health standards. Because most coal conversion processing is

carried out in closed systems, emissions would largely result from leaks, accidents, or emergency venting of tar, char, soot, or other toxic substance. However, potential exposures vary widely from technology to technology, and continual monitoring will be essential. The general features of the DOE programmatic approach to ensure adequate occupational and public health protection are discussed in Sect. 1.2.5.

4.1.2 Materials of concern

As evidenced by chemical, biological, and epidemiological research, coal conversion processes, including liquefaction, produce various complex organic materials that have the potential for serious adverse health effects.^{4-11,15} These materials include PNAs, aromatic amines, heterocyclic compounds, highly substituted phenols, and other materials.^{4-11,15} Many of these materials, particularly the PNAs, are also produced by processes other than solvent refining of coal, for example, pyrolysis or incomplete combustion of various organic materials, including coal, wood, and petroleum. Varying levels of carcinogenic potential, as measured in laboratory rodents, have been observed for other synthetic fuels (e.g., shale oil), heavy coal liquids (Bergius process), and crude petroleum. In general, the most pronounced effects are associated with the heavy, high-boiling-point (>600°F) liquid and solid fractions of process materials. Initial tests have suggested that the light hydrocarbon fractions are relatively free of mutagenic activity in cellular systems and are probably free of carcinogenic activity in rodents, although low-dose effects would probably not be revealed without more understanding of the biological mechanisms. Many of the PNA materials are solid or tarlike at ambient temperatures; all are high-boiling and have very low vapor pressures at ambient temperatures. Thus, concerns relate primarily to process streams at high temperatures and pressures where these materials may be in vapor state.

Results from acute toxicity tests, in which doses are given orally, show that all SRC materials fall into the same category — moderate acute toxicity.¹¹ This means that they are less toxic than many materials used in commerce today. Some SRC materials, at high doses, have been found to be teratogenic in rats (e.g., causing malformations in fetal tissue) when given orally to the dam at certain intervals during gestation. However, in most cases examined to date, signs of toxicity were also found in the dam. Because species vary greatly in teratogenic response, these results may not be totally applicable to man. Planned research relevant to teratogenic effects of SRC material in a nonrodent animal species (e.g., rabbit) may aid in elucidating the teratogenic potential of SRC materials.

4.1.3 Sources of exposure and control plans

The currently proposed techniques for emission control summarized below, as well as the procedures under which the plant will be operated and the products distributed, are being incorporated into the engineering design of the plant. Many of these techniques are highly developed and commercially available and are used in other industries. Others are based on the industrial hygiene program at the Fort Lewis pilot plant. Some are also the result of using the best available technology (BAT) to control emissions from those points in the process where the process material is suspected to have significant toxicological activity.

These techniques can be broadly classified as engineering controls incorporated into the design of the plant and operating procedures to mitigate the effects of worker and public exposures. The engineering controls are intended to (1) minimize emissions from the plant that could affect the surrounding public and (2) reduce the exposure of plant workers to those materials suspected of toxicological activity. Included in this latter category is a thorough industrial hygiene program.

4.1.3.1 Engineering control of process emissions during normal and upset conditions

Process operations could cause public exposure by three mechanisms: atmospheric dispersion, wastewater discharge, and solid waste disposal.

Atmospheric emissions

Atmospheric emissions of criteria pollutants such as SO₂, NO_x, suspended particulate matter, carbon monoxide, and hydrocarbons are regulated by the Clean Air Act.¹² The unit processes, procedures, and equipment used in the design of the SRC demonstration plant are aimed at ensuring compliance with these regulations. Engineering controls to achieve compliance with the Clean Air Act (discussed in Appendix C) should minimize public health impacts due to this source.

Atmospheric emissions of process materials that are not criteria pollutants but that are suspected of having genotoxic or other biological activity will be minimized by the use of several advanced engineering controls. The most important of these is a controlled combustor to efficiently convert hydrocarbon emissions to carbon dioxide and water vapor. During normal operations and all process upsets except the most severe emergencies, hydrocarbon effluent streams from process equipment will be completely contained, and the emissions will be sent to the controlled combustor. Emissions from venting of safety valves, evaporative emissions from tanks and filling operations at product shipping points, and all other relatively continuous or small point sources will be treated in this fashion. Fugitive emissions are discussed in Sect. 4.1.3.3.

Combustion conditions in the controlled combustor will be maintained so as to ensure combustion residence times at turbulence and temperatures that will destroy the hydrocarbon compounds of concern. Flue gases from the combustor will be monitored to detect emissions and to adjust combustion conditions to maintain high efficiency control.

Another significant potential source of atmospheric emissions that may result in public exposure to these biologically active materials is the cooling tower. A preliminary analysis of heat rejection options is presented in Appendix C. One of the most significant indirect routes for public health impacts resulting from the heat rejection system is from leaks into the cooling system. If biologically active compounds leak into cooling water that is sent to a wet-cooling tower, those compounds could be released to the atmosphere through codistillation, aerosol formation, or entrainment in drift. The proposed design has identified the processing equipment that typically contains the heavy hydrocarbon (boiling point $>600^{\circ}\text{F}$) materials of most concern from a health standpoint. This equipment includes the coal dissolver, hydrogen recovery units, product separation units, naphtha recovery, and the fractionation and distillation units. As discussed in Appendix C, an indirect wet-cooling system has been proposed for cooling all streams containing more than 2% of material with a $>600^{\circ}\text{F}$ boiling point to prevent leakage from contaminating water recirculating in the cooling tower.

Wastewater and spills

Public health impacts due to wastewater discharge will be mitigated by the proposed plant design, which incorporates a sophisticated tertiary wastewater treatment system that emphasizes the removal of toxic metals and organic compounds from the wastewater (Appendix C, Sect. C.3.6). This system will collect and treat all process wastewaters, process area runoff, runoff from product storage and shipping areas, leachates from the coal storage area, leachates from the slag disposal and hazardous waste landfill areas, and blowdown from the boilers. Cooling tower blowdown will be handled in a separate treatment system. The system will be designed to treat and discharge all wastewater when the ambient characteristics of the Monongahela River allow it to be done without violation of in-stream water quality standards. Desalination equipment will be provided to eliminate the discharge and enable water recycle within the process when the discharge condition or instream water quality conditions make the discharge environmentally undesirable.

Major spills occurring in the main process area, the product storage area, or the shipping area will be contained to prevent them from reaching groundwater or surface water through runoff. The design of the containment systems (discussed in Appendix C, Sect. C.3.5.3) is in distinct contrast to the tank farm at the Fort Lewis pilot plant, where an SRC liquid spill quickly soaked into the soil and contaminated local groundwater. (Reference 2 in Appendix Z gives a detailed discussion of the Fort Lewis spill.) Residues from cleanup operations at such spills will be recycled when possible and contained at the plant site in all cases. The proposed design of the product storage area will include liners and dikes of impermeable materials (Appendix C, Sect. C.2.16).

Because wastewater will be discharged to the Monongahela River under some conditions, a monitoring program will be instituted to assess impacts (Sect. 4.5). The program will emphasize effluent monitoring in the wastewater stream and monitoring within the river for bioaccumulation of process-specific chemical entities that have potential for adverse health impacts as determined through ongoing research and established criteria.

Solid waste disposal

Potential public health impacts due to solid waste disposal are expected to be small. Solid wastes from the demonstration plant will be disposed of onsite in compliance with the provisions of the Resource Conservation and Recovery Act (RCRA). Materials of concern due to potential public health impact will be contained on the site in two landfills designed to minimize transport into the environment, which includes groundwater. These landfills are described in Appendix C, Sect. C.3.7. They will be lined with low-permeability clay, with leachate collection systems above and below. These leachates will be recycled to the wastewater treatment plant.

The major solid waste stream in terms of volume generated will be the slag produced by the gasification of vacuum bottoms. Preliminary experimental work on this slag from the SRC-II process (Appendixes C and K) indicates that the slag would be classified as nonhazardous under RCRA. Further tests (Appendix C) on gasified slag from the SRC-II process indicate that benzene-soluble compounds were present in low concentrations. If biologically active organic compounds were present in the slag, they would be expected to appear in this benzene-soluble fraction. However, in ongoing research, other solvent systems will be tested for their effectiveness in leaching of organic components from slag. Based on available data, it is concluded that public health impacts due to leaching of biologically active organic compounds from the gasifier wastes will be minimal (Sect. 4.2.2.2 and Appendixes C and K). If testing indicates the presence of significant amounts of biologically active compounds in leachate from SRC-II gasifier slag, this material will be treated as hazardous and disposed of accordingly. Dust from slag disposal, a potential source of inhalation exposure to occupational and environmental populations, will be analyzed for biological effect in appropriate assay systems. Fugitive emissions from slag disposal are considered in the air quality impact analysis (Sect. 4.2.3.1).

Other solid wastes will be produced in smaller quantities than the slag, but some may be more hazardous than the slag. These too will be stored in secure landfills as described for slag disposal (Appendix C, Sect. C.7.2).

4.1.3.2 Major emergency upsets

Emissions during emergency conditions could be of two types: (1) an upset or other condition that requires venting of process materials at a rate too great to provide controlled combustion and requiring flaring or (2) an uncontrolled ground-level release of process materials resulting from equipment failure. Emergency conditions of the first type result from the necessity to relieve pressures within process equipment to prevent catastrophic failure (explosion or failure of containment resulting in fire). Such incidents will result in the removal of a hot, high-pressure hydrocarbon stream from the equipment being protected. Most of these releases will be small enough to be completely routed to the controlled combustor system. It is estimated that more than 90% of the incidences in which materials are emitted under emergency conditions can be handled in this combustor system. Currently, only a few major releases of the "worst-case" type are expected to be too large and released over too short a time period to be treated in the controlled combustor.

To provide a significant measure of protection to the environment and public health, current plans are for all such releases to be directed to an elevated flare system. This elevated flare should destroy most compounds having acute toxicity or reduce their concentration to levels that are not acute health hazards when transported to points of population exposure. The flare should also provide at least partial combustion of materials that have potential long-term effects (i.e., biologically active complex hydrocarbons). The flare would be elevated to protect personnel and equipment from the high levels of thermal radiation (heat) emitted by flaring these large process upsets.

Both the controlled combustor system and the flare will be designed to prevent grounding of the plume in the process area. Thus, emergency releases of the first type are not considered to be a significant exposure mechanism for the work force. Small emergency releases that occur frequently will be directed to the controlled combustor. Large-scale emergency releases through the flare may result in only partial combustion of some of the biologically active compounds. However, the concentrations to which the public is exposed are expected to be small [below the limit specified by the Occupational Safety and Health Administration (OSHA) for coal-tar pitch volatile (CTPV) continuous 8 h/d exposure of workers]. As discussed in Appendix C, the duration of such an event should be less than 2 h. Furthermore, such major incidents will be very infrequent and will not be continuous. (The controlled combustor and flaring systems are discussed in Appendix C.)

If emergencies were to arise in other process areas where streams are toxicologically active (e.g., gasifier area, gas treating), these streams would also be vented to the elevated flare. Such streams could be destroyed as effectively in a flare as in a controlled combustor.

The second type of emergency condition would be due to ground-level equipment failure. This could release a large quantity of hot, high-pressure hydrocarbons in an uncontrolled fashion. (Note that one purpose of the flaring system is to relieve pressures to prevent this type of incident.) Accidents involving uncontrolled ground-level releases of process materials resulting from equipment failure would probably involve fire or explosion. Emissions of process materials resulting from such an event cannot be predicted at this time. The safety analysis report (see Appendix AA) will address (1) the likelihood of these events, (2) impacts that would result from their occurrence, and (3) appropriate design and operating measures to protect employees and the public.

An uncontrolled release of high-temperature process materials could, in some cases, cause fire, thermal, and acute toxicity hazards considered to be more significant than the long-term health hazards. These acute hazards will determine the design of safeguards to minimize the probability

of occurrence and the actions to be taken if uncontrolled ground-level releases occur. The plant design will use the best engineering practices of modern petroleum refining and petrochemical facilities to minimize the likelihood of such releases. Personnel and equipment hazards due to fires and/or explosions will be minimized to the extent possible by careful equipment layout, isolation of equipment with valving, fire control and emergency response planning, and other such techniques practiced in modern petrochemical facilities.

4.1.3.3 Engineering controls of fugitive emissions

Fugitive particulate emissions contribute to the total suspended particulate emissions of the plant. These include dusting from coal piles and coal- and slag-handling operations. Such emissions fall under the provision of the Clean Air Act. Control measures designed to comply with this act (discussed in Appendix C) should minimize public health impacts due to this source. Furthermore, transport of most fugitive particulates will probably be over short distances only, which will restrict environmental impacts to areas near the facility (Sect. 4.2.3.1). Nevertheless, measurements will be made to determine the physical and chemical characteristics of these materials.

Additional concerns from an occupational and public health viewpoint are fugitive hydrocarbon emissions from process equipment that may be adsorbed on particulates or occur as vapors. Pump and compressor seals, valve packings, and drains are major sources of leaks and fugitive emissions. The proposed plant design will include double mechanical seals with fluid barriers for centrifugal pumps and compressors that handle potentially hazardous materials. The distance pieces on reciprocating pumps and compressors will be purged with nitrogen, and the purged materials will be directed to the controlled combustor. Sampling points used to characterize process streams will be double-valved to eliminate small fugitive emissions due to sampling valve failure. Operating procedures for sampling will be designed to minimize evaporation or aerosol formation during sampling and to eliminate losses to the environment due to discard of the initial sampling flow. Selected flanges will be equipped with O-ring compression gaskets to reduce the probability of leaks past metal-metal interfaces.

It is planned that additional controls of fugitive emissions will include a program of equipment inspection, leak detection, and area monitoring for early identification and elimination of emission sources. Appendix C, Sect. C.3.5.1, discusses the Directed Maintenance Program proposed for the demonstration plant as part of the program for reducing and controlling fugitive hydrocarbon emissions. Because such leaks (especially from high-pressure sources) can pose a fire hazard as well as a health hazard, they will receive immediate attention after detection. Major process system components containing materials of concern that are anticipated to require frequent maintenance will be installed in parallel redundancy to allow for repair immediately after detection of emissions without overall system shutdown.

For workers involved in maintenance operations, skin contact and inhalation are of concern. Measures to mitigate these exposures are discussed in Sect. 4.1.3.6. Fugitive emissions to the atmosphere are expected to be the major exposure source to other categories of workers at the plant site. Engineering controls previously discussed will be designed with the intent to limit concentrations of fugitive hydrocarbon emission to within the OSHA-specified permissible exposure limits (PEL) for coal-tar pitch volatiles in all process areas. The DOE program previously summarized will provide data to set priorities for materials of health concern and to select compounds that will be monitored continuously to ensure adequate health protection.

The epidemiological study of coke oven workers⁵ that related CTPV exposure groups to death rates concluded that "the established TLV of 0.2 mg/m³ is considered to be adequate, as this level of exposure for an average period of 30 years does not increase the risk of dying from lung cancer." This is the principal type of internal organ cancer associated with coke oven exposure, although other cancers (liver, kidney, etc.) may occur less frequently. Engineering controls will be designed to keep exposures within the limits specified by OSHA⁵ for CTPVs. However, further monitoring, chemical characterization, biological testing, and occupational and public health assessments will be carried out in conjunction with operation of the SRC-II plant to develop directly applicable protection procedures.

To reduce worker exposure in enclosed environments such as control rooms and office areas, consideration is being given to control measures such as filtration of recycled ventilation and air-conditioning air to prevent buildup of high concentrations of fugitive hydrocarbon aerosols.

Because of dispersion, exposure to fugitive hydrocarbons transported away from the plant site is not expected to be a significant health impact because concentrations in the immediate plant area will be held to low levels. Section 4.5 discusses monitoring in the surrounding area to ensure that such concentrations are negligible.

4.1.3.4 Maintenance

Although maintenance operations provide an opportunity for unplanned releases to the environment, the major risk will be occupational exposure via skin contact and inhalation. Experience at the Fort Lewis SRC pilot plant and at plants manufacturing hazardous chemicals indicates that this risk can be significantly ameliorated by providing industrial hygiene training and protective equipment for the work force and by developing safe, proper maintenance procedures to minimize environmental release and personnel exposure.

For the demonstration plant, specific, highly detailed maintenance procedures will be developed after detailed design of the process equipment is completed. These procedures will be based on experience developed in other industries that involve handling materials that are hazardous due to personal contamination, especially by skin contact. These procedures will specifically address (but will not be limited to) the potential health hazard, frequency of maintenance, required maintenance identified by emissions monitoring, procedures for minimizing fugitive emissions during maintenance, decontamination procedures prior to working on equipment or shipping offsite, and containment of decontamination fluids and wash waters.

4.1.3.5 Monitoring

Part of the mitigation process to prevent health impacts will be a thorough monitoring program. This will consist of three types of monitoring: emissions monitoring from point sources, ambient monitoring (at the site and in the surrounding environment), and area and personnel monitoring to determine worker exposures. The latter is an integral part of the industrial hygiene program and is discussed in Sect. 4.1.3.6 (see also Appendix Y).

Monitoring of point emission sources will make it possible to ensure that emission control processes and equipment are functioning properly and that emissions are within regulated limits. The monitoring systems will include stack sampling for air emissions to monitor all criteria pollutants as well as materials believed to be potential health hazards (e.g., polycyclic aromatic compounds, both as vapors and in suspended particulate matter). Monitoring methods for other compounds shown to be toxicologically active through ongoing research will be developed and deployed. Wastewater discharge will be monitored for regulated pollutants [e.g., toxic metals, biochemical oxygen demand (BOD), total suspended solids] and for materials that are potentially toxic (e.g., polycyclic aromatics and other materials of concern, as identified through ongoing research). In addition to ensuring compliance with regulatory limits, this monitoring will help to identify sources of potential problems and appropriate areas for process modification.

Ambient monitoring of air, surface water, and groundwater quality will be carried out in the vicinity of the plant to determine the impact of emissions. This program will be designed to monitor the impact of emissions at the point of maximum concentrations and at significant receptors, even though pollutants are dispersed before reaching these receptors. This information will be used to (1) ensure compliance with ambient air and water quality standards for regulated pollutants, (2) assess the impact on attainment regions for prevention of significant deterioration (PSD) determinations, and (3) provide a baseline for comparison when planning for possible commercialization. It will also be used to ensure that there is no significant impact from pollutant concentrations on groundwater or surface water due to emissions from the demonstration plant. If significant impacts are detected, mitigation measures will be implemented.

Because complex hydrocarbons are a potential public health problem of concern, they will be monitored at places where air dispersion modeling predicts greatest exposure for the surrounding public. This monitoring will serve to indicate significant exposures as they occur. In conjunction with source monitoring, ambient monitoring will allow source mitigation techniques to be analyzed and instituted at the plant when required to protect public health.

Similar monitoring for toxic materials will be carried out by sampling aquatic life that might be exposed to trace concentrations from wastewater effluents. This will be especially directed toward identifying bioaccumulation of these materials by organisms. Special emphasis will be given to accumulation in organisms that could cause direct dosage to man (e.g., fish, crayfish) or that are in the foodchain of these organisms.²⁰

4.1.3.6 Occupational health protection program

A thorough industrial hygiene program will be instituted to ensure the adequacy of engineering controls designed to minimize worker exposure to potentially toxic materials and to institute additional controls if necessary. This program will be based on the program at the Fort Lewis SRC

pilot plant and will be modified as required by results of additional studies for the SRC-II demonstration plant (Appendix Y).

Engineering controls are expected to (1) minimize exposures to materials having acute chemical toxicity and (2) reduce concentrations of all regulated substances to within limits specified by OSHA, except during emergency conditions (fires, explosions). Additionally, the industrial hygiene program will minimize the impact of exposure to potentially toxic materials that are currently unregulated.

To provide the greatest amount of protection, it will be assumed that all process streams having the potential to contain toxic materials, carcinogenic or otherwise, are toxic. Until or unless toxicological and process stream characterization studies have identified a process stream as being noncontributory to carcinogenesis processes of "initiation" and "promotion," it will be treated as a potential hazard to workers, and all applicable elements of the occupational health program will be followed in dealing with it.

The primary mechanisms for worker exposure to these biologically active materials will be through skin contact and inhalation. The industrial hygiene program will be designed to control both of these mechanisms of exposure. Worker education and training is the first element of the program. The core of any successful occupational health program is worker acceptance and participation, and this is a stated goal of the program. The means of attaining this goal is threefold: initial training of new employees, annual retraining, and periodic health and safety meetings. The latter will allow airing of individual concerns and permit review of emergency procedures. The workers will be familiar with the potentially hazardous nature of process materials and with mechanisms of exposure.

The proper use of protective equipment and clothing helps to minimize any adverse health effects of worker exposure to coal liquefaction materials that may pose health hazards. For normal operations, employees in areas where contact can occur will be issued and required to use overalls, underwear, socks, and leather boots with oil-resistant soles. In the event of a spill of toxic materials or work assignment that might lead to personal contamination, the employee will wear special protective equipment such as synthetic rubber boots, special gloves, an impervious rain suit, face shield, goggles, and/or respirator. Hearing protection will be provided in areas with high noise levels. Visitors entering the plant will be provided with protective clothing to prevent contamination of their street clothing.

To protect the worker and to prevent transport of coal liquefaction contaminants off the plant site, special procedures and facilities have been developed for employees working in areas where contamination may occur. Contaminated clothing will be laundered at the plant and will be segregated from uncontaminated clothing. Contaminated wash water will be treated in the wastewater treatment system. The key elements in the design and use of the change facility are the segregated "clean" and "dirty" areas and a mandatory daily shower and shampoo for workers. All employees and visitors must pass through a change facility when entering or leaving plant areas where contamination can occur. Monitoring of personal hygiene effectiveness, for example, removal of skin contamination, will be assessed as a technique for improving worker hygiene. If this is concluded to be a safe and effective practice, it will be made available to workers as they pass through the change facility. One possibility depends on optical fiber methods currently being developed; these methods will quantitate dermal exposure to polycyclic aromatic materials. The methods are being refined to minimize the ultraviolet (uv) light intensity used in the technique. This is necessary because, in addition to possessing genotoxic dangers by itself, uv light may activate some polycyclic aromatics absorbed in the skin to their active mutagenic and carcinogenic forms. This monitoring need not be done daily, but only periodically and after known high-dose exposure incidents involving workers. This method may not detect the aromatic amines that can easily pass through the skin into the lymph and blood. However, because these compounds will represent only a small proportion by weight of the total fluorescent material present, an accurate estimate of total dermal polycyclic aromatic exposure can be obtained.

The second element of the worker protection program is a carefully designed set of specific work practices. The demonstration plant will follow comprehensive and specifically defined work practices in the following areas: personal decontamination, washing practices following accidental contamination, eating, drinking, smoking, material transferrals, material storage, material disposal, maintenance procedures, and emergency plans and procedures. These work practices will be in accordance with accepted principles of industrial hygiene followed in other industries that have handled hazardous materials in the past.

Medical monitoring is an important third element in the program. A medical monitoring program will be made available to all employees who may be occupationally exposed to coal liquefaction

products, and participation in the monitoring program will be mandatory. Examinations designed to detect potential coal-liquefaction-related symptoms will be made before employment and annually thereafter unless a different frequency is indicated on the basis of professional medical judgment. This medical monitoring will help detect medical problems early (should any occur) when prognosis for successful treatment is generally very high.

It is of utmost importance to retain employee records for a sufficient time. Due to the occupational health uncertainties inherent in a new industry and the long latency period of potential cancers, employee records will be kept for a period consistent with or longer than those stipulated in Federal regulations. These records shall include demographic information as well as comprehensive work histories, exposure monitoring data, and medical surveillance results.

The fourth element of the program, a thorough system of industrial hygiene monitoring, will assess worker exposures to potentially harmful substances and help formulate work practices and engineering controls to prevent exposure. Potential indicator compounds will be evaluated by methods equivalent to or more current than those specified by the National Institute for Occupational Safety and Health (NIOSH). Frequency of monitoring will depend on an assessment of the potency of toxicants and the initial concentrations measured. Protocols will be developed by a certified industrial hygienist. Initial area and personnel monitoring will be conducted for, but not limited to, the following agents: coal dust, CTPVs, PAHs, aromatic amines, phenols, creosols, hexane, carbon monoxide, nickel carbonyl, carbonyl sulfide, hydrogen sulfide, sulfur dioxide, hydrogen cyanide, welding fumes, silica, trace metals, noise, lighting, and radiation. Materials will be identified (indicator compounds) that may be monitored routinely and continuously to ensure health protection.

4.1.3.7 Control of other industrial health hazards

A variety of potential health hazards associated with the SRC process do not involve genotoxic materials and are typical of other chemical process industries. Engineering controls and other mitigation measures have been developed by these industries as they have gained design and operating experience. These control methods are not considered extraordinary or developmental. Such control measures will be used in the design and operation of the demonstration plant to control such potential hazards.

These hazards can be broadly classified as physical or chemical. Potential health hazards from physical agents fall into four categories: noise, radiation, thermal, and general industrial hazards. Where it is feasible, excess noise will be reduced by engineering controls; however, not all sources will be controllable because of their size or specific dynamic characteristics. Areas around these sources will be identified with warning signs, and hearing protection will be provided. In addition, all plant personnel will receive audiograms annually to detect hearing losses.

In the proposed plant design, radiation sources will be used at some locations as fluid-level-indicating devices. Areas near these radiation sources will be monitored periodically to ensure against contamination by leakage from the source.

Thermal hazards will primarily be in the form of burns due to the high temperatures inherent in the liquefaction processes. Detailed specific work practices will be written and followed for working with equipment handling high-temperature materials. Thermal protective equipment will be specified as required for handling certain hot equipment.

Other general industrial hazards (injuries due to falls, operating machinery, etc.) will be minimized by a worker safety program as is standard practice in equivalent chemical industries.

Potential health hazards caused by chemical agents can be broadly grouped as those having acute toxic effects with rapid onset of symptoms and those having long-term chronic effects. Materials of long-term concern due to their potential for causing mutagenic, carcinogenic, or teratogenic effects have been discussed in Sects. 4.1.1 and 4.1.2.

In the demonstration plant, potential health hazards from gases are primarily from acute toxicants. Those of concern include carbon monoxide, hydrogen sulfide, hydrogen cyanide, carbonyl sulfide, and sulfur dioxide. Exposure to these gases will be minimized through the prudent use of engineering controls that are standard design practice in equivalent chemical industries. For example, flaring of gaseous streams containing such materials will be done through elevated flares designed to prevent grounding of plumes containing quantities of hazardous materials that exceed OSHA standards. A monitoring program (as discussed in Sect. 4.1.3.6), will be instituted to monitor worker exposures, and the above controls will be modified where necessary to keep worker exposures at acceptable levels.

In addition to liquids suspected of long-term genotoxic effects previously discussed, some liquids have other long- or short-term toxic effects. Such liquids are primarily hydrocarbon components of the process streams. Hexane, benzene, phenols, creosols, toluene, and xylene have specific organ or tissue toxicity and will be carefully monitored. Specific work practices similar to those in other chemical industries will be developed for dealing with these materials.

4.1.3.8 Transportation accidents

Introduction

Although accidental releases on the plant site are not expected to result in public exposure, it is likely that transportation of the products will at some time result in accidental releases that result in direct and indirect exposure of the public to process materials. Direct exposure may result from contact with the material due to involvement in the accident, response and cleanup operations, or from inhalation of materials aerosolized as a result of fire. (Appendix Z has a detailed transportation spills analysis.)

Transport route

It is not currently possible to specify the exact routes by which SRC-II liquid products will move, because the end users are not yet known. For the purposes of this analysis it was assumed that the SRC-II distillate product will be transported to Baltimore, Maryland, although alternative ports under consideration range from Norfolk, Virginia, to Philadelphia, Pennsylvania. A number of possible routes exist from the site to Baltimore, and identification of the specific route to be used has not been made. Two rail routes were chosen by computer analysis as representative of typical routes from the proposed Fort Martin site to Baltimore. One route leaves the site to the north through Pennsylvania to Maryland. The other route leaves the site to the south through Morgantown and travels through West Virginia and Maryland to Baltimore. The northern route is 713 km long, and the southern route is 485 km long. It is assumed that both routes will be considered in order to ensure competitive tariffs, but the southern route is considerably shorter and is considered much more likely to be used.

SRC-II shipments from the Fort Martin plant via the southern route will originate on the Monongahela Railroad at the railroad spur at plantside. The shipment will be routed south into Fairmont, West Virginia, where it will be transferred to B&O lines of the Chessie system. The shipment will proceed to Grafton, West Virginia, then move eastward into Cumberland, Maryland, and through numerous towns in the Potomac River Valley, continuing east through Harper's Ferry, West Virginia, into Frederick Junction, Maryland, and finally Baltimore. The B&O main line generally parallels the Potomac River until Harper's Ferry; it crosses the Potomac four times and crosses 100 smaller creeks and streams.

For most of the length of this route, the railroad lines follow streams. The proximity of the rail lines to these streams poses a threat to the aquatic ecology of the streams and municipal water supply systems in the event of a spill of SRC liquids in transit. Two streams that are followed for significant distances are the Monongahela and Potomac rivers, both of which are important sources of water for many municipal systems.

On the B&O main line route from Fairmont to Baltimore, there are 15 major river crossings. In total, there are more than 100 bridges that cross major rivers and smaller streams and creeks along this route. The rail bridges along this route are constructed of concrete, wood, and steel and are capable of accommodating 1.15×10^5 kg rail cars. It is at these crossings that stream systems are most vulnerable to spills of SRC-II liquids. Spilled SRC-II liquid could contaminate municipal water supplies along the route, both those systems supplied by surface water and those supplied by groundwater. Spills on land could contaminate groundwater by infiltrating the soil and percolating to groundwater; however, the soil tends to retard and attenuate many chemical species.

It is estimated that more than 2 million people rely on the Potomac for water (telephone conversation with Kevin Flynn, Interstate Commission for Potomac River Basin, Oct. 6, 1980). Since the water intakes for the Washington, D.C., area are south of Harper's Ferry, downstream from the point at which the rail route last crosses and diverges from the Potomac, the water supply could be threatened by any spill upstream of the intakes.

The exact location of the rail to barge terminal that will transfer the SRC shipment is unknown, but some assumptions and descriptions of the necessary facility can be stated. The rail to barge transfer point will most likely require a storage and handling facility with the necessary storage

tanks and piping connections. The SRC shipments could probably use an oil tank terminal facility. There are private oil terminals in the Baltimore Harbor and, for the purpose of this analysis, it is assumed that there is excess capacity to store the similar SRC product. The end users and their locations are not known at this time.

Spill probability

Because the SRC-II liquid fuel is a new energy product, very few shipments have occurred and no accident data have been reported. To measure the probability of an accident involving future SRC-II shipments, an analysis of shipments of similar commodities and reported rail incidents involving hazardous materials is presented in Sect. Z.4, Appendix Z.

It is assumed that SRC-II liquid products, produced at a rate of 13,800 bbl/d, will be shipped by unit train to Baltimore, Maryland (about 485 km), every 2.5 d. Each unit train will consist of 74 tank cars, each of a 75,800-liter (20,000-gal) capacity.

Shipments of SRC-II liquid may be classified as hazardous because the SRC-II liquid contains naphtha, polynuclear aromatics (PNA), tar, and other chemical compounds previously determined to be hazardous. Three commodity classes from the standard transportation classification code (STCC) were chosen for analysis; they are industrial inorganic chemicals, miscellaneous chemical products, and products of petroleum refining. Based on the accident record for these three commodity classes (Table 4.1), probabilities of spills from SRC-II shipments were determined (Table 4.2).

Table 4.1. Selected commodity rail shipments and probabilities of incidents, 1976-1978

Commodity description (STCC) ^a	No. of shipments		
	1976	1977	1978
Industrial inorganic chemicals	702,400	779,200	759,700
Miscellaneous chemical products	110,900	110,330	108,500
Products of petroleum refining	315,000	333,400	313,800
Total	1,128,300	1,222,900	1,182,000
Number of reported incidents	982	899	1,191
Probability of incident occurrence (Number of incidents per shipment)	0.0009	0.0007	0.0010

^aStandard transportation classification code.

Sources:

1. U. S. Department of Transportation, Federal Railroad Administration, *Carload Waybill Statistics*, 1976-1978, Washington, D.C.
2. RYMDSM Data Base, Office of Hazardous Materials, Federal Railroad Administration, Washington, D.D., Oct. 24, 1980.

The four methods used to determine accident probability show highly variable results, with the estimate based on number of shipments predicting the fewest accidents for SRC-II shipments and the estimate based on volume shipped predicting the most frequent accidents. The estimate based on number of shipments probably underpredicts the actual accident rate, because of the large volume of each SRC-II shipment.

Spill probabilities for marine transportation are presented in Table 4.3. The three-year average spill rate would result in an annual average of 74 bbl of SRC-II liquid spilled to oceans and estuaries.

Table 4.2. Predicted accident and spill frequencies for shipment of SRC-II liquid products

	Frequency ^{a,b}
Reportable accidents in terms of	
No. of shipments	95.8
Volume shipped	1.35
Ton-miles	2.76
Car-miles	2.75
Reportable spill incidents to water bodies in terms of	
No. of shipments	2148.8
Volume shipped	29.95
Ton-miles	44.40
Car-miles	61.65

^a Frequency is defined in terms of months: for example, 95.8 equals 1 occurrence every 95.8 months; 1.35 equals 1 occurrence every 1.35 months; etc.

^b Frequencies were derived by the formulas given in Tables Z.13 and Z.14.

Table 4.3. Marine transportation and accidents involving petroleum and petroleum products on Chesapeake Bay and associated estuaries

Year	Tons shipped (crude petroleum and petroleum products)	Liters spilled	Probability of spill (bbl/bbl shipped)
1976	23,153,755	982,218	3 per 100,000
1977	23,916,814	301,690	1 per 100,000
1978	33,277,884	181,680	4 per 1,000,000
3-year average	26,782,818	488,530	2.4 per 1,000,000

Average yearly spill from SRC-II demonstration plant: 12.1 bbl

Source: U.S. Army Corps of Engineers, *Waterborne Commerce of the United States*, Vicksburg, Miss., 1976, 1977, and 1978.

Impacts of a spill

Accidental spills of major and minor proportions may be expected to occur. An in-plant product spill has occurred at the Fort Lewis pilot plant and provides some insight into the design of the containment system for the demonstration plant and the impacts of a product spill on ground-water (see ref. 2 in Appendix Z). Available information on the organic constituents of the SRC liquid product suggests resulting ecological effects greater than those for crude oil.²¹ There is a potential for waterborne dispersal of these constituents over large areas and for long-term accumulation in bottom sediments. Consequently, release into surface waters is regarded with the greatest degree of concern. Specifically, the worst-case scenario for a spill of SRC-II materials is believed to be a spill directly into the Potomac River, because of the large number of people that are dependent on the Potomac for water supplies and the proximity to sensitive environments in the Potomac estuary. The four sites where the railroad crosses the Potomac River were considered. The Harper's Ferry crossing clearly constitutes the worst case since this site is roughly 110 km (70 river-miles) upstream from the water supply intake for the Washington, D.C., metropolitan area. Potential groundwater contamination is considered in Appendix Z and is not regarded as the worst case. Appendix Z (Sect. Z.5.2.2) also discusses the spill that occurred at the Fort Lewis pilot plant.

Based on Federal Railroad Administration statistics, it can be expected that rail shipments of SRC-II liquids will experience 1.5 accidents per year, of which 0.34 will involve spills of chemicals. This is the estimate for the accidental probability for the entire route. The probability of an accident specifically involving a spill into the Potomac River is considerably less than this frequency. Using an exaggerated crossing distance of 1 km at Harper's Ferry, the spill probability would be $(1.5 \text{ accidents per year}) \times (1 \text{ km per } 485 \text{ km}) = 0.003 \text{ accidents per year}$, or 1 in every 300 years, at Harper's Ferry. The average volume of spill from railroad accidents from 1975 to 1979 was 33,230 liters (8780 gal), based on information from the U.S. Coast Guard's pollution incident reporting system. A worst-case spill is considered to be a total loss of cargo from a tank car, resulting in a spill of 75,700 liters (20,000 gal) of SRC liquids. Of all liquid petroleum products and crude oil shipped on the Chesapeake Bay during 1976, 1977, and 1978, about 220 liters was spilled for each 100,000 bbl shipped. This accident rate would result in about 74 bbl of SRC liquid spilled in estuaries and oceans per year. A worst-case spill during marine transport would be the loss of an entire barge, equaling about 900,000 gal of SRC liquid. The case of a spill of a tank car of SRC-II product is considered likely to be more damaging than a spill of a barge full of SRC-II product; hence, the Potomac case was analyzed further.

In the event of a spill at the Harper's Ferry crossing, a slug of highly contaminated water would form and be carried downstream. Contaminants in solution would be rapidly carried downstream at the normal velocity of streamflow, and insoluble material would contaminate a limited area (perhaps 1 to 2 km of river channel). The concentrations of dissolved contaminants would be acutely toxic, killing many or most of the organisms in the river near the spill area. As the contaminated slug of water moved downstream, the concentrations of pollutants would be reduced by dilution, uptake by organisms, and adsorption to sediments. Hydrocarbons would also decline in concentration due to volatilization and photolysis (see Appendix S). Massive mortality of river biota might therefore be limited to the 5 to 15 km reach immediately downstream from the spill.

Downstream from the zone of massive mortality would be a zone of selective mortality, in which only the more sensitive species would be killed. Further downstream, organisms would suffer chronic effects of contamination rather than outright mortality. As the contaminated slug moved downstream the decline in concentration of contaminants would depend on many specific aspects of the spill site and the nature of the spill event. Therefore, the size or location of the above zones of impact cannot be estimated.

In all probability, the spill of SRC-II fuel described above would result in a minor water supply emergency for the Washington, D.C., metropolitan area. The time of transit from the spill area to Washington would allow for advance preparation. With such advance notice the local authorities would have adequate time to build up a reserve so that intake from the Potomac could be terminated until the contaminated slug had passed the intake. Reserve capacity of the water treatment system could probably supply water for the 2- to 3-d duration, or households could be instructed to store drinking water. As the contaminated slug passed Washington, D.C., concentrations of phenolics would clearly cause taste and odor problems in the water supplied. However, most uses for water other than for drinking and cooking would be unaffected.

Long-term impacts would result largely from the less soluble compounds in the SRC-II product. Close to the spill site, gross contamination would cause significant aesthetic damage. Oil-covered rocks and shoreline could cause limited mortality to birds and other riparian wildlife. Substantial quantities of spilled product would be mixed with gravel, sediment, and other debris in the river. Contaminants adsorbed to fine sediment and organic detritus could be transported downstream, thus allowing dispersion of low-solubility PNA.

The high molecular weight PNA, although unlikely to be acutely toxic because of limited solubility (see Appendix S, Fig. S.2, and Table Z.5.4), are susceptible to bioaccumulation and bioconcentration. Because some PNAs are carcinogenic (Sect. 4.1.2), these could become serious contaminants in downstream ecosystems, including sport fish. Both the soluble and the less soluble phenolics would cause taste and odor problems in fish and shellfish of the Potomac River and Estuary. Recreational fishing in the Potomac could be affected for one or more years, and contamination of shellfish beds in the estuary could cause substantial economic impact. Because of the many unknown factors affecting the distribution of organic contaminants in aquatic ecosystems, it is not possible to estimate the severity of these impacts.

The effect on groundwater quality of a spill in the Potomac River would depend on the nature of the bottom sediments, soils and aquifers, and on the flow in the river. The SRC-II product liquid is primarily composed of (1) substantially insoluble aromatic and aliphatic hydrocarbons, (2) more soluble phenolic compounds, and (3) basic nitrogenous compounds such as amines. These various product compounds may be evaporated, carried in surface water (either floating or dissolved), chemically or biologically oxidized, or leached into the sediments and underlying rock.

The insoluble hydrocarbons (from classes 1 and 3 above), which do not float on the surface, may be sorbed by soil particles and bottom sediment or may seep into underlying aquifers and coat the rock surfaces.

Accidents involving spills will cause releases of pollutants into the atmosphere for a short time. The quantity of release will be a function of the spill size. Spills on land or water, either at the storage sites or while in transit in unit trains or barges, would have the immediate effect of releasing high concentrations of nonmethane hydrocarbons into the atmosphere. Those light, insoluble distillates, which would remain on the water surface, would evaporate. Some of the vapors released are known toxic gases, such as the vapors from naphthalene and phenol portions of the SRC-II product, and proper protective respiratory equipment should be worn when near such spills.

Spills on land would have a temporary effect on air quality because the liquid would be absorbed by the soils in the area or would be cleaned up as quickly as possible. Spills on water also have a temporary effect on air quality because they will be contained, recovered, and cleaned as soon as possible.

If the vapors of a spill should ignite, the resulting combustion would emit various other compounds into the atmosphere, such as carbon monoxide (CO) and sooty particulates. Again, such an event would be temporary in nature.

See Appendix Z for a more detailed discussion of transportation accidents involving spills of SRC liquids.

4.1.3.9 Summary of Health and Environmental Plan

Ongoing studies are discussed in detail in Appendix Y and include environmental research that will:

- aid in the development of an environmentally acceptable SRC-II process, and
- provide data for environmental assessment of the process.

The detailed health and environmental plan for the SRC-II process (Appendix Y) provides a management plan that involves the cognizant offices of the Department of Energy [Assistant Secretary for the Environment and Assistant Secretary for Fossil Energy (ASFE), Oak Ridge Operations office], the developers of the SRC-II process, and environmental research groups. The SRC-II process is described, criteria for selection of samples to undergo environmental analyses are given, and approximate timetables are presented for obtaining pertinent samples. The general DOE approach for synfuels health risk assessment is outlined in Sect. 1.

At this time, the SRC-II process is at the pilot-plant stage of development. Since design criteria may change, the environmental research described in the environmental plan document is organized in four phases that correlate with and will provide information early in process development.

Phase I research (screening) evaluates samples from existing SRC-II facilities [pilot, process demonstration unit (PDU), bench], which may bracket potential demonstration/commercial practice in terms of physical and chemical criteria. The samples are being subjected to a battery of short-term biomedical and ecological assays. Chemical fractionation and analysis are being performed to determine compounds and compound classes of potential concern. In some cases, chemical fractionation/manipulation is required to provide materials amenable to biological and ecological testing. Phase I research provides a first estimate of potential environmental properties of SRC-II materials. As such, phase I aids in:

- setting research priorities for the second phase of work, which involves longer term, more extensive biomedical and ecological assays and chemical analyses;
- providing initial data on materials and chemical entities that may require ameliorative action during process development; and
- providing first, qualitative analyses for assessing environmental risk to be expected from deployment of the SRC-II process.

Phase II (baseline) research will evaluate the SRC-II materials considered most representative of potential demonstration/commercial practice. These materials will be subjected to longer term,

more extensive biological and ecological analyses relative to effects and environmental fate. Chemical fractionation and analyses will again be used to (1) provide materials amenable to bioassay and (2) determine compounds and compound classes of concern.

Appendix Y contains summaries of ongoing efforts and results to date on research in phases I, II, and III. The current program is defined most specifically in phase I, with decreasing levels of specific description in phase II, and little specificity in phases III and IV. Phases III and IV are contingent on process development and on the results of phases I and II. Therefore, the plan will be routinely updated to more specifically define later-phase research efforts. Studies suggested in the plan are consonant with the environmental concerns and requirements stated in the Environmental Development Plan for Coal Liquefaction and in the DOE Program Environmental Plan for SRC processes.

4.1.3.10 Exposure from product end-use applications

Exposure from product end use may involve occupational and public exposure. Occupational exposure may result primarily through skin contact, and public exposure may result from combustion emissions (assuming that combustion is the only end use for demonstration plant products). The discussion of skin contact for maintenance workers in Sects. 4.1.3.4 and 4.1.3.6 applies to occupational exposures for end users. DOE will provide information on the toxicity of SRC-II materials, recommend handling procedures, and suggest employee medical surveillance programs. Full-scale tests have been carried out using liquid products from the SRC-II process. In addition, many smaller tests of both liquid and solid products have been performed. Appendix C discusses these tests in more detail.

A combustion demonstration using distillate fuel oil from the SRC-II process was conducted on a utility boiler located at the 74th Street Generating Station of the Consolidated Edison Company of New York (Con Ed). The overall program was sponsored by Electric Power Research Institute (EPRI), Con Ed, and the New York State Energy Research and Development Administration, in cooperation with DOE, which supplied the SRC-II fuel oil. Appendix C discusses combustion tests in more detail.

The test boiler was a corner-fired, Combustion Engineering, Inc., unit with a rated steam flow of 450,000 lb/h. Emissions and boiler performance were investigated at full, half, and three-quarter loads for baseline and low- NO_x (staged-combustion) conditions. About 4500 bbl of SRC-II fuel oil was used during the program. Nitric oxides, oxygen, carbon monoxide, polycyclic organic matter, total unburned hydrocarbons, sulfur trioxide, particulate mass, and particle size distribution were measured. The performance of SRC-II fuel oil was also examined with respect to combustion characteristics and adaptation to existing boiler hardware. The No. 6 fuel oil now burned in the test boiler was also compared with the SRC-II fuel oil.

A number of conclusions regarding the combustion and emission characteristics of SRC-II fuel oil in a utility boiler have resulted from this test program. Although these conclusions are based on results obtained using specific SRC-II and No. 6 fuel oils in a specific boiler, and should be interpreted on this basis, the data trends and comparative characteristics are considered to be generally valid.

Nitrogen oxide emissions were nominally 70% greater than those obtained for the No. 6 fuel oil, under both baseline and low- NO_x conditions. Assuming equivalent thermal NO_x formation, this implies a 20% conversion of the differential fuel nitrogen to NO_x for baseline conditions. Reductions in NO_x levels through staged combustion were about 35% for both SRC and No. 6 fuel oils. A boiler now capable of satisfying the EPA New Source Performance Standards (NSPS) for NO_x emissions of 0.3 lb/10⁶ Btu would be expected to be capable of satisfying the proposed 0.5 lb/10⁶ Btu NSPS for coal-derived liquids, if an SRC-II fuel oil equivalent to that burned in this test program were used.

Particulate mass emissions were nominally lower for SRC-II fuel oil than for the No. 6 fuel oil and were below the EPA-proposed NSPS of 0.03 lb/10⁶ Btu under all test conditions. The emissions at full load exhibited a bimodal size distribution comprised of a large number of carbon particles with diameters of about 0.05 μm or less and a smaller number of agglomerated particles with sizes greater than 0.1 μm . The No. 6 fuel oil emissions did not exhibit this agglomerated behavior, although the actual particle concentrations were higher than for the SRC-II fuel oil. No mechanism was determined for the observed agglomeration, which was substantially reduced at lower boiler loads. The No. 6 fuel oil emissions contained numerous large particles (greater than 1 μm), indicating an atomization-related formation mechanism. Such particles were not totally optimum for this fuel.

Total hydrocarbon emissions were less than 3 ppmv under all operating conditions with both fuels.

Carbon monoxide levels were maintained below 50 ppmv for all test conditions at generally equivalent total excess air levels for both fuels. Thus, the SRC-II fuel oil used in this program did not indicate any greater tendency toward incomplete combustion than did the No. 6 fuel oil.

Polycyclic organic matter (POM) emission levels with both fuel oils were low — less than 6×10^{-6} lb/10⁶ Btu. Trends indicated by the POM data, although qualified by the overall test uncertainty, indicated that emissions at half load were higher than those for full load with both fuels and that the emissions with SRC-II fuel oil were nominally higher than the No. 6 fuel oil levels. All the POM emission levels with both fuels were substantially lower than those obtained on other programs with coal-fired boilers. Because of the limited number of POM samples and uncertainties in the combined sampling, extraction, and analysis techniques, the absolute values of POM emissions obtained in this program must be interpreted with caution.

A complete tabulation of the emissions data is presented in Appendix C Tables C.27 and C.28 for SRC fuel and No. 6 fuel oils, respectively. Test methods and procedures used to obtain these data are discussed in Appendix C.

Hydrotreatment of SRC liquids

In the proposed SRC-II demonstration plant, various grades of liquid products are produced. Some of these liquids present potential health concerns (see Appendix Y).

Hydrotreating entails catalytic hydrogenation of SRC liquid products to light distillate or naphtha fuels suitable for use as transportation fuels and as medium and heavy oil fractions. Preliminary research studies have indicated that hydrotreating SRC liquid products in the boiling range of 185 to 360°C (365 to 716°F) may significantly reduce the mutagenic activity of transported products, as determined by the Ames *Salmonella typhimurium* assay.^{22,23} Although other important biological endpoints were not measured, chemical analyses showed marked reductions in the amount of genotoxic chemical classes such as PNAs, heterocyclic PNAs, and primary aromatic amines (PAAs).²³ However, the samples characterized were blends of middle and heavy distillate fractions of SRC-II liquid produced from Pittsburgh seam (West Virginia) coal at the Fort Lewis pilot plant and were only generically representative of projected demonstration plant materials. They also contained significantly less heavy end material than some of the demonstration plant heavy fuel oils that are of primary processing interest and that have been shown to be more biologically active.

Although studies to date on the biological activity of hydrotreating have been strictly exploratory, they have demonstrated the need for better characterization of the potential health impacts of possible fuel oil upgrading processes. A comprehensive plan for evaluating the influence of upgrading operations and changes in plant operations on the biological effects of SRC liquids is therefore now in preparation. The results of this program will provide valuable input to the health and environmental management options for heavy SRC-II liquid products.

Although hydrotreating might reduce the potential impacts of the transportation and use of heavy liquid products, including the impacts of accidental releases, it would have a negligible effect on the emission of complex organics from the demonstration plant. Inclusion of a hydrotreating section to provide sufficient capacity to treat liquid products from the demonstration plant would result in a small increase in the emission of criteria pollutants. DOE has decided not to include a hydrotreating facility at the demonstration plant (Sect. 1.3). Relevant studies of SRC-II heavy liquid products are in progress, and results may be available in early 1981. It should be noted that, at this time, the extent of hydrogenation that might change mutagenic properties of SRC materials is not known, and thus, the economic impacts of hydrotreating for environmental and control purposes are difficult to predict. Further, it has not been demonstrated that results derived from microbial assays of hydrotreated SRC materials correlate quantitatively with results from animal assays of skin or pulmonary carcinogenicity. These assays are considered more appropriate in assessing risk to man than are the microbial tests.

4.2 PROPOSED SITE — FORT MARTIN, WEST VIRGINIA

4.2.1 Land

This section discusses the construction and operational impacts predicted for the proposed site on land use, geology and soils, and terrestrial ecology. Section 4.5 discusses recommended construction and operational monitoring, and Sect. 4.6 discusses recommended mitigation measures.

4.2.1.1 Land use

The project facilities will change 151 ha (373 acres) within the proposed site boundaries from principally rural uses to an industrial area covered by permanent facilities. Additional land area will be temporarily disturbed during site preparation and project construction.

Relationship between proposed site use and local land use plans

The proposed site is adjacent to the coal-fired Fort Martin generating station. Part of the site has been subject to ongoing industrial activity in the form of strip and underground mining for many years. Part of the site was considered by Coalcon for industrial development. The site is not subject to zoning regulations. No designated wild areas, parks, or greenbelts are in the vicinity of the proposed site.

Construction impacts

Impacts on land use will result primarily from acquisition of the site and construction of facilities. About 12 ha (30 acres) of cropland, 48 ha (120 acres) of hay meadows, and 480 ha (1200 acres) of pasture will be taken out of agricultural production for the life of the plant. Pasture not occupied by facilities will revert through natural succession unless open land is deliberately maintained. About 20% of the proposed site has been affected by current or past surface mining.

The area adjacent to county road 53, about 2% of the site, is currently in residential use. Of the 29 tracts comprising the currently proposed site, 19 are occupied by a total of 24 residences. Acquisition of the site will result in relocation of about 60 persons. The number of families to be relocated is small in relation to the available housing market. Because the majority of residences will not be immediately affected by construction, residents should have ample time to locate replacement housing. It is anticipated that schedules for vacating residences can be arranged to accommodate the needs and desires of each family. It is currently anticipated that, except for the two estates whose owners decided not to relocate, all will vacate the property by March 1, 1981.

Access to the church and the associated cemetery will be maintained, and access to the private cemetery will be provided as appropriate. At this time, it is not certain whether services will continue to be held in the Fort Martin Church; this will be decided by members of the congregation.

A community center is located within the proposed site. The building used for the center is the Fort Martin School, built in 1898, which has been identified as a potential historic site. The three-room building is no longer used for educational purposes and is used infrequently by the community association. The site will not be directly disturbed by construction, and current plans do not call for acquisition of this property. However, the project will adversely affect the value of the school from an aesthetic standpoint, and DOE is investigating the possibility of moving the structure to a new location.

Recovery of mineral resources is not expected to be affected significantly. Coal is the only significant mineral resource remaining on the site. Most of the remaining coal on the site will be removed before construction of the facilities.

Operational impacts

Operation of the demonstration plant should have no additional impacts on site land use.

Offsite land use impacts

With the exception of possible changes in utilization of the church and community center, construction and operation of the demonstration plant are expected to have no significant effect on offsite land use. Due to uncertainties concerning commercialization of the demonstration plant at an expanded capacity, secondary growth directly related to the demonstration plant is not anticipated in the immediate area. Secondary growth is expected to occur primarily through expansion of existing business; new businesses are expected to locate in areas already being used for commercial enterprise.

Impacts of commercialization

Construction of a commercial facility at the demonstration plant site is expected to have additional impacts on land use. A total of about 160 ha (395 acres) of land will be required for expansion of the process, coal storage and slag landfill areas, utilities, and product storage (Fig. 2.2). Some additional expansion of the product storage and shipping area may also occur, depending on the mode of product shipment. Because the areas that will be used for commercial expansion are adjacent to the areas used for demonstration operation, changes in land use will be minimal.

Secondary growth is possible in the area of a commercial facility. The extent of such growth cannot be predicted at this time. The impacts of secondary growth during commercial operation could be controlled through implementation of land use planning and appropriate zoning.

4.2.1.2 Geology and soils

Construction impacts

The geologic impacts associated with construction will fall into two categories: impact on geologic materials during site preparation and impact of the site's geology on the requirements for site preparation.

The proposed plant site will be graded, stripped, and either excavated or filled before construction. About 172 ha (425 acres) will ultimately be disturbed for the product loadout area, the demonstration process area, and the demonstration waste disposal area (see Fig. 2.2, Sect. 2.2.1, for the plant layout drawing).

Erosion during construction, clearing and grubbing of the site, and removal of topsoil will affect site soils. Erosion control measures are planned (discussed below). During the detailed design stage, a Project Environmental Plan will be prepared by the industrial participant and submitted to DOE in early 1981. This plan, which should not be confused with the DOE Project Environmental Plan, will specify construction practices and procedures, as well as facilities that will be used to reduce soil erosion and prevent sedimentation. Particular emphasis will be given to:

1. scheduling of site preparation activities to minimize the area disturbed at any time,
2. early construction of drainage collection and permanent sediment control facilities,
3. use of construction practices and grading techniques designed to minimize erosion,
4. use of temporary sediment control facilities,
5. removal and proper storage of topsoil for use in revegetation of disturbed areas,
6. protection or removal and proper disposal of pyritic or other soils that should not remain exposed,
7. prompt revegetation of disturbed areas and use of mulch or other temporary protection on areas that cannot be revegetated immediately, and
8. use of dust suppression techniques to prevent wind erosion and fugitive dust.

Such measures will reduce soil loss and toxicity problems, but they will not prevent some disruption of soil structure, which may reduce aeration and inhibit plant growth.

The total soil profile averages 1 m over the site, and the most productive zone lies in the first 15-20 cm.

For the purpose of evaluating a worst-case situation, it has been assumed that no erosion control measures will be used. Using this assumption and applying the universal soil loss equation, sheet erosion from construction is predicted to result in the loss of about 180,000 metric tons of soil per year. Appendix L.5 discusses the assumptions and accuracy of this equation. Soil losses without the use of conservation practices are estimated to be equivalent to a loss of about 3.8 cm depth, averaged over the entire 172-ha area. Gully erosion, such as may occur along haul roads or pipeline routes, could significantly add to soil losses if uncontrolled. The amount of this loss cannot be predicted at this time because of the lack of both field data

and predictive models that are valid over large sections of the United States. The soil loss from uncontrolled sheet erosion was estimated assuming that major construction and revegetation activities would be completed in one year. Lengthening of the period of soil disturbance would increase potential soil losses; the extent of such loss would depend on construction practices and rainfall. The schedule of clearing, construction, and revegetation is not known at this time. Soil erosion can produce a number of significant environmental impacts. Increased sediment loading can reduce water quality and adversely affect aquatic ecology. Wind erosion can increase suspended particulate levels, reducing air quality and adversely affecting terrestrial ecology. Loss of topsoil, disruption of soil structure, and exposure of pyrite- or boron-rich soils may slow revegetation, resulting in additional erosion and the release of toxic soil materials.

Geotechnical soil properties. The geotechnical properties of soils and underlying strata at various areas of the site will affect the design and stability of structures, pipelines, waste disposal area liners, and storage areas. In general, environmental impacts related to geotechnical properties will be reduced by avoiding unsuitable areas in the final plant layout and considering these properties in the engineering design. Final analysis and design of such measures will be completed before construction. Potential geotechnical problems, which will be addressed, along with engineering measures, in detail in the safety analysis report (Appendix AA), are:

1. Corrosivity of shale materials. Certain excavated materials such as dark-colored shales may be encountered on site and would be expected to contain pyrite, which is corrosive to concrete.
2. Foundation or liner failure by differential settlement. Fill and strip-mine spoil materials occur on portions of the site and are subject to compaction, which will vary with location and soil composition. This is of concern in coal and slag disposal areas.
3. Foundation failure by subsurface collapse. The Pittsburgh coal seam has been mined underground on part of the site, and this area is subject to subsidence caused by mine roof collapse. This characteristic is associated primarily with the western portion of the site and should not influence the demonstration plant as proposed.
4. Slope stability. Fill materials and natural slopes along the river have a high potential for landslides and other types of mass movement, particularly when these earth materials are saturated.²⁴ This is of concern for the proposed product pipeline that transports heavy oil from the process area to the riverside storage tanks.

Operational impacts

Subsidence. Instabilities due to slumping, landslides, and subsidence related to underground mining may occur on certain portions of the site during plant operation. Areas known to be affected by underground mining and subsidence have been avoided in the siting of process, waste disposal, and coal storage areas. Because the bedrock dips downward toward the west, coal seams that were mined underground in the western part of the proposed site are at the surface or have been eroded away in the eastern section. Based on the slope of the coal beds, underground mining of Pittsburgh, Redstone, Sewickley, and Waynesburg coals could not have occurred beneath the proposed process and waste storage areas. Hence, subsidence due to mine collapse is not expected.

Landslides. Landslides may occur in several areas of the proposed site because of the nature of the geologic material and the presence of steep slopes (see Appendix H). Hillsides along the river are particularly prone to landslides,²⁴ especially during periods of high rainfall. Disruption of the pipeline transporting product over these hillsides from the process area to the storage area near the Monongahela River could occur during landslides. Landslides of this type are often caused by heavy rainfalls, and pipeline failure with resulting product spills is difficult to mitigate under these conditions. Analysis of the probabilities and effects related to slumping, landslides, and subsidence and measures to mitigate the risk will be presented in the safety analysis report (see Appendix AA). The possibility of landslides will be considered in the final design of critical structures such as the product pipelines from the main process area to the riverside storage tanks.

Seismicity. Given the seismic history of the area, it is unlikely that an earthquake of intensity greater than V (on the Modified Mercalli scale, used to rank earthquake intensities) will occur in the vicinity of the site. Damage to structures caused by earthquakes of this predicted intensity should be negligible.

Soils. Chemical and physical changes in the soils may occur due to spills, deposition of airborne particles, leachates from coal storage and waste disposal areas, and compaction. In one study,²⁵ small increases in trace metal concentrations have been found to be insignificant in terms of plant toxicity or impact on water quality. The increase may be enough, however, to affect certain enzymatic processes in the soil that convert nutrients to forms that can be absorbed by plants.²⁶ Addition of such inhibiting elements may decrease soil productivity slightly. The characteristics and impacts of coal and slag leachates are discussed in Appendix K and Sect. 4.2.2.2.

Impacts related to commercialization

Impacts due to expansion will include (1) increased construction activity and (2) increased mining activity necessary to supply the additional feedstock. Impacts and mitigating measures involved in expanded coal mining activities are documented in other publications (also see Foreword and Sect. 1.4.3.5).²⁷⁻³⁰

Impacts related to decommissioning

Impacts on the geology and soils of the site due to decommissioning would depend on the amount of additional earth moving required. This may be a result of the construction of new facilities resulting from an alternative use of the site or the dismantling of demonstration-phase structures. Such disturbances will increase the amount of soil erosion and sedimentation in a manner similar to that outlined in the preceding discussion of construction impacts. Mitigating measures (Sect. 4.6.4) can substantially reduce impacts related to the erosion of soils.

Some impacts related to changes in soil chemistry or permeability are likely to persist after decommissioning, thus restricting future uses of the soils.

4.2.1.3 Terrestrial ecology

Construction impacts

Vegetation. Land clearing, leveling, and general construction activities will destroy or disturb vegetation in and around construction areas. Permanent facilities will preempt land for at least the life of the project. Areas used for construction laydown and vehicle access will be disturbed only during the construction period and will be revegetated afterwards. The total area required for permanent demonstration plant facilities will be about 151 ha (373 acres) (Table 4.4). The area that may be temporarily disturbed during construction is larger, but it has not been quantified due to the tentative nature of construction plans involving areas for temporary storage of materials. The approximate areas required for the various facilities are summarized in Table 4.4.

As currently proposed in Fig. 2.2, the process area and coal stockpile will be located east of Fort Martin Road in an area occupied mostly by grassland and scrub. The solid waste disposal area will be west of Fort Martin Road in an area that is predominantly pasture and mined land. The product storage tanks, loadout, railroad sidings, and associated facilities in the Monongahela bottomlands, will occupy man-made communities and 1.0 ha of forested wetland. The main haul road will occupy deciduous forest and smaller amounts of other communities. The truck storage area will destroy about 3.5 ha of the sedge-rush meadow near the Fort Martin School/Community Center (Appendix D).

Grassland, shrub and tree grassland, scrub, and sedge-rush meadow, which are early successional communities dominated by relatively common or widespread species, might be fairly readily reestablished after disturbance. However, species diversity will be lower in revegetated areas than in original communities until natural revegetation by nonplanted species occurs. Woody species take longer than herbaceous plants to reestablish, and sedge-rush meadow would not reestablish unless a suitable moisture regime was present. Forest and forested wetland are advanced successional communities in which the effects of disturbance would be longer lasting. Recovery to current conditions might take 100 years or longer.

The most serious impacts will probably be the total loss of the 1 ha of forested wetlands in the product storage area on the Monongahela River bottomlands and severe disruption of the mixed mesophytic forest occupying the narrow valley through which the haul road will be built and below which the railroad spur will pass. The wetlands contain 3 species and the forest contains 16 species not encountered elsewhere on the site. Wetlands along the Monongahela River in the vicinity of the site are not abundant. An inventory of wetlands 4 h or larger completed by the West Virginia Department of Natural Resources (DNR) did not show the presence of wetlands

Table 4.4. Vegetation communities at the proposed site to be removed for permanent SRC-II demonstration facilities^a

	Approximate area	
	ha	acres
Process area, support facilities, and utilities		
Grassland	29.2	72.2
Pond	0.3	0.8
Scrub	13.7	33.8
Residential	1.8	4.4
Total	45.0	111.2
Coal stockpile		
Forest	0.5	1.2
Grassland	9.9	24.5
Shrub-tree grassland	0.5	1.2
Total	11.0	27.2
Slag disposal area		
Grassland	19.6	48.4
Shrub-tree grassland	2.6	6.4
Residential	1.4	3.5
Total	23.6	58.3
Railroad spur and facilities in river bottoms ^b		
Forest	26.6	65.7
Forested wetland	1.0	2.5
Grassland	0.2	0.5
Pond	0.3	0.7
Cropland	7.3	18.0
Scrub	1.1	2.7
Residential	2.6	6.4
Conifer plantation	4.2	10.4
Total	43.3	107.0
Truck loadout area		
Grassland	5.0	12.3
Sedge-rush meadow	3.5	8.6
Shrub-tree grassland	2.1	5.2
Total	10.6	26.2
Coal conveyor		
Forest	2.0	4.9
Grassland	0.5	1.2
Scrub	0.5	1.2
Total	3.0	7.4
Stockpile, process area to stockpile, and process area roads ^c , total	14.7	36.3
Total area required for permanent facilities		
Forest	29.1	71.9
Forested wetland	1.0	2.5
Grassland	64.4	159.1
Sedge-rush meadow	3.5	8.6
Pond	0.6	1.6
Shrub-tree grassland	5.2	12.8
Scrub	15.3	37.8
Conifer plantation	4.2	10.4
Cropland	7.3	18.0
Residential	5.8	14.3
Unknown	14.7	36.3
Total	151.1	373.4

^aCommercial facilities are not included; temporary facilities for construction will disturb additional land; slight inconsistencies in numbers are because of rounding to nearest tenth.

^bFacilities in the Monongahela River bottoms included in this estimate are the product storage area and associated buildings, loadout railroad sidings, unload railroad spur, haul road (in bottoms and on forested valley slope), barge slip, access road, and raw water intake structure.

^cVegetation types to be disturbed were not estimated for these categories.

along the Monongahela River in the vicinity of the site (Ron Fortney, West Virginia DNR, personal communication, May 13, 1980). A field survey along a 17.5-mile stretch of the Monongahela River bottoms that include the proposed site (river miles 87 through 104.5), found a total of 10.1 ha of various types of wetlands at least 0.04 ha in size. This included 2.6 ha of 9 floodplain ponds, 3.2 ha of 3 ponds in ravine mouths, 2.8 ha of 7 forested floodplain wetlands (the term "wetlands" is used to indicate that little standing water is present in comparison with ponds), 1.1 ha of 2 forested wetlands in ravine mouths, and 0.4 ha of 1 herbaceous wetland. Loss of the two forested wetlands on the site represents 10% of the area of all wetland types found and 36% of the forested floodplain wetlands found. The small size of the site's forested wetlands and their lack of rare plant or animal species indicate that these wetlands are not particularly important in comparison to wetlands in general. Current estimates indicate that 12.5 ha of forest will be cleared for the railroad spur, and 12 ha of forest will be cleared for the haul road (Table 4.4).

The loss and clearing of floodplain and riparian forests is a significant national problem. As much as 90% of the nation's original riparian wetlands may have already been lost, and current losses are about 6% per year.³¹ Floodplain forests are very important in many ways, including the support of a large number of wildlife species (many threatened and endangered species), storage and slow release of floodwaters, water quality maintenance (e.g., sediment entrapment), ground-water recharge, the prevention of downstream flooding, and very high productivity.³²

No Federally listed endangered or threatened plant species (Sect. 3.2.1.3 and Appendix E) would be affected. Of the two plant species considered rare in West Virginia by the West Virginia Heritage Trust (WVHT) Program, northern water plantain (*Alisma triviale*) in the Crooked Run sedge-rush meadow will not be affected, whereas *Panicum verrucosum* near Garlow Cemetery may be destroyed. The latter species appears to be just outside the solid waste disposal area.

In addition to direct physical removal and damage, construction activities may affect terrestrial plant communities through the release of fugitive dust, vehicle emissions, and erosion-derived sediments. Dust control measures (Sect. 4.2.1.2) and the region's high rainfall should preclude measurable damage from dust. The effects of vehicle emissions and chemical release should be minimal (Appendix G). Erosion will be controlled by temporary dikes, sedimentation ponds (Sect. 4.2.1.2), and other construction practices.

Wildlife. The proposed facilities will be located primarily in areas that do not support highly diverse or dense wildlife populations. These areas include shrub and tree grassland, grassland, scrub, cropland, residential areas, and conifer plantation [total 102.2 ha (Table 4.4)]. Other habitats to be affected are pond, sedge-rush meadow, forest, and forested wetland (total 34.2 ha), which support populations of a larger number of species. The habitat acreages to be affected by permanent facilities represent about 14% of the forest on the site, 20% of the grassland and shrub and tree grassland, 7% of the scrub, 100% of the forested wetlands (1 ha), and about 15% of the sedge-rush meadows (wetland). Thus, relatively small fractions of most habitats on the proposed site would be affected (if acreages for temporary uses are minimized), and most wildlife populations should not be seriously reduced. There is no evidence to indicate that any species' population is more abundant in the permanent facility area than in surrounding areas on and off the proposed site (except as noted).

Although the grassland and shrub and tree grassland on the site are not high-quality wildlife habitats, they are potential breeding habitat for 12 bird species listed by the WVHT Program and the Audubon Society *Blue List* (Sect. 3.2.1.3). These are the short-billed marsh wren, Henslow's sparrow, marsh hawk, upland sandpiper, short-eared owl, common nighthawk, loggerhead shrike, eastern bluebird, grasshopper sparrow, lark sparrow, Bachman's sparrow, and vesper sparrow. Although all are potential breeders, only the loggerhead shrike, grasshopper sparrow, eastern bluebird, and vesper sparrow appear to have breeding populations on site; populations of these species will quite likely be reduced in proportion to the amount of habitat lost. The marsh hawk was observed on the proposed site during the summer, but whether it nested there is not known. The other species probably do not breed on the proposed site. The vesper sparrow, which breeds primarily on mined land, might not be greatly affected, depending on the level of disturbance at the proposed solid waste disposal site. On the proposed site, the eastern bluebird is probably limited by low availability of nest cavities or boxes; its population could probably be increased by adding nest boxes, even in the presence of the proposed facility. Another grassland-associated species is the meadow jumping mouse. This species was found at the margin of a small pond on Keener's Knob, located off site. Although this locality will not be affected, this species may also occur on the proposed site.

Additional WVHT and *Blue List* species are the fox squirrel, sharp-shinned hawk, Cooper's hawk, yellow-billed cuckoo, hairy woodpecker, yellow-breasted chat, warbling vireo, ruby-throated

hummingbird, and yellow warbler. These are generally associated with forest, scrub (immature forest), and shrubby habitats. Most of these species are known to breed on the proposed site, and the others (sharp-shinned and Cooper's hawks) probably breed on or near the site. Populations will be reduced in proportion to habitat destruction; species sensitive to noise and human activity (possibly the hawks) might be reduced in greater proportion than habitat loss. The remaining species listed probably do not occur regularly on the proposed site.

Game and fur animals breeding on the proposed site include the white-tailed deer, fox squirrel, gray squirrel, woodchuck, cottontail rabbit, spotted skunk, striped skunk, possibly the least weasel and mink, muskrat, opossum, raccoon, long-tailed weasel, red fox, gray fox, ruffed grouse, American woodcock, mourning dove, wood duck, and possibly the ring-necked pheasant. Breeding populations of these species would be reduced in proportion to habitat loss, and potential additional losses could result from noise and human activity. However, regional populations should not be significantly affected because most of the species are widespread and common in the region.

The white-tailed deer on the proposed site may be affected more than most of the species because the proposed location of the coal storage pile and process area lie along most of the Monongahela slope forest. Thus, use of the forest edge and adjacent habitats by the slope deer herd might be greatly restricted and could result in a significant reduction in the site's deer population. The total deer population on the proposed site and between the northern part of the site and the Monongahela River has been estimated to be about 37, including about 21 deer along the Monongahela River and about 16 deer in the western half of the site. These data indicate that deer density in this area is about 2.8 deer/km², which is below the estimated densities of 3.6 deer/km² for West Virginia overall and 4.6 deer/km² for Monongalia County. Therefore, the region's deer population should not be significantly reduced. The deer in the western part of the site should not be affected by construction. One area heavily used by deer that will be severely affected is a forested ravine in the eastern part of the proposed site, which is the planned location for the haul road.

No animal species listed as threatened or endangered (Sect. 3.2.1.3) should be affected by the project. The bald eagle and the arctic peregrine falcon would occur only as very rare migrants at the proposed site, and the Indiana bat would not be likely to breed there (Sect. 3.2.1.3). DOE has contacted the U.S. Fish and Wildlife Service about Federally protected fauna and flora in accordance with the Fish and Wildlife Coordination Act (PL 85-624, 16 USC 661-666) and the Endangered Species Act. Results of this formal contact, presented in Appendix E, indicate that no endangered species are known to exist in the proposed project's impact area (except for occasional transient individuals) and that none should be affected.

Conclusion. Ecologically, the proposed site appears to be satisfactory. Most of the site has been recently disturbed by mining and used for pasture. These affected areas are generally low-quality habitats for most plant and animal species, but they are potential habitat for several rare, uncommon, or declining species.

The hardwood forest on the Monongahela Valley slope is a relatively undisturbed habitat that is more valuable to wildlife. Portions of this forest will be cleared for the haul road and railroad siding. No alternative locations for these facilities appear feasible. The railroad siding must be located adjacent to the Monongahela Railroad Company main line along the river. The existing highway cannot be used as a haul road because it is neither wide enough nor structurally stable enough for large equipment. Routing the road up a steep slope rather than up the ravine would require a great deal of earthwork to sufficiently reduce the slope.

As proposed, the process area, coal stockpile, and solid waste disposal area will be located primarily in grassland and scrub rather than in higher-quality habitats. Thus, the location of these facilities on the site appears reasonable. Species listed by the Federal government as endangered or threatened should not be affected. Although a small amount of wetlands will be affected, these are not considered to be particularly important wetlands. Mitigation of habitat loss is considered in Sect. 4.6.7.

Operational impacts

Ecological and land use impacts could result from particulate and gaseous emissions, vehicular traffic, noise, human presence, and production of waste products. Because the effects of vehicular traffic, noise, and human presence would be relatively minor and obvious, only air pollution effects are addressed in this section. The analysis focuses on impacts to vegetation because air pollutants have generally not been shown to significantly affect wildlife populations directly, except in extremely high concentrations³³ (Appendix G). Because threatened or endangered biota do not frequent the site or surrounding area (Appendix E), none should be affected by plant operation.

The maximum expected increase in concentrations of the major air pollutants — sulfur dioxide (SO_2), nitrogen oxides (NO_x), and particulates — resulting from operation of the proposed plant is roughly one-sixth to one-tenth of the existing concentrations at the site.* The existing concentrations could already adversely affect extremely sensitive plant species. The small increment from plant operation would slightly increase any existing levels of impacts on vegetation. Any such increases would be difficult to detect by monitoring and could probably not be distinguished from effects on vegetation caused by air pollution from other industries in the area. Applicable EPA air quality standards should not be violated during normal plant operation (Sect. 4.2.3.1). Detailed analyses and background information are given in Appendix G.

At the specific locality at which pollutant concentrations will be maximal, as determined by wind direction and dispersion modeling (about 2.5 km NE of the facility), normal plant operation is expected to increase ambient ground-level concentrations of SO_2 by $53 \mu\text{m}^3$ for the 3-h maximum, $13 \mu\text{m}^3$ for the 24-h maximum, and $4 \mu\text{m}^3$ for the annual average (Sect. 4.2.3). These concentrations compare with current ambient SO_2 levels of 705, 239, and $44 \mu\text{m}^3$, respectively (Table 4.5). [Note: For the reader's convenience, Table 4.5 will be shown again in Sect. 4.2.3.1, where much of the data is applicable.] For sensitive plants, 4-h SO_2 concentrations required to produce threshold injury have been projected to range from 262 to $2620 \mu\text{m}^3$ (ref. 34). Therefore, both the short-term existing ambient level and the resulting ambient level during plant operation could affect extremely sensitive species. Pasture is the predominant vegetation and land use in the area [480 ha onsite (ER)]; hay meadow (48 ha) and cropland (12 ha) are lesser uses. Most pasture grasses are considered sensitive species,³⁴ and those in areas of maximum concentrations near the site could experience slightly reduced productivity as a result of plant operation.

Table 4.5. Maximum pollutant concentration estimates for the proposed SRC-II demonstration facility

Values are in $\mu\text{g}/\text{m}^3$. Refinement in emission data is the result of additional design work since the DEIS was published in June 1980

Pollutant	Averaging time	Predicted ground-level maximum concentrations ^a	Observed background ^b	Federal standards			West Virginia ambient standards ^e	Percentage of PSD increment consumed
				NAAQS ^c		PSD ^d class II		
				Primary	Secondary			
SO ₂	3 h	52.9	705		1,300	512	1,300	10.3
	24 h	12.1	239	365		91	365	13.3
	Annual	3.7	44	80		20	80	18.5
NO ₂	Annual	23.4	29	100	100		100	
CO	1 h	1.1	2,587	40,000	40,000		40,000	
	8 h	1.0	1,508	10,000	10,000		10,000	
O ₃	1 h	None ^f	217	235	235		e	
NMHC ^g	3 h	5.4	2,453	160	160		160	
TSP ^h	24 h	12.9	114	260	150	37	150	34.9
	Annual	6.3	42	75	60	19	60	33.2

^aDue to demonstration plant alone.

^bJuly 1978 through June 1979; computed at 329 m (1079 ft) and 25°C (77°F).

^cNational Ambient Air Quality Standards; maximum allowable concentrations, including background.

^dPrevention of significant deterioration; maximum allowable increases in concentrations above background.

^eWest Virginia standard will be changed to agree with NAAQS.

^fOzone, as such, is not emitted but is thought to be related to NMHC emissions after due time for conversion (see text Sect. 4.2.3).

^gNonmethane hydrocarbon; guideline only; maximum concentration between 0600 and 0900 local time; includes point sources and fugitive losses.

^hTotal suspended particulates.

Plants are several times less sensitive to NO_x than to SO_2 (ref. 35). Normal plant operation of all facilities except the thawing shed* is expected to increase the ambient annual average NO_x concentration of $29 \mu\text{m}^3$ by a maximum of $5 \mu\text{m}^3$ (Sect. 4.2.3.1). Therefore, NO_x emissions should not significantly affect plants (except possibly near the site, due to thawing shed operation).

* Additional information obtained after the DEIS was published includes emissions of NO_x from a thawing shed, which will emit only 2% (1.21 g/s) of the total NO_x emissions (58.9 g/s) from the SRC-II facility. However, the emissions from the shed will be released near ground level, which will result in a higher ground-level concentration ($23.4 \mu\text{g}/\text{m}^3$ maximum annual average, located 500 m east of the center of the SRC-II process area) of NO_x than from all other SRC-II sources. Because the shed represents an anomaly, its emissions were not added to this analysis, which was originally presented in the DEIS.

Predicted maximum concentrations of carbon monoxide represent less than 0.1% of the air quality standard. Most hydrocarbons are expected to be consumed by the plant flare or controlled combustor (Sect. 2.2.1). The maximum 3-h concentration increase of nonmethane hydrocarbons is predicted to be $5.4 \mu\text{g}/\text{m}^3$ (including fugitive emissions), which is much lower than the background level of $2453 \mu\text{g}/\text{m}^3$ and about 4% of the air quality standard. Particulates from coal handling and storage, which will settle primarily within a few hundred meters of the facility (Sect. 4.2.3.1), should not significantly affect vegetation surrounding the site. Normal plant operation (excluding coal handling and storage) is expected to increase the ambient annual average particulate concentration of $42 \mu\text{g}/\text{m}^3$ (Table 4.5) by $7 \mu\text{g}/\text{m}^3$ (Sect. 4.2.3.1). This increase in concentration represents 12% of the secondary air quality standard ($60 \mu\text{g}/\text{m}^3$). No significant impacts on vegetation or animals because of particulates should occur.

The formation of secondary pollutants, such as PAN (peroxyacetyl nitrate), and the occurrence of acid rain are regional rather than site-specific problems. Acid rain has had severe effects on fish and other aquatic biota in the Adirondack Mountains and lesser effects in other areas. Acid rain indirectly affects the endangered bald eagle, which feeds on fish. Operation of the proposed plant may increase these problems by a very small increment.

Operation of the cooling towers will result in deposition of small amounts of biocides and various salts on vegetation and soils (Sect. 4.2.3.1) and small emissions of organics from heat exchanger leaks (Appendix C, Sect. C.3.5.5). Cooling tower installations at industries throughout the United States have not caused significant ecological problems. Therefore, operation of the relatively small cooling towers at the proposed site should not significantly affect vegetation.

Impacts related to commercialization

Commercialization at an expanded capacity will result in the same types of impacts as those due to the demonstration facility, except that they would be somewhat increased. A total of about 160 ha (395 acres) of land will be required for the expansion (Sect. 4.2.1.1). If unexpected impacts (e.g., severe vegetation stress due to air pollutant emissions) occur during demonstration, these will have to be assessed when deciding whether to commercialize.

Impacts related to decommissioning and mothballing

These actions would not be expected to have any significant adverse impact on terrestrial biota. Some minor short-term impacts might occur during decommissioning due to the increased levels of construction-type activities during this phase.

4.2.2 Water

This section discusses the construction and operational impacts predicted for the proposed site on surface water hydrology, groundwater quality and hydrology, surface water quality, and aquatic ecology. Section 4.5 discusses recommended construction and operational monitoring, and Sect. 4.6 discusses recommended mitigation measures.

4.2.2.1 Surface water hydrology and water use

Construction impacts

Surface water impacts associated with construction will fall into one of two categories: (1) a change in the quantity and quality of rainwater runoff from the site and (2) special site preparation requirements imposed by the possibility of major flooding from the Monongahela River.

Rainwater will run off of about 151 ha (373 acres) of land when construction is under way within the proposed site boundaries. The proposed site will be graded, stripped, and either excavated or filled before construction. The protective ground cover will be stripped away, increasing the amount of water that runs off during a rainfall. This runoff is expected to be high in suspended solids and may contain some floating material. Although erosion will occur, mitigation measures (Sect. 4.6) will substantially reduce the sediment load reaching the Monongahela River and the sections of the stream below the sediment basins (see Sect. 4.2.1.2).

Operational impacts

The proposed barge dock, product storage tanks, and associated facilities in the Monongahela River bottomland will disturb about 2.5 ha below the 500-year flood elevation, and about 1.2 ha of the 2.5 ha will be filled (raised to accommodate the storage tanks) (see Appendix D). It is estimated, using computer modeling techniques (see Appendix J), that filling this portion of the floodplain could cause flood elevations and velocities to increase slightly, with an insignificant increase in the risk of flood damage. Table J.1 (in Appendix J) presents elevations and velocities at three locations along the site for natural conditions and for postconstruction conditions. These data indicate that the filling of this small portion of the Monongahela River floodplain will not significantly affect the elevation or velocities for floods. However, this effect, although insignificant in itself, contributes to a cumulative effect. Continuing increases in floodplain development have been found elsewhere to increase flooding in downstream areas that were not originally subject to flooding.

All runoff up to that resulting from a 24-h storm with a frequency of occurrence of 10 years will be collected and diverted to a treatment facility that recycles the water for process use. In the event of a spill in the main process area or within the product storage and shipping area, the spilled material will be collected in the site drainage system, treated, and recycled within the plant. (See Sect. 2.2.1 for a description of the proposed water treatment and spill collection system; see Appendix C, Sect. C.2.11.3, for wastewater treatment under abnormal conditions.)

Flooding by the Monongahela River could inundate a portion of the area adjacent to the dikes (see Fig. D.2) and the docking facilities located near the river. The probability of structural failure will be analyzed in the safety analysis report (see Appendix AA) before final design of the storage area.

Water use impacts of the demonstration plant

Under normal operating conditions, the SRC-II demonstration plant is expected to withdraw from the Monongahela River 304 liters/s (10.7 cfs) of water and discharge 78 liters/s (2.7 cfs). The amount of consumptive use from the river would be 226 liters/s (8.0 cfs). In addition, the transport of coal to the plant by barge up the Monongahela will increase the minimum flows required for navigation between the site and Pittsburgh because of the increased amounts of water that must be let through the locks for lock operation. The issue of water use was addressed in the Water Resources Council (WRC) Water Assessment Report,³⁶ and the findings of that study are summarized and evaluated in the following paragraphs. This EIS presents a worst-case assessment because, like the WRC report, it assumes (1) a slightly higher consumptive use [246 liters/s (8.7 cfs)] than is currently proposed, (2) water consumption figures for the basin based on summer conditions when consumption by all users is highest, and (3) no changes in streamflows due to water conservation, that the Corps of Engineers hopes to achieve through changes in lock operation.

The SRC-II demonstration plant would be a significant new water consumer. Including the proposed SRC-II project, the total consumptive water use upstream from lock and dam (L&D) 8 (see Fig. 3.4) would increase from 2265 liters/s (80 cfs, Table 3.3) to 2511 liters/s (89 cfs) by 1990. At L&D 8, the demonstration project would account for 10% of the total consumptive withdrawal from the river. Under most flow conditions, the Monongahela River has enough water to support both the proposed SRC-II demonstration project and the projected increased consumption by all other sectors of the economy through 1990 with no significant impacts. For instance, the demonstration plant's consumption (using the WRC estimate of 246 liters/s) would be only 0.2% of Monongahela's mean flow [130 m³/s, or 130,000 liters/s, from Table 3.2]. However, during low-flow periods, SRC-II's consumptive use may have an impact on water availability, water quality, and navigation. During drought conditions (the 7-d, 10-year low flow), the demonstration plant will consume 2.4% of the river's flow at the plant site. The streamflow consumed by the SRC-II demonstration plant would be unavailable to downstream or in-stream water uses.

Barge transport of coal for the proposed SRC-II demonstration plant is projected to increase the flow requirements for lock operation.³⁶ More importantly, however, the increased barge traffic is expected to exceed the economic capacity of L&D 7 by 1988 if coal for the SRC-II demonstration plant is still operating and the feed coal is transported by barge. This will limit the extent to which the SRC-II plant can use barge transport of coal unless the lock capacity is increased. The Corps of Engineers' plans for expanding the capacity of L&D 7 depend on uncertain Federal appropriations.³⁷

The SRC-II demonstration plant has the potential of competing with the water requirements for navigation only with recurrence of the drought of record. Table 4.6 indicates the estimated surplus or deficit in streamflow based on projected in-stream flow requirements for navigation and water quality and estimated off-stream consumption with and without SRC-II. The Corps of Engineers

Table 4.6. Estimated water availability^a

Flow requirement	Low-flow comparison	Consumption (in liters/s) at:					
		Project site lock and dam No. 8		Maxwell lock and dam		Lock and dam No. 4	
		Without SRC-II	With SRC-II	Without SRC-II	With SRC-II	Without SRC-II	With SRC-II
1990 – Demonstration plant							
To maintain total dissolved solids standard	7 d, 10 year	<i>b</i>	<i>b</i>	<i>c</i>	<i>c</i>	–23,955	–24,210
To maintain dissolved oxygen standard	7 d, 10 year	+368	+113	<i>c</i>	<i>c</i>	+6,909 ^d	+6,654 ^d
Navigation	7 d, 10 year	+7,221	+6,966	+7,787	+7,532	+12,402	+12,148
Without SRC-II	7 d, 50 year	+6,937	+6,683	+4,247	+3,992	+8,438	+8,183
demonstration traffic	Minimum navigable flow	+6,654	+6,399	–566	–821	+2,917	+2,662
With SRC-II demonstration traffic	7 d, 10 year		+6,824		+7,174		+11,864
	7 d, 50 year		+6,541		+3,624		+7,900
	Minimum navigable flow		+6,258		–1,189		+2,379
2020 – Commercial plant							
To maintain total dissolved solids standard	7 d, 10 year	<i>b</i>	<i>b</i>	<i>c</i>	<i>c</i>	–34,999	–35,565
To maintain dissolved oxygen standard	7 d, 10 year	+170	–623	<i>c</i>	<i>c</i>	+680 ^d	+255 ^d
Navigation	7 d, 10 year	+6,881	+6,088	+8,042	+7,249	+10,902	+10,137
Without SRC-II	7 d, 50 year	+6,598	+5,805	+4,502	+3,709	+6,937	+6,173
commercial traffic	Minimum navigable flow	+6,314	+5,522	–311	–1,104	+1,416	+623
With SRC-II commercial traffic	7 d, 10 year		<i>c</i>		+5,550	<i>c</i>	<i>c</i>
	7 d, 50 year		<i>c</i>		+2,010	<i>c</i>	<i>c</i>
	Minimum navigable flow		<i>c</i>		–2,803	<i>c</i>	<i>c</i>

^aFuture low-flow augmentation alternatives are not included. Positive numbers denote a surplus in liters/s, and negative numbers denote a deficit.

^bNo standard.

^cNot analyzed for this assessment.

^dStreamflow deficits may occur if best available technology effluent limitations are less effective than expected in reducing future biochemical oxygen demand loadings.

Source: U.S. Water Resources Council, "Coal Liquefaction Demonstration Plant near Morgantown, W. Va. Water Assessment Report," *Fed. Regist.* 45(164), 55994-56003 (Aug. 21, 1980), Table 5.

has identified Maxwell L&D, the largest L&D on the Monongahela, as the critical point for navigation flow requirements. With operation of the SRC-II demonstration facility (plant water consumption and barge transport of coal) and recurrence of the 7-d, 10-year low flow in 1990, flow at Maxwell would be 13% short of the flow required for navigation. SRC-II's consumptive use would constitute 21% of this deficit, and the increased flow needed for SRC-II's barge traffic would constitute 31% of the deficit (assuming the capacity of L&D 7 is increased by this time). Thus, the demonstration plant's consumptive water use could cause roughly 50% of the 1189-liters/s (42-cfs) deficit. In practice, it is unlikely that SRC-II or other industrial water users would deplete the river flows needed for navigation, because water allocation to navigation has priority over industrial uses. During an extreme drought, Federal jurisdiction over waterways could permit the Corps of Engineers to require all industrial water users on the Monongahela to reduce or stop their consumptive withdrawals to preserve the flows necessary for navigation.³⁸

Consumptive water use by the proposed SRC-II demonstration project would have a small exacerbating impact on the Monongahela's existing water quality problems. During low-flow periods, the river's flow will provide insufficient dilution of incoming pollutants, and violations of standards for total dissolved solids (TDS) and dissolved oxygen (DO) are expected to recur. Although the relationships between streamflow and water quality are complex and variable, West Virginia and Pennsylvania have attempted to specify the streamflows that by dilution would allow their water quality standards to be met (Table 3.4). Table 4.6 indicates how SRC-II will affect future compliance with the streamflows needed to meet water quality standards. The estimated surplus or deficit in streamflow takes into account projected consumptive water use with and without SRC-II. For instance, at L&D 4, Pennsylvania has estimated that 42,190 liters/s of streamflow will be needed in 1990 to meet the TDS standard of 500 mg/liter. Since the 7-d, 10-year low flow is 18,405 liters/s (Table 3.2) and consumptive use is expected to increase without SRC-II by 170 liters/s (Table 3.3), the streamflow deficit of 23,955 liters/s is projected (18,405 - 170 - 42,190 = -23,955). With SRC-II's additional consumptive use assumed to be 226 liters/s, the

deficit increases to 24,181 liters/s. Thus, for TDS, SRC-II's consumptive use would increase the streamflow deficit at L&D 4 by 1%. Total dissolved solids were not considered at L&D 8 because Pennsylvania had insufficient information to specify a streamflow, and West Virginia has no standard for TDS.³⁹ For DO, Table 4.6 indicates a projection that the SRC-II demonstration plant would not deplete streamflows below the amount required to maintain the DO standard at L&D 8.

It is also possible to consider, in a general way, the water quality impacts due to consumptive use. During a low-flow event, the proposed SRC-II demonstration plant would consume 2.4% of the river's flow at the plant site. Any pollutants entering the river downstream would therefore be diluted in 97.6% of the river's flow (not considering additional tributary flow). Pollutants would thus have a concentration of 102.5% (i.e., their concentration would increase 2.5% as a result of SRC-II's consumptive use). This is the worst-case impact on water quality and would be barely detectable.

Mitigation of water use impacts

During extreme droughts, the Monongahela River Basin will face serious streamflow deficits with or without the SRC-II project. The demonstration project, however, will be a significant new water consumer and will require substantial streamflow to operate the navigation locks if coal is transported by barge, as is currently proposed. To reduce or eliminate SRC-II's contribution to low streamflows, the demonstration project will develop alternative plans of operation that reduce or eliminate water consumption or provide alternative sources of process water during critical low-flow events. Curtailing plant operation is one option for reducing water consumption. The plant's turndown capability is discussed in Appendix C, Sect. C.2.18. Off-stream storage and conjunctive use of groundwater are two alternative sources of water. DOE accepts the possibility that SRC-II plant operations may have to be limited or curtailed during water supply emergencies. Because such severe drought conditions tend to develop over a period of several weeks, plant shutdown periods for maintenance can be scheduled to coincide with the low flows to reduce economic impact. In addition, it may be possible to use the western portion of the SRC-II plant site for limited onsite water storage, because this area is generally not suitable for development of process plant facilities (personal communication, John F. Pearson, SRC Projects Office, DOE, to Gerald D. Seinwill, Water Resources Council, Sept. 19, 1980).

To resolve the Monongahela Basin's current and future water problems, the WRC suggested development of a basin-wide water management program.³⁶ Under such a program, cooperating states and agencies would (1) conduct additional water quality monitoring and analysis, (2) develop a basin-wide water budget, and (3) develop strategies to balance competing water uses with available supplies. Options for reducing streamflow deficits that could be used under a coordinated basin plan include water conservation; additional storage and/or reallocation of storage at basin reservoirs, such as Tygart and Stonecoal; additional water storage at sites such as the proposed Stonewall Jackson Reservoir; and development of supplemental groundwater resources.

In addition to recommending adoption of a basin-wide comprehensive water plan, the Ohio River Basin Commission (ORBC) report³⁹ on the SRC-II project recommended the following data collection and research: (1) a program established by Pennsylvania, Ohio River Sanitation Commission (ORSANCO), and EPA to provide additional monitoring and analysis of total dissolved solids along the Monongahela River in Pennsylvania and (2) a streamflow management study to determine impacts of the SRC-II plant and other consumptive uses on fish and wildlife habitat in the Monongahela River.

DOE endorses the WRC suggestion that a comprehensive water management plan be developed for the Monongahela Basin. As a participating member of both the WRC and the ORBC, DOE will take the necessary steps to initiate basin-wide water resource planning for the Monongahela River.

Water use impacts with commercial expansion

Estimated consumptive use for the proposed SRC-II commercial plant is 793 liters/s (28 cfs), a quantity 22% greater than the 651-liter/s (23-cfs) estimate used in the WRC Water Assessment.³⁵ By the year 2020, the SRC-II commercial project would account for roughly 14% of the consumptive use from the Monongahela River and 24% of the consumptive use above L&D 8. Assuming no additional low-flow augmentation, the project would consume 7.8% of the 7-d, 10-year low flow at the site, thus worsening streamflow deficits downstream.

In previous studies assessing the impacts of water consumption for energy, the Ohio River Basin Commission specified the following guideline: if energy industries consume more than 10% of the 7-d, 10-year low flow, negative impacts may occur.⁴⁰⁻⁴¹ Similarly, if municipal and industrial

withdrawals exceed 10% of the 7-d, 10-year low flow, the potential exists for negative impacts. These guidelines are not absolute, but 10% statistically represents a margin approximating the standard error in most low-flow probability estimates. If combined consumption exceeds these generally accepted allocations, water supply problems may occur.

Existing base-load power-generating plants consume about 510 liters/s (18 cfs) from the Monongahela upstream of L&D 8 and a total of 1303 liters/s (46 cfs) in the basin.⁴¹ Adding the 510 liters/s (18 cfs) steam-electric cooling requirement above L&D 8 to the estimated 793 liters/s (28 cfs) requirement of the commercial SRC-II plant brings water-for-energy consumption to 12.8% of the 7-d, 10-year low flow at that point, which exceeds the 10% "rule of thumb" allocation to energy. Likewise, combining WRC's projected level of consumption for the year 2020 (Table 3.3) for all other uses [2463 liters/s (87 cfs)] with the SRC-II demand yields a projected cumulative total percentage consumption of over 30% of the 7-d, 10-year low flows at the West Virginia-Pennsylvania border; this total is well in excess of the combined guideline for identifying potential water quantity problem areas, even without including increased in-stream flow needs for navigation by SRC-II coal barge traffic.

During droughts water consumption by the SRC-II facility could affect downstream water users under Pennsylvania's policy for consumptive use (Sect. 3.2.2.1). When streamflows fall below the levels specified as necessary for maintenance of water quality, Pennsylvania could require municipal water supply users to curtail their withdrawals or make compensatory releases from off-stream storage. Consumptive use by the SRC-II commercial plant could increase the frequency of this occurrence.

Assuming that the capacities of locks 7 and 8 were increased between 1990 and 2020 to accommodate barge traffic for the commercial plant, streamflow deficits at Maxwell L&D would increase substantially during recurrence of the drought of record (Table 4.6). However, this impact could be avoided by using rail transport or by using local coal in the plant. Rail capacity to the SRC-II site may need to be increased before 1988 because of the limited traffic capacity of L&D 7. In addition, experience developed in operating the demonstration project may provide flexibility in the commercial process such that Monongahela Valley coal can be used. (Appendix C includes a discussion of the suitability of local coals.)

As indicated in Table 4.6, with recurrence of the 7-d, 10-year low flow in 2020, the commercial project's consumptive use would contribute to the depletion of flow below the level projected as necessary to meet the DO standard at L&D 8. The project would contribute about 2% to the estimated deficit in the flow required to meet Pennsylvania's TDS standard at L&D 4 under 7-d, 10-year low-flow conditions. The commercial plant's 7.8% depletion of the 7-d, 10-year low stream flow would cause incoming pollutants to be 8.5% more concentrated in the river downstream from the plant (worst-case conditions).

Before transfer of the SRC-II demonstration plant to the industrial partner for commercial expansion, DOE would prepare appropriate NEPA documentation (see Appendix X). In addition, under Sect. 13(c) of the 1974 Federal Nonnuclear Energy Act, another assessment would be made to more accurately assess water availability and related water impacts of the commercial facility.

Impacts related to decommissioning

Impacts related to the hydrology of small streams on site would be similar to those generated during the demonstration phase, provided no large-scale removal of structures or construction occurs. Consumptive use of water in the Monongahela would cease (Sect. 2.3.1).

4.2.2.2 Groundwater quality and hydrology

Groundwater quality impacts — construction

Little impact on groundwater quality is expected during construction. Sanitary wastes will be treated, and any toxic materials used in construction or uncovered during grading will be handled so as to prevent spilled materials or leachates from infiltrating to groundwater.

Groundwater quality impacts — operation

Groundwater quality in the area of the site may be affected by infiltration of process area run-off, spills of process liquids outside the controlled area, and seepage of leachates from coal storage or solid waste disposal areas. These potential sources of groundwater contamination are

discussed in the following paragraphs. The magnitude and likelihood of the impact depends on the control measures used, the ability of the soils to attenuate contaminants, and the nature of groundwater flow in the area of the site. On a short-term basis, contamination control measures (Sect. 2.2.1 and Appendix C), the composition of the gasifier solid waste leachate (Appendix K), and the nature of soils on the site (Appendix L) appear to mitigate serious groundwater impacts. However, uncertainties still exist as to (1) the long-term effectiveness and stability of the liner and drainage system, (2) the nature of the leachate from other solid wastes, (3) the behavior of certain organic and trace element species in the soils, and (4) the way in which leachate composition changes over time. These points are discussed in more detail in the following paragraphs.

Infiltration of process area runoff. Runoff from the process area, possibly containing pollutants washed from process equipment and other facilities, will be collected, monitored (Sect. 4.5), and treated before infiltration into the groundwater can occur. In the unlikely event that the rainfall exceeds the capacity of the runoff collection and retention system, the excess will be released to surface water drainage where a portion may infiltrate into groundwater. The concentration of pollutants would be lower than that found in the initial rainwater runoff because of dilution with the large volume of rainwater in the collection and retention system, and the soil would be saturated, reducing infiltration of the runoff to the groundwater. Hence, no significant impact during normal operating procedures is expected.

Infiltration of spills and wastewater. It is planned that any spills on the site will be collected by the plant drainage system and reclaimed in the wastewater treatment system (Sect. 2.2.1). There is a slight possibility, however, that spills may occur outside the drainage system (e.g., the pipeline from the process area to the product storage area near the Monongahela River) or that system efficiency might be disrupted by incorrect operating procedures. Major process units and storage vessels will be provided with secondary containment to retain accidental releases. In the event of a failure of the containment system, the material would enter the drainage collection system. Only in the unlikely event of simultaneous failure of the containment and collection systems would a direct release to the offsite drainage or soils occur. The risks of such an event and the adequacies of the treatment system will be evaluated in the safety analysis report. Barriers to the aquifers (aquicludes) are discontinuous in the process area, and groundwater movement is toward the Fort Martin area. Prevention of possible contamination will require careful preparation of the process area, appropriate spill containment facilities, and prompt cleanup of spills that do occur. The significance of any containment that does occur will be determined in part by the ability of the soils to absorb the contaminants (see below and Appendix L).

Untreated wastewater will be impounded in various unspecified locations in the process area. These wastewaters are expected to contain hydrogen sulfide, phenols, ammonia, cyanides, metals, and trace organics. Retention areas will be cement lined to minimize infiltration of contaminants into groundwater.

As discussed in Sect. C.4.2, it is believed that the soluble inorganic salts that result from plant wastewater operation will be discharged to the Monongahela River a majority of the time. During times when river conditions dictate a cessation or reduction in the quantity of TDS or other wastewater species discharged, desalination equipment will be operated, and the soluble salts will be recovered as a concentrated brine. Due to the relatively low initial production rate of brine (see Appendix C, Table C.11) that is anticipated, an acceptable plan for brine disposal will not be a pressing need for at least the first two years. (See Table C.2 for plant capacity vs time during the demonstration period.) Consequently, it is planned to retain the brine during this period in a small reservoir constructed in accordance with RCRA requirements, when they are issued. This two-year period will provide time to more thoroughly assess the chemical characteristics of the brine and to develop a suitable disposal plan. If it becomes necessary to permanently dispose of the brine during this two-year period, it most likely would be hauled by truck to a certified disposal site.

Options that have been identified for the alternative disposal of waste soluble salts are:

- onsite chemical landfill,
- onsite chemical fixation and landfill,
- deep well injection,
- barging to sea,
- offsite chemical landfill, and
- storage with subsequent river (high-flow period) disposal.

Onsite disposal of these soluble salts, either in a lined hazardous waste facility or by chemical fixation would reduce but not eliminate the long-term risk of contaminating subsurface freshwater supplies with soluble chlorides or other potentially hazardous substances. These alternatives are being considered as disposal options for the intermittent requirements of the demonstration plant and for the long-term requirements of the expanded commercial plant.

Deep well injection may be a viable option for the long-term disposal of soluble salt. The fully treated wastewater could be injected into a brine aquifer of similar salinity and adequate geologic barriers, as is now done in the area near Morgantown.

Barging of the soluble salt to the Gulf of Mexico would not be expected to result in a significant environmental hazard. Operating costs and the impact on barge traffic might preclude use of this disposal option for the long term. It could, however, be an environmentally desirable method for meeting any intermittent requirements of the demonstration plant.

Finally, the concentrated brine could be stored on site during periods when the assimilative capacity of the river cannot accommodate a wastewater discharge from the plant; it could then be released in a controlled fashion when river conditions permit.

For the longer term, potential for use of the waste as a chemical feedstock could be explored. This effort, as well as efforts to explore the conventional disposal alternatives described above, is hampered by detailed knowledge of the composition of the product salt. Thorough exploration of these alternatives will, in some cases, have to follow actual production of the salt.

Coal pile leachates. Another potential source of groundwater contamination is the leachates formed by reaction of water with minerals in the coal piles. The actual coals to be used in the proposed facility have been analyzed by the Oak Ridge National Laboratory (ORNL) for the type of leachate that will be produced. Results (see Appendix K) indicate that the leachate would probably be acidic, with high levels (greater than primary or secondary drinking water standards) of iron, dissolved solids, sulfate, and possibly cadmium. The exact nature of the leachate would depend on the precise location of the coal mine, the weather during the period, the method of coal handling and storage, and the particle size of the coal. The risk of groundwater and surface water contamination will be reduced by collection and treatment of coal pile leachates and runoff and by soil compaction or lining of the storage area (see Sect. 2.2.1.2 and Appendix C). In addition, soils beneath the storage area are expected to be deep and of low permeability (based on their characteristics in other areas of the site). This would further reduce the possibility of groundwater contamination. There is evidence that the shallow groundwater system is recharged near the coal storage area and then discharged as springs flowing into local streams. Although the apparent risks of contaminant movement are low, these springs will be monitored quarterly to determine whether contamination of the shallow groundwater system is occurring. If contaminants are detected in the springs, DOE will evaluate the significance of the impact of these contaminants and will design appropriate mitigation measures as needed. A detailed analysis of the storage area soils and groundwater flow beneath the area will be conducted to optimize the design of the storage area and to select appropriate monitoring locations for early detection of infiltration.

Solid waste leachates. The major solid waste streams from the proposed facility will consist of gasifier slag, water-soluble salt brine, liming sludge, biological sludge, cooling tower blowdown treatment sludge, sanitary sludge, rainwater-runoff treatment sludge, and catalysts and sorbents (see Appendix C, Sect. C.3.7). The disposal of slag from the gasifier requires the largest commitment of land resources and is discussed below. All other solid wastes, except the water-soluble salt brine, will be disposed of in a common, secure landfill designed like the slag landfill. The location of this landfill has not been specified and the composition of these solid wastes is unknown. The leachates from these other solid wastes are likely to be more hazardous than the leachates from slag disposal, resulting in a greater potential for groundwater impacts. Quantification and characterization of these wastes during the detailed design phase and demonstration plant operation will determine the option or combination of options selected and the potential impacts. Appendix C discusses these alternatives.

Studies have been performed to analyze the composition of the leachate generated during short-term contact with slags formed during gasification of SRC-II vacuum bottoms. Results of the slag and leachate analyses are presented in Tables K.1, K.2, and K.3 in Appendix K. In general, concentrations of chemical species for which primary drinking water standards exist were below the drinking water standards and the standards for designating a waste leachate as "hazardous" under the criteria set forth in the RCRA. The only exception was cadmium in the acid leaching tests, which was present at 2.5 times the drinking water standards, but was below proposed RCRA criteria for hazardous waste identification (set at 100 times the primary drinking water standards to account for dilution in the aquifer). The acid extraction is more severe than the extraction procedure outlined under the RCRA criteria and was used for laboratory simulation of a high leaching rate.

Other species determined in the laboratory slag analysis program included sulfate, iron, copper, beryllium, antimony, and nickel. The species were chosen on the basis of certain secondary drinking water (non-health-related) and aquatic standards. Iron exceeded secondary drinking water recommendations by 2 to 4 orders of magnitude. A high level of iron does not constitute a health hazard, but imparts a reddish-brown color to water, stains laundry and utensils, and imparts a taste to the water, making the water objectionable for food processing and beverages. The formation of sediment and of iron-reducing bacteria are also favored. The concentration of nickel in the slag leachate was determined to be above the level that may affect the growth of aquatic life. Aquatic effects are discussed in Sect. 4.2.2.4. Column leachate studies also indicated initially high levels of cadmium and selenium, although concentrations decreased rapidly to acceptable levels in the laboratory studies. This rate of reduction correlated to the rate that would occur in the field. Arsenic levels were below limits, but concentrations increased slightly over time. It is unknown whether long-term leachate concentrations of arsenic would continue to increase.

The effects of long-term leaching of the solid wastes or of changes in the conditions under which the waste is formed are not currently known. In the short-term tests, leachate heavy element concentrations generally decreased with time. To address the concern that over longer intervals the matrix material in the solid wastes may break down or dissolve and release toxic elements, experiments were conducted at ORNL to simulate this breakdown by mechanical crushing, which was followed by leaching. No substantial change in leachate composition was observed, and the waste remained in the RCRA nonhazardous category. Other factors may act to change trace element concentrations. These include changes in the nature of the solid wastes due to operational or feedstock alterations or disruption of the waste area drainage, allowing water logging and possible anaerobic conditions to occur. It is possible that these conditions could occur during the life of the demonstration plant. Monitoring of the solid waste and the leachate will be carried out (Sect. 4.5).

Current plant design calls for the construction of a compacted clay liner below the solid waste disposal area and drains to collect the leachate for analysis and treatment (see Sect. 2.2.1.2 and Appendix C for cross-sectional diagrams). Proper design and installation of the liner will be carried out, and it is anticipated that leakage across the liner would be very slow, in amounts that would be unnoticeable compared with the very much larger volume of groundwater flowing beneath the site. Disruption of the liner or overflow would release larger quantities of leachate. Risk of liner disruption is less at this site due to the low seismic potential in the area and the location of the landfill away from the areas of potential coal mine subsidence. However, strip mine soils occur beneath the disposal area and, since these materials were probably not compacted when disposed of on the site, they are subject to differential settlement. Differential settlement could cause failure of the clay liner and the underdrain system. Therefore, a detailed investigation of the engineering properties of these soils will be conducted before construction of the landfill. Design of the landfill and specific engineering measures for handling the strip mine soils will be based on the results of these tests. It is possible that underdrains may fail under normal operating conditions;⁴² however, the volume of the slag disposal area is sufficient to allow for remedial action to be taken before overflow occurs. It is recognized that the stability and effectiveness of liners and drains over extended periods of time is poorly documented due to the lack of long-term industrial experience with this method of disposal. However, the use of liners and underdrains is considered to be a significant improvement over past disposal practices and is specified for disposal of hazardous wastes in EPA's current RCRA regulations. Monitoring of the system will be carried out to detect any adverse effects (Sect. 4.5) and the need for additional mitigating measures (Sect. 4.6). In addition, clay liner compatibility studies will be carried out to ensure that the leachate generated does not adversely affect the stability of the liner material.

The nature of the site soils and their ability to attenuate contaminants will greatly affect the potential for groundwater and surface water contamination. Specific tests of the attenuation capacity of the soils are under way, and certain background physical and chemical data have been determined. On the basis of these data (given in Appendix L), most of the undisturbed soils will probably attenuate contaminants well, provided aerobic (oxygen-rich) conditions exist (the normal condition near the surface of well-drained soils). This conclusion is based on the fine texture of the soils (predominantly silt and clay), the deep soil profile, and the probable occurrence of iron and manganese hydroxides (assuming that is the dominant mineral species of those elements). A possible exception would be the Culleoka soil near the coal storage area, which has a slightly sandier texture and greater permeability than the other soils. In addition, some of the soils, such as strip mine spoil material, have lenses of material with low pH. Mobilities of cobalt, manganese, iron, and zinc may be increased if leachates move through such soils.

If water-logged or anaerobic soils occur within or beneath the waste disposal or coal storage areas due to high rainfall or drainage of water within the pores of the wastes or coal, the mobility of some species could increase. Contaminants that have been found experimentally to be more mobile at low oxygen levels include arsenic, cadmium, chromium, cobalt, manganese, and

mercury. Preliminary laboratory tests indicate that anaerobic microbial activity should not occur in leachate from slag. Attempts to have bacteria survive in the leachate have been unsuccessful. Both sulfate and BOD levels are low and are not able to support biological activity. In addition, the mobilities of some components (such as nickel) may be increased due to the high sulfate concentration of the leachates. Nickel-sulfate complexes have lower activity in solution and do not adsorb onto clays as well. A more detailed discussion of contaminant mobility in soils is presented in Appendix L.

Strip mine soils cover parts of the slag disposal area. The strip mine soils are not likely to attenuate contaminants as well as undisturbed soils do because of the coarser texture, lower pH, and greater probability of highly permeable zones.

In conclusion, there are several important factors that suggest that groundwater impacts will be minimal: (1) the slag leachate generated in laboratory tests indicates it probably would be classified as nonhazardous under RCRA criteria; (2) the soils are generally deep and of low permeability and high silt and clay contents (all favoring attenuation of contaminants); and (3) RCRA guidelines for construction of a hazardous type of landfill will be followed. Table 4.7 presents a summary of these factors and the uncertainties associated with them. A monitoring program will be implemented to identify potential failures in the containment system and resulting water quality impacts. This program is discussed in more detail in Sect. 4.5.

Groundwater hydrology — impacts

The sandstone unit used as a source of groundwater by Fort Martin residents has its recharge area to the southeast. If the aquifer at this location follows the regional dip of 1 to 5° to the northwest, the recharge area would include the proposed process area. Paving the process area and diverting runoff could reduce the amount of water entering the aquifer and the level of water in local wells. However, Fort Martin obtains its drinking water from a public utility and uses existing wells only for supplementary uses. Other areas of the county more dependent on groundwater supplies are likely to be beyond the affected area. Wells in such areas would have different recharge areas or would obtain water from a geologic unit other than the sandstone that occurs below Fort Martin. Hence, the effect of the proposed project on currently utilized groundwater supplies in the area is expected to be minimal.

Impacts related to commercialization

Expansion of the facility would require enlarging the coal storage and waste disposal areas. This increases the risk of leachate contamination of aquifers below the site by increasing the affected land area and by expansion of the slag disposal area into land that has been strip-mined. Infiltration of leachate into cracks and auger holes in the high wall or disruption of the clay liner may occur (see "Operational Impacts"). Impacts can be reduced by grouting of the high wall to seal cracks, backfilling of the holes with clay plugs, and the use of seals such as clay or chemically fixed material.⁴³ However, some of the uncertainties that now exist in connection with waste disposal will be studied during the demonstration phase (see Table 4.7). This can be used to optimize the disposal area design and to reduce the impacts associated with the increased volume of generated wastes.

The increase in land area requirements, with attendant facilities and paving, would reduce infiltration to groundwater and potential well-water yields downgradient from the facility. The importance of this effect will be determined during monitoring of the aquifers on the site. However, groundwater near the site will not be used as a water supply during the life of the plant. After decommissioning, infiltration may be increased by breaking up and removing paving in the plant area.

Impacts related to decommissioning

Decommissioning of the facility will remove the process area and coal storage pile as potential sources of groundwater contamination. The solid waste will still be contained on site, in an area that will be secured in a manner approved by State or Federal regulatory agencies. Potential impacts from slag disposal are those discussed above, under operational effects. Possible actions that may alter the impacts include (1) mining of the slag for its minerals or metals content, (2) excavation of the fill if a break in the liner or leakage are found during monitoring, or (3) removal of the slag to another site. Long-term impacts of the slag would then be reduced, but short-term spillage or leaching through a broken liner could occur. The effects are highly dependent on the chemical characteristics of the slag during the time of removal.

Impacts on groundwater flow will be similar to those already discussed, unless the paving in the plant area is removed, allowing infiltration to the aquifers.

Table 4.7. Summary of factors and uncertainties influencing groundwater quality impacts

Known factors that will mitigate groundwater quality impacts	Uncertainties in assessing impacts that will be studied prior to closure of the disposal area	Uncertainties that are not likely to be resolved prior to closure of the disposal area
1. All current studies indicate that the leachate generated in the laboratory is nonhazardous, as defined by proposed RCRA regulations. 2. RCRA proposed disposal practices for hazardous substances will be followed. These will include installation of a liner, monitoring and collection of leachates, and monitoring of groundwater quality. 3. Undisturbed soils beneath the proposed disposal area are deep, are slowly permeable, and have moderate iron and manganese contents and high clay plus silt fractions. Such factors are thought to favor attenuation of contaminants (see Appendix L).	1. Geotechnical studies have not been completed due to the resiting of the slag disposal area to an area that has not been undermined. Such studies, including determination of the stability of stripmined soils and stability of onsite soils for use as embankments and liners, will be completed before construction. 2. The depth, thickness, and hydraulic properties of the aquifer below the disposal site will be determined before disposal. Design of the groundwater monitoring system will be based on this information. 3. The liner material will be evaluated with respect to (a) its permeability, (b) the feasibility of achieving adequate compaction in the field by heavy equipment, and (c) the compatibility of the liner and leachate. 4. Attenuation of the leachate components by site soils will be evaluated by the study of borings logs, permeability tests, and column leachate adsorption tests in the laboratory. 5. Alterations in the coal feedstock or plant operating conditions from pilot plant operations may be expected. The effect on the composition of the leachate will be evaluated during the monitoring of leachate actually generated on site. 6. The nature, including the environmental impacts, and disposal plans for other hazardous wastes will be determined. 7. The effectiveness of the engineering design of the disposal area (liner characteristics, embankments, drains) will be studied during operational monitoring. Remedial measures will correct design problems or operating procedures.	1. The long-term leachate compositions and effectiveness of the clay liner will not be definitely resolved unless long-term monitoring is carried out. 2. Field conditions can only be approximated in the laboratory tests. Natural variability in the soils, unanticipated and untested reactions and components, and changes over time may affect leachate behavior. In addition, the effects of anaerobic conditions on the mobilities of leachate contaminants in the liner and soils are not currently known. 3. It is uncertain whether an effective means of cleaning up contaminants can be developed once pollution of soils or groundwater occurs. Monitoring groundwater quality alone will not prevent or cure groundwater degradation. Current containment plans emphasize preventing the contamination from ever occurring.

4.2.2.3 Surface water quality

Construction impacts

Construction activities may affect surface water quality by erosion and sedimentation resulting from site preparation and shoreline construction operations. These impacts will generally be temporary and localized. Because construction of sedimentation basins will limit sediment discharge from site disturbance, significant impacts are not anticipated. Similarly, shoreline construction activities are expected to cause only minor impacts to the water quality of the Monongahela River.

Site preparation activities (clearing, grubbing, and excavation and fill operations) will disturb a total of about 151 ha (373 acres) for permanent facilities (Sect. 4.2.1). Some additional area will also be used temporarily during construction. Because development will occur in the eastern portion of the site, Robinson Run and Crafts Run will be essentially unaffected. At the start of construction, drainage will be routed to sediment retention basins that discharge to Crooked Run, its unnamed tributary, or the Monongahela River. As construction proceeds, a site drainage system will be built so that all runoff (from a 10-year, 24-h rain event) from the developed parts of the site will be routed to the wastewater retention basin and treatment systems, with eventual discharge to the Monongahela.

The erosion potential for this portion of the Monongahela River Basin ranges from very severe to extremely severe.⁴⁴ Consequently, a construction project environmental plan will be developed, control measures will be employed (Sect. 4.6.5), and monitoring will be undertaken (Sect. 4.5.3.3) to ensure the effectiveness of control measures. Discharges from sediment control basins will be regulated by National Pollutant Discharge Elimination System (NPDES) permits. Although control measures will be implemented, site preparation activities will unavoidably increase the loads of sediment and some dissolved or adsorbed chemicals in streams on or near the site. Dissolved oxygen concentrations in these drainages may be decreased because of the oxygen demand of inflowing disturbed materials. Removal of overhead vegetative stream cover may cause a localized increase in surface water temperature.

Project developments planned for the floodplain and shoreline are described in Appendix D. Developments include the raw water intake, the wastewater discharge structure, the barge dock, haul road, railroad siding, and product storage area. Construction runoff from these areas will also be routed to sedimentation basins. During shoreline construction activities, concentrations of total suspended solids and some dissolved or adsorbed chemicals may increase slightly in the Monongahela's waters at about Mile Point 93 to 94. Dissolved oxygen may also be slightly depleted. These potential impacts, however, will be localized and short-term.

Operational impacts

Wastewater discharge. Wastewater streams generated by the SRC-II facility will include process wastewater, coal pile runoff, slag pile leachate, runoff from the process and product storage areas, and cooling tower blowdown (Fig. C.4). These waste streams will receive various treatments depending on their composition (Fig. C.10), and the wastewater treatment system will include equipment to enable complete recycle of treated wastewater within the plant and zero discharge to the Monongahela River when necessary. Process streams and process area runoff will undergo biooxidation treatment to remove most of the phenolic compounds and other organic contaminants. All wastewater except cooling tower blowdown will receive tertiary treatment consisting of sand filtration and carbon adsorption. Cooling tower blowdown will be treated to remove chromium compounds used to inhibit corrosion. Following these treatments, a portion of the wastewater [33 liters/s (1 cfs)] will be reclaimed by evaporation or reverse osmosis and recycled as makeup water for the utility boiler or other plant uses. The remainder of the treated effluent, 78 liters/s (2.7 cfs), will be discharged to the Monongahela when river conditions permit.

For coal liquefaction facilities, the EPA has not yet defined the wastewater treatment technologies that constitute best available technology (BAT). The SRC-II facility's wastewater treatment system, however, is designed on the basis of experience from petroleum refining, coking, and other related industries, and it is believed to be BAT. However, the wastewater treatment system design will be reviewed by the Water Quality Division of the West Virginia DNR and by EPA as part of the NPDES permit application procedure. These organizations will make the formal BAT determination.

To evaluate the impacts of wastewater discharge, a worst-case situation was considered. During periods of low river flow, it has been proposed that discharge would be eliminated by storing or treating wastewater streams (as described in the following paragraphs) or by plant shutdown (Sect. 4.2.2.1). Nevertheless, to anticipate the possibility that the zero wastewater discharge equipment could fail, effluent discharge during low flow is considered as a worst case for this analysis. In addition, the maximum concentration of chemicals observed in the Monongahela without the plant was assumed (Table 3.5). Failure of the wastewater treatment system that allowed discharge of untreated wastewater is not included in the worst case, since such an event would be detected by monitoring and cause a shutdown of the plant. Using a simple mixing model, it is assumed that 78 liters/s of wastewater is fully diluted in 9323 liters/s (329 cfs) [the minimum navigation flow, 9627 liters/s (340 cfs), minus the SRC-II raw water withdrawal, 304 liters/s (10.7 cfs)]. The results of this analysis (Table 4.8) indicate borderline levels or noncompliance with standards or criteria for numerous water quality constituents. However, this situation is attributable primarily to the poor ambient water quality assumed or inadequate analytical sensitivity in determining baseline water quality. Except for cyanide, TDS, and sulfate, the proposed SRC-II discharge

Table 4.8. Compliance of SRC-II demonstration plant discharge with water quality standards or criteria after mixing with minimum river flow

Constituent	Water quality standard or criterion ^a (mg/liter)	Effluent concentration ^b (mg/liter)	Maximum ambient concentration (mg/liter)	Total mixed concentration ^c (mg/liter)	Compliance with standard or criterion
Ammonia	0.02 as un-ionized NH ₃	5.0	1.1	1.13	Uncertain; depends on temp. and pH
Aluminum		0.2	3.6	3.6	
Arsenic	0.01	0.01 ^d	0.01 ^d	0.01	Borderline ^e
Biochemical oxygen demand		10	20	20	
Cadmium	0.0012	f	0.01 ^d	f	No ^e
Chemical oxygen demand		100	5.0 ^d	5.8	
Chromium, total	0.05	0.2	0.05 ^d	0.051	Borderline ^e
Copper	1.0	0.07	Assume 0	0.001	Yes
Cyanide	0.005	0.15	0.004	0.005	Borderline
Fluoride	1.0	1.0	0.6	0.6	Yes
Iron	0.3	1.0	24	23.8	No ^e
Lead, total	0.05	0.05	0.05 ^d	0.05	Borderline ^e
Manganese	0.05	f	0.7		No ^e
Mercury	0.00005	0.001	0.0005 ^d	0.0005	No ^e
Nickel	0.2	0.01	0.05 ^d	0.05	Yes
Oil and grease		5	Assume 0	0.04	
PNA compounds, all ^g		0.082	0.0002	0.0009	
Phenol	0.001	0.1	0.038	0.039	No ^e
Selenium	0.01	0.03	0.01 ^d	0.01	Borderline ^e
Sulfate	250	1000	276	282	No ^e
Sulfide	0.002 as undissociated H ₂ S	f	Assume 0	f	
Suspended solids		10	532	528	No ^e
Total dissolved solids	500	3000	500	521	No ^e
Zinc	5.0	0.1	0.15	0.15	Yes

^aConcentrations listed are not to be exceeded (from Tables S.1 and S.2).

^bIt should be noted that this effluent characterization is an estimate. EPA will develop effluent limitations for the plant, which will be identified in the NPDES permit and factored into the design basis for the wastewater treatment plant.

^cMixed concentration calculated by the formula $C_m = [C_e(Q_e) + C_a(Q_A)] / (Q_A + Q_E)$, where C_m is the mixed concentration, C_e is the concentration of undiluted effluent, C_a is the maximum ambient concentration, Q_e is the effluent flow rate (78 liters/s), and Q_A is the minimum streamflow minus the demonstration plant withdrawal (9323 liters/s).

^dConcentrations that were reported as less than a certain number are assumed equal to that number.

^eNoncompliance with standard or criterion is due to poor ambient water quality and/or inadequate analytical sensitivity (see footnote d).

^fTo be determined.

^gPolynuclear aromatic hydrocarbon compounds.

will not produce significant changes in water quality. It should be noted that the wastewater characteristics have been estimated from available data as discussed in Appendix C. EPA will develop effluent limitations for the plant, which will be identified in the NPDES permit and factored into the design basis for the wastewater treatment plant.

The problems indicated by this worst-case analysis illustrate the rationale behind the facility's zero-discharge capability. During periods of low flow in the Monongahela Basin, ambient concentrations of TDS, sulfate, and some other pollutants occasionally exceed the water quality standards, and further discharge of these constituents by the proposed plant would be unacceptable. Under these circumstances, the SRC-II wastewater would be either (1) stored for discharge when river flow provides adequate dilution (intermittent discharge) or (2) desalinated to produce reclaimed water for process use and a concentrated brine requiring disposal (Appendix C). During extreme low flows (e.g., recurrence of the drought of record) the plant would be shut down because of its consumptive water use.

The choice of whether or not to discharge SRC-II treated wastewater will be made on the basis of monitoring the flow rates and water quality of the Monongahela River and the treated wastewater

stream. Principal attention will be given to monitoring TDS because of the problem it currently represents during low flows and because of the high levels of TDS in the wastewater. The Monongahela's assimilative capacity for TDS can be calculated as

$$A = C_s(Q) - C_a(Q) ,$$

where

- A = assimilative capacity (mg/s),
- C_s = water quality standard for TDS (500 mg/liter),
- C_a = ambient concentration of TDS (mg/liter),
- Q = river flow rate (liter/s).

The Monongahela's flow exceeds 14,158 liters/s (500 cfs) 95% of the time.³⁹ With this flow rate and a hypothetical TDS concentration of 300 mg/liter, the river could "assimilate" up to 2.8 kg of TDS per second without exceeding the standard. The SRC-II plant would discharge 0.23 kg of TDS per second, which is less than 10% of the assimilative capacity. Based on data for flow and TDS concentration (Fig. C.11), Appendix C indicates a rough estimate that the SRC-II demonstration plant could operate 95% of the time without discharging more than 10% of the river's assimilative capacity for TDS. During plant operation, in-stream monitoring would be used to determine when the assimilative capacity became inadequate, at which time the plant's wastewater treatment system would shift to the zero-discharge mode. In determining when zero discharge will be necessary, plant operators will also consider river and ambient concentrations of other water quality constituents such as dissolved oxygen, biological oxygen demand, phenol, cyanide, and heavy metals. Using this strategy, significant degradation of water quality during low-flow events can be avoided. It is anticipated that the exact criteria for determining when zero-discharge operation is necessary will be defined in the NPDES permit issued for the SRC-II plant by West Virginia and the EPA.

Wastewater brine of soluble salts produced when the wastewater treatment system is operating in the zero-discharge mode can be disposed of with little or no impact on the Monongahela's water quality. Brine production is discussed in Appendix C, Sect. C.3.7.2. Options for disposal under investigation include holding in a lined pond for later discharge, chemical fixation and land-filling, deep well injection, and barging to sea. Section 4.2.2.2 discusses the groundwater impacts of these options. Appendix C, Table C.11, shows the production rate and required storage area for brine. This table states that 33 acre-ft of storage would be required to hold the brine produced during the third year of demonstration plant operation. This assumes a 93% plant capacity factor, a chloride concentration of 0.2 wt % in the feed coal, and operation in the zero-wastewater-discharge mode during 14% of the year. Even considering extra capacity to store rainwater or to accommodate extended periods of zero-discharge operation, this is considered a relatively small pond. The pond would be designed to meet RCRA criteria for disposal of hazardous wastes (Appendix C, Sect. C.3.7.2).

Although the SRC-II discharge is expected to meet water quality standards, there is concern about potential pollutants such as PNA, for which no standards exist. Draft criteria and estimated permissible concentrations (EPCs) for these water quality constituents are presented in Tables S.3 and S.4. Table 4.9 compares these with the in-stream concentrations projected after dilution in the worst-case streamflow. All concentrations of PNA in the Monongahela would be less than 0.2 µg/liter and at least 2 orders of magnitude less than the draft criteria levels of EPCs. It must be noted that no regulatory significance can be attached to the draft criteria or EPCs and that EPCs are established on the basis of limited data. Although the analysis in Table 4.9 suggests that the SRC-II discharge of PNA will not represent a great threat to water quality, further research and monitoring are needed to determine the impacts. The possible bioaccumulation of PNA is discussed in Sect. 4.2.2.4, and monitoring that will be conducted is described in Sect. 4.5.3.3.

Nonroutine discharge. The SRC-II plant's wastewater retention basins for coal pile runoff, slag leachates, and process area runoff will be sized to hold runoff from rainfall events up to the 10-year, 24-h precipitation event. For power plants, this level of runoff retention constitutes both BPT and BAT.⁴⁵ During storms in which runoff exceeds the capacity of the retention basins, operators will discharge the runoff stream that represents the least loading. Based on research to date, it is believed that the leachate and runoff from slag disposal will have the lowest concentrations of contaminants, and runoff from the process area will be designated as the priority stream for retention. Therefore, runoff and leachate from the slag disposal area would be diverted first to prevent overflow of the wastewater retention basin. If additional diversion

Table 4.9. Projected instream concentrations of polynuclear aromatic hydrocarbons compared with draft criteria and estimated permissible concentrations

Constituent	Draft criterion ^a or estimated permissible concentration ^b	Effluent concentration ^c (μg/liter)	Ambient concentration (μg/liter)	Mixed concentration ^d (μg/liter)
Fluorene	None	20	0 ^e	0.17
Pyrene	8333 ^b	15	0	0.12
Phenanthrene	280 ^b	1	0	0.008
Fluoranthene	200 ^a	1	0	0.008
Tetralin	None	5	0	0.04
Biphenyl	13.8 ^b	5	0	0.04
Acenaphthene	20 ^a	2	0	0.017
Diphenylmethane	None	18	0	0.15
Benz[a]anthracene	4 ^b	f	0.04	f
Triphenylene	None	f	0	f
Methylbenz[a]anthracene	None	f	0	f
Dibenzofuran	None	10	0	0.08
Anthracene	2000 ^b	3	0	0.03
Benzo[a]pyrene	20 ^b	f	0.04	f
Benzo[e]pyrene	109 ^b	f	0.04	f
Xanthene	None	2	0	0.017
Benzo[g,h,i]perylene	None	f	0.013	f

^aDraft criteria from Table S.3.

^bEstimated permissible concentrations from Table S.4.

^cIt should be noted that this effluent characterization is an estimate. EPA will develop effluent limitations for the plant, which will be identified in the NPDES permit and factored into the design basis for the wastewater treatment plant.

^dCalculated as indicated in Table 4.8.

^eAssumed; no concentration reported.

^fTo be determined.

were required, coal pile drainage would be discharged through a pH correction system to neutralize acidity; as a last resort, process area runoff would be released. This priority for discharges is expected to minimize the impacts of excess runoff. If in-plant monitoring determines that any of these runoff streams is more hazardous than expected, the priority for discharge will be altered. Impacts on the Monongahela's water quality from excess runoff are expected to be minimal because of the dilution of potential contaminants in the large volume of rainwater. In any case, scouring of the wastewater retention basin would be avoided, so that pollutants accumulated in the basin's sediments would not be discharged. Furthermore, the wastewater system would retain the most contaminated runoff, which results from the "first flush" at the start of a storm.

Current plans call for storage of products from the proposed SRC-II facility above the flood level on a filled area in the 500-year floodplain of the Monongahela River. (Appendix D provides a detailed floodplains/wetlands assessment.) Because of the dikes, runoff control, and spill control measures provided, release of this product into the nearby river is unlikely. Product storage areas will be surrounded with dikes designed to contain the entire contents of the storage tanks plus runoff from the 10-year, 24-h storm. Storm runoff and/or any spilled material will be pumped to the oil/water separators to provide maximum recovery of any spilled product. The remaining wastewater will be treated before discharge. The possibility of a product spill outside of the controlled areas is recognized as a serious threat to river water quality, but the probability of its occurrence is unknown. The impacts of an SRC-II product spill into the Monongahela River would be similar to the consequences described for a transportation spill (Appendix Z and Sect. 4.1.3.8). Because of the phenolic compounds in the SRC-II product, a major spill could cause substantial water quality degradation. A serious product spill could cause water supply emergencies in downstream communities that withdraw water from the Monongahela River.

Other impacts. Alteration of surface water quality as a result of groundwater contamination is a remote possibility. As noted in Sect. 4.2.2.2, groundwater contamination might result from failure of the landfill liner or the coal pile drainage collection system. Before reaching any surface waters, contaminated groundwater would pass through soils that would remove some trace elements. Significant pollution of surface waters by contaminated groundwater can almost certainly be avoided through adequate monitoring (Sect. 4.5) and process design to minimize leachate movement.

Spillage of coal from barge unloading operations may constitute a localized, relatively minor impact to the water quality of the Monongahela River. Spilled coal is not likely to be a source of PNA compounds because these result principally from combustion or conversion of coal. However, oxidizing conditions will promote the formation of acid from the sulfide minerals in coal, and trace elements may gradually be released into the water column. Coal spilled at the proposed barge dock is expected to cause only minor impacts.

Impacts related to commercialization

With expansion of the demonstration plant to a commercial facility, water consumption is projected to increase from 226 to 793 liters/s. Although plant capacity would increase five-fold, water consumption would only increase by a factor of 3.5 due to the increased thermal efficiency of the larger facility. It is assumed that the volume of wastewater would increase by this same factor, going from 78 to 273 liters/s. Characteristics of the wastewater are assumed to be the same as for the demonstration plant. Because it is recognized that TDS concentrations will be a continuing water quality problem during low-flow periods in the basin, no improvements in ambient water quality are assumed to occur before commercial operations would begin.

To prevent degradation of water quality, the commercial plant would also use the strategy of shifting to zero wastewater discharge operation at times when the Monongahela River had inadequate assimilative capacity. It is estimated (Appendix C.8.3) that zero-discharge operations would be necessary 40% of the time for the SRC-II discharge to use only 10% or less of the river's assimilative capacity for TDS.

Design and operation of the commercial plant will depend greatly on experience gained with the demonstration plant. Characteristics of the raw wastewater and performance of the wastewater handling systems will be determined under a variety of loading, operating, and environmental conditions. Monitoring during the demonstration phase will also provide a better understanding of the Monongahela's water quality and impacts of the SRC-II discharge. The ultimate impacts on water quality from commercial-scale plant operation will depend on the demonstration plant experience and several unknown factors, including effluent limitations, other regulations applied to the solvent refining process, and possible changes in process technology.

Impacts related to mothballing and decommissioning

Impacts resulting from mothballing of the SRC-II demonstration facility would depend on the disposal of materials and wastes that have been generated or stored on the site. Residual products, by-products, process intermediates, and raw materials would have to be removed from the site in a manner designed to avoid leaks, spills, or other accidental releases into the aquatic environment. Cleaning wastes generated by shutdown operations and the contents of onsite retention basins would have to be treated and disposed of appropriately. It is not known at this time whether the Monongahela River would be a viable alternative for the disposal of these treated wastewaters.

The extent of (1) environmental monitoring and (2) collection and treatment of process area runoff and disposal area leachate would be based on information obtained during the operational phase (Sect. 2.3.1.2).

It is likely that the demonstration facility would be sold as an industrial site if the decommissioning option is chosen. The development of an alternative industry would require the procurement of permits for point-source discharges and for dredging from State and Federal agencies. Modification of the facility for alternative industrial use may produce impacts to the Monongahela River and drainages on or near the site similar to those projected to occur during demonstration site construction (Sect. 4.2.2.3).

4.2.2.4 Aquatic ecology

Construction impacts

Erosion and sedimentation from site preparation activities may adversely affect aquatic habitats in Crooked Run and its unnamed tributary (Fig. 3.3). Sediment discharges will be limited to the extent practicable by construction of sedimentation control basins at the beginning of site preparation. These basins and accompanying mitigation measures will be designed to reduce the discharge of total suspended solids (TSS) to a maximum concentration of 100 mg/liter in runoff from precipitation events less than or equal to the 10-year, 24-h value. Although these practices will greatly reduce impacts to the aquatic environment, elevated concentrations of TSS may be unavoidable. Construction-related disturbances are expected to be relatively short-term.

Potential impacts of increased sediment and turbidity on aquatic organisms are manyfold.²² Increased sedimentation may modify or destroy benthic habitat, thereby reducing or eliminating food available for fish. Also, it may disturb fish spawning habitat and affect the viability of fish eggs. Of drainages on or near the site, Crooked Run appears to have the greatest biological productivity (Sect. 3.2.2.3); therefore, it may be more sensitive to disturbances from construction. Although Crooked Run is not listed as one of the high-quality streams in the Monongahela River Basin,²³ it does provide spawning habitat for fish populations of the Monongahela River near the proposed plant site. The magnitude of impacts from eroded sediments will depend primarily on the effectiveness of control measures. If sediment control basins hold the suspended solids concentration of runoff below 100 mg/liter, only minor impacts are expected to occur.

Onsite ponds will be destroyed during site preparation. Loss of these aquatic habitats may be mitigated by creation of a pond and wetland area.

Another aquatic environment that will be affected by construction activities is the western shore of the Monongahela River from about Mile Point 93 to 94.6. Construction of the water intake structure, the barge dock, and barge slip near the product storage area will modify the shoreline and benthic habitat. About 886 m of shoreline will be disturbed to build a coal barge dock and barge unloader. The existing shoreline will be removed and dragline or clam shell dredge will remove about 76,500 m³ of material. This will create a uniform shoreline and additional area for barges (see Figs. D.5 and D.6). A raw water intake structure (Fig. D.7) and barge slip (Fig. D.4) will require excavation and dredging of about 7650 m³ and 9180 m³ of material, respectively. Plans for the wastewater discharge structure are not yet complete, but dredging of perhaps 15,000 m³ of material would be necessary for its installation. The product storage area (Fig. D.8) will be filled to a level 4.1 m (13.5 ft) above the 500-year flood level and surrounded by dikes. About 153,000 m³ of fill material will be required. If the 108,000 m³ of material dredged for shoreline development is suitable, it will be used as fill for the product storage area and supplemented with fill from the haul road excavation. If the dredged material is not suitable for fill, another disposal site will be used in accordance with the requirements of the dredging permit. The shoreline development activities will be reviewed by the Corps of Engineers through the Sect. 404 permitting process.

Shoreline disturbance for the barge dock and other structures will essentially destroy the value of about 1 km of shoreline to fish and wildlife. The existing shoreline provides habitat for benthic organisms, fish feeding, and fish spawning (Sect. 3.2.2.3). Shoreline development for the SRC-II project will encroach on a small but significant portion of relatively undisturbed shoreline. The loss of this shoreline habitat will be mitigated by enhancing the value of habitat in the remaining undisturbed shoreline under the project's control (see Sect. 4.6.6).

Endangered species. No unique areas, such as habitat of endangered or threatened species, are expected to be affected during construction activities. The U.S. Fish and Wildlife Service identified no threatened or endangered aquatic species in the Monongahela Basin (see Appendix E), nor did the baseline monitoring program encounter any aquatic organisms included on the list of threatened and endangered species.²³

Operational impacts

Water intake. The proposed SRC-II facility is projected to withdraw 304 liters/s of water from the Monongahela River for plant process requirements (Appendix C.3.11.1). Current plans are to widen the channel by dredging a small area so that the intake structure can be placed out of the navigation channel, about 3 m (9 ft) below the normal pool elevation (Fig. D.7). At the pores in the perforated pipe structure, the intake velocity will be relatively low (less than 10 cm/s) so that only plankton, and not juvenile and adult fish, are likely to be entrained.

Of the planktonic organisms that can be killed by withdrawal of water supplies, ichthyoplankton (fish larvae) are the most significant. Phytoplankton and zooplankton reproduce within periods ranging from days to weeks, whereas reproduction in fish is mostly limited to once per year. The impact of water withdrawal on ichthyoplankton depends primarily on the distribution of ichthyoplankton in the river. This distribution varies both with time and location. Ichthyoplankton occur at very low densities throughout most of the year and reach peak densities in June and July (Table F.6). No data are available describing the distribution of fish larvae near the shoreline versus in midchannel. However, since fish nests have been observed along the river's edge (Sect. 3.2.2.3), it can be assumed that ichthyoplankton density near the shore would be greater than in the center of the channel. Based on these considerations it follows that an intake near the shoreline will cause more significant impacts than an intake located away from the shoreline. In addition, impacts will be most severe during the early summer periods of peak ichthyoplankton density.

To perform a worst-case analysis of the potential loss of ichthyoplankton, we assume that (1) ichthyoplankton cannot avoid entrainment, (2) all entrained organisms are killed, and (3) the maximum density of ichthyoplankton near the shore is 2 to 10 times that recorded at station M-2 in the center of the river channel. Based on these assumptions, entrainment losses may be as high as 7400 to 37,000 larval fish per day during periods of peak ichthyoplankton density. An alternative location for the intake structure would be near the channel bottom and somewhat away from the shoreline. At this location it is reasonable to assume that ichthyoplankton densities would be no greater than those observed at the center of the channel, and worst-case ichthyoplankton losses would be 37,000 per day during peak density periods.

The significance of ichthyoplankton losses caused by the SRC-II intake depends on the fraction of fish larvae removed from the river. Under minimum flow conditions, the SRC-II withdrawal would remove 3.2% of the river's streamflow. Therefore, because of the distribution of larvae in the river, the worst-case loss of ichthyoplankton would be less than a 3.2% loss for an offshore intake and a loss somewhat greater than 3.2% with shoreline intake. An offshore intake with an ichthyoplankton loss of 3.2% or less would not cause a significant reduction in fish populations of the Monongahela River. The onshore intake structure appears to have the potential to destroy more than 3.2% of the river's fish larvae under the worst-case conditions of low river flow. The offshore intake structure appears to be the environmentally preferable alternative. Therefore, both shoreline and off-shore intake structures are highlighted for further evaluation in Sect. 2.3.2.1.

The worst case described above is an unlikely occurrence for several reasons. Low flows typically occur in late summer in the Monongahela River (Appendix N). Although low-flow periods have occurred in July, it is uncommon for low flows to coincide with peak ichthyoplankton densities. One of the factors that can trigger fish spawning is increased stream-flow following rainfall events. Consequently, during the time of peak density for most years, the fraction of fish larvae destroyed by the SRC-II withdrawal would probably be considerably less than the worst case. Clearly, further monitoring of the river's ichthyoplankton is required, as indicated in Sect. 4.5.3.3.

Wastewater discharge. The SRC-II discharge may cause two types of impacts on aquatic biota: acute toxicity and chronic effects. Acutely toxic effects are important primarily in the mixing zone for the discharge, whereas chronic effects must be considered for the entire river ecosystem near the facility. Impacts are considered for the worst case, which is defined in Sect. 4.2.2.3 and summarized in Tables 4.8 and 4.9.

The acute toxicity of the SRC-II discharge can be assessed by comparing projected concentration of water quality constituents in the effluent with bioassay data. Table 4.10 summarizes bioassay data for trace elements for various taxonomic groups and compares these with the effluent concentrations. This analysis suggests that the concentrations of individual substances in the mixing zone will not be acutely toxic to most organisms. For phenol and cyanide also, the effluent concentrations are unlikely to be acutely toxic to most organisms. EPA's draft criteria indicate the concentrations "never to be exceeded" as 3.4 mg/liter for phenol and 0.038 mg/liter for cyanide (Table S.3) compared with effluent concentrations of 0.1 and 0.015 mg/liter, respectively.

In the mixing zone for the SRC-II effluent, the concentration of potential pollutants will be rapidly reduced below the concentrations in the wastewater. The discharge structure will be designed and located to provide wide dispersion and rapid dilution of the effluent. Although concentrations of individual chemicals are not expected to be toxic, water quality in the mixing zone will be degraded. The interactive toxic effects of many contaminants could cause mortality to some organisms, especially pollution-intolerant species and benthic organisms. Planktonic species, however, should have a relatively short time of passage through the mixing zone, with very little effect. During cold weather the effluent will be warmer than the ambient water temperature, and this may attract fish into the mixing zone. This behavior is likely to increase the chronic effects of exposure to contaminants, but is unlikely to cause mortality.

Chronic effects on aquatic biota from the SRC-II discharge could include increased susceptibility to disease, shorter lifespan, and decline in the reproductive capacity of organisms. The effects may result from bioaccumulation of toxicants, sublethal toxic effects, and effects on organisms' behavior. In general, water quality criteria for protection of aquatic life are established at levels intended to protect organisms from chronic effects. Tables 4.8 and 4.9 compare water quality standards, criteria, and EPCs with the "mixed concentrations," which would result after complete dilution of the SRC-II discharge. This comparison suggests that, outside of the mixing zone, chronic effects on organisms would not be severe. Only one toxic pollutant, phenol, has a concentration significantly above the criteria as a result of the SRC-II discharge. The standard for phenol — 0.001 mg/liter — is based on the concentration required to prevent taste and odor problems in drinking water and tainting of fish flesh. The EPA draft criterion for phenol for protection of aquatic life is 0.6 mg/liter (Table S.3). Although some chronic effects may result from the SRC-II discharge, these effects will probably occur primarily in the mixing zone.

Table 4.10. Potential toxicity and bioaccumulation of selected elements in SRC-II effluent
Numbers in parentheses indicate numbers of determinations

Chemical constituent	Projected maximum concentration ^a (mg/liter)	Mean concentration toxic to aquatic organisms ^b (ppm)						Bioaccumulation potential	
		Fish	Crustaceans	Insects	Molluscs	Phytoplankton	Macrophytes	In general ^c	In aqueous coal conversion effluents ^d
Cadmium	0	8.2 (29)	0.035 (2)			0.27 (3)	7.4 (1)	Readily accumulated by marine and freshwater organisms, particularly shellfish	Low potential for hazard
Chromium	0.2	100.2 (90)	6.8 (13)	76.3 (5)	17.1 (2)	1.8 (11)	5.4 (2)	Accumulated by fish and invertebrates; may be rapidly eliminated	High potential for hazard
Copper	0.07	2.9 (114)	0.95 (14)	3.8 (11)	0.27 (12)	0.66 (59)	0.25 (1)	Accumulated by freshwater and marine fish, shellfish, and aquatic insects	High potential for hazard
Iron	1	482.7 (40)	8.1 (5)	10.8 (3)	200.0 (4)			Accumulated by fish; readily accumulated by some marine organisms	High potential for hazard
Lead	0.05	40.8 (53)	1.8 (5)	37.3 (3)		2.5 (1)	363.0 (1)	Accumulated by fish and invertebrates, particularly shellfish	High potential for hazard
Manganese	To be determined	838.0 (20)	12.4 (3)			1.4 (18)		Accumulated by marine and freshwater organisms	High potential for hazard
Mercury	0.001	0.80 (21)	0.009 (2)	2.0 (3)		1.3 (13)	3.4 (1)	Methylmercury readily accumulated by aquatic organisms	Medium potential for hazard
Nickel	0.01	31.3 (26)	0.32 (2)	33.8 (3)		1.0 (2)		Does not appear to be accumulated in significant amounts by aquatic organisms	High potential for hazard
Selenium	0.03	23.9 (7)				2.5 (1)		Not as well studied as other elements; some evidence for accumulation in aquatic organisms, particularly invertebrates	High potential for hazard
Zinc	0.1	8.8 (134)	2.3 (7)	24.3 (111)	2.9 (27)	1.7 (14)	16.3 (2)	Readily accumulated by marine and freshwater organisms	High potential for hazard

^aSource of data: Table C.18.

^bData taken from H. M. Braunstein, ed. *Environmental and Health Aspects of Disposal of Solid Wastes from Coal Conversion: An Information Assessment*, ORNL-5361, Oak Ridge National Laboratory, Oak Ridge, Tenn., September 1978, Table 3.4, p. 3-7. Source of data contained in this table: compiled from R. M. Cushman, S. G. Hildebrand, R. H. Strand and R. Anderson, *The Toxicity of 35 Trace Elements in Coal to Freshwater Biota: A Data Base with Automated Retrieval Capabilities*, ORNL/TM-5793, Oak Ridge National Laboratory, Oak Ridge, Tennessee, June 1977, 41 pp. 00).

^cReferences include D. J. Wilkes, "Animals: Bioenvironmental Effects," Ch. 9 in H. M. Braunstein, E. D. Copenhaver, and H. A. Pfuderer, ed., *Environmental Health, and Control Aspects of Coal Conversion: An Information Overview*, vol. 2, ORNL-5361, Oak Ridge National Laboratory, Oak Ridge, Tennessee, April 1977; G. R. Phillips and R. C. Russo, *Metal Bioaccumulation in Fishes and Aquatic Invertebrates: A Literature Review*, EPA-600/3-78-103, U.S. Environmental Protection Agency, Duluth, Minn., December 1978, 115 pp.

^dFrom S. G. Hildebrand, R. M. Cushman, and J. A. Carter, "The Potential Toxicity and Bioaccumulation in Aquatic Systems of Trace Elements Present to Aqueous Coal Conversion Effluents," p. 311 in *Trace Elements in Environmental Health-X. 1976. A Symposium*. D. D. Hemphill ed., University of Missouri, Columbia, Mo., Table III.

One potentially significant impact resulting from the SRC-II discharge may be bioaccumulation and perhaps bioconcentration of trace elements and organic compounds. Each compound released will have unique patterns of transport and transformation. Frequently, compounds adsorb to particles and enter the sediments (Fig. 4.1). Here, compounds can undergo microbial transformation and/or be taken up by benthic organisms such as aquatic worms or insect larvae. Another possibility is that discharged compounds can be taken up by planktonic organisms. In either case, compounds enter food chains and can be bioconcentrated in predators at the top of the food chain, for example, large fish and humans.

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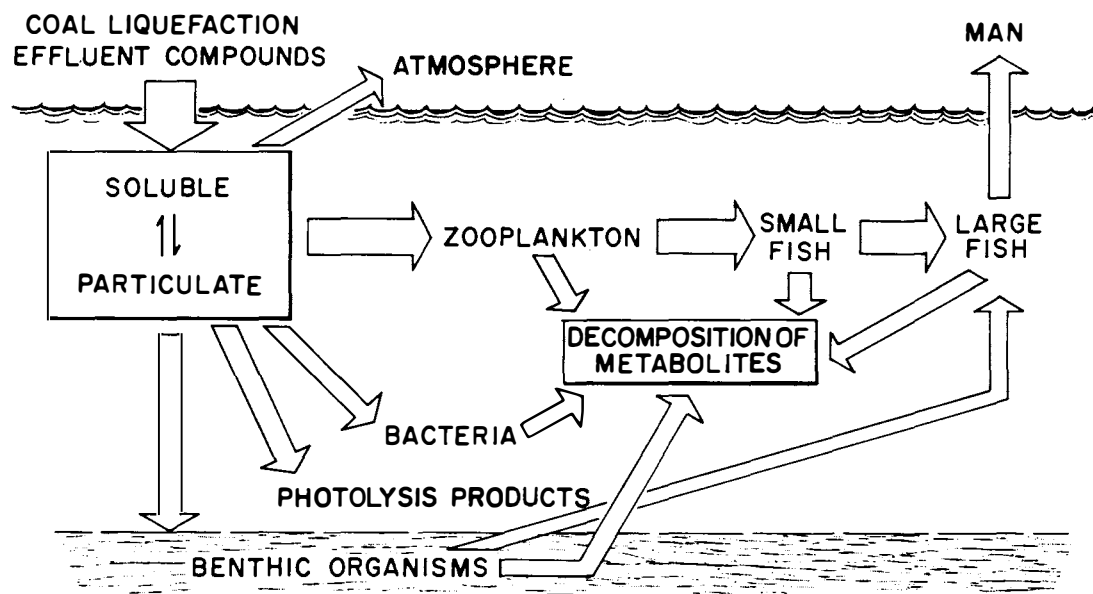


Fig. 4.1. Major transport and transformation processes acting on PNA and trace elements in natural waters (Mussler's dilemma). Source: S. E. Herbes et al., "Critical Pathways of Polycyclic Aromatic Hydrocarbons in Aquatic Environments," pp. 113-128 in H. Witchi, ed., *The Scientific Basis of Toxicity Assessment*, Elsevier/North Holland Biomedical Press, 1980, Fig. 2.

Table 4.10 indicates that many of the trace elements to be discharged by the SRC-II plant have high potential for bioaccumulation. These substances may cause sublethal effects on aquatic organisms that live or feed in the mixing zone. However, outside the mixing zone, minimal impacts are anticipated since the SRC-II discharge will cause only very slight increases in the concentrations of trace elements.

The bioaccumulation potential of organic compounds is highly variable. As noted in Appendix S, organic compounds with relatively low molecular weights (e.g., phenol, 2- and 3-ringed PNS) tend to have higher solubilities and lower potential for bioaccumulation. Compounds with higher molecular weight (e.g., 4- and 5-ringed PNA) have low solubilities and higher potential for bioaccumulation.

The SRC-II facility is projected to discharge small quantities of PNA (Table 4.8). After dilution in the Monongahela River, the concentrations of PNA are believed to be sufficiently low so that bioaccumulation or bioconcentration will not cause adverse impacts. However, the monitoring program will include sampling of fish tissues to determine the extent of bioconcentration.

In summary, the principal ecological impact from the SRC-II discharge will be to create a mixing zone inhabited principally by pollution-tolerant organisms. In and near the discharge mixing zone, organisms will suffer chronic effects due to exposure to elevated concentrations of trace elements and organic compounds. The downstream river ecosystem will suffer slightly increased loadings of phenolic compounds, which may cause sublethal effects to fish or tainting of fish

flesh. For the river as a whole, the SRC-II discharge will constitute a small stress on the aquatic ecosystem, but it is not expected to substantially degrade water quality or "ecosystem health." The operating strategy of eliminating discharge during low flow periods will substantially reduce adverse impacts.

Admittedly, the prediction of impacts on aquatic biota is imprecise. The chemical form of trace elements in the wastewater is uncertain, and data are limited regarding the behavior of PNA in aquatic environments. Consequently, the impacts of the SRC-II discharge will be the subject of intensive ecological monitoring (Sect. 4.5.3.3).

Nonroutine discharges. The design and operating plans for the SRC-II demonstration plant will include systems to prevent spills, dikes to contain any spilled materials, and systems to recover and/or treat spilled materials (Appendix C). Runoff during extreme precipitation events will be handled so as to minimize potential adverse impacts (see Sect. 4.2.2.3). During the early phase of operation, the SRC-II plant will undergo startup and shutdown quite frequently, creating uneven loadings on the wastewater treatment plant. Measures to ensure effective wastewater treatment during such operations will also be employed (Appendix C). Despite these control measures, it must be assumed that spills, accidents, or errors will occasionally result in release of materials more deleterious to water quality than is the typical wastewater.

It should be noted that a significant failure of the wastewater treatment system would be detected by process monitoring (Sect. 4.5) and would constitute one of the criteria that would cause the plant to shut down.

Because the composition and quantity of nonroutine releases is unknown, impacts on aquatic ecology cannot be accurately assessed. Nonroutine releases could cause impacts ranging from the trivial to the extremely serious effects associated with a major product spill (Appendix Z). A major product spill into the Monongahela could cause massive mortality to aquatic biota and substantial impacts on recreation and public water supply. Although major spills have a very low probability of occurrence, minor releases are more likely. Such nonroutine releases from industrial facilities often account for significant ecological impacts on aquatic systems.⁴⁶ Although the impacts cannot be accurately quantified, it must be assumed that nonroutine releases from the SRC-II demonstration plant will cause stress on the "ecosystem health" of the Monongahela River over and above the stresses caused by routine wastewater discharge.

Summary. Construction and operation of the SRC-II demonstration plant will produce multiple impacts on the Monongahela River's ecosystem from (1) destruction of habitat for shoreline development, (2) chronic effects due to contaminants in wastewater and occasional nonroutine releases, and (3) minor impacts from coal spillage, consumptive water use, and entrainment of planktonic organisms. Although each of these is a relatively small impact, their aggregate effect must be considered. Collectively, the various impacts of the SRC-II project have the potential to change the river's character near the facility and shift the composition of the biological community toward those species tolerant of disturbance and the elevated contaminant levels in the mixing zone. Therefore, it is important that high priority be given to minimizing the facility's impacts during construction and operation, employing suitable mitigating measures (Sect. 4.6.6) and monitoring to determine which impacts actually occur and the success of the mitigating measures (Sect. 4.5.3.3).

Impacts related to commercialization

A detailed water balance has not been prepared for the commercial-scale plant. Assuming a 3.5 x scale-up factor used for consumptive water use, the commercial-scale SRC-II plant is projected to withdraw 1064 liters/s. This withdrawal constitutes 11.1% of the minimum navigation flow of 9627 liters/s (340 cfs) or 10.4% of the 7-day, 10-year low flow (10,194 liters/s or 360 cfs). If the water intake structure withdraws water from near the shoreline (as currently planned), the potential exists for losses of more than 10% of the river's ichthyoplankton during extreme low flows. The impacts of raw water withdrawal on ichthyoplankton are uncertain, and additional monitoring is needed. Further baseline and/or operational monitoring may indicate the need for placement of the intake structure in an area of minimum ichthyoplankton density.

Under worst-case assumptions, the wastewater discharge from the commercial SRC-II plant would cause significant additional stress to the aquatic ecosystem over that produced by the demonstration plant. As discussed in Appendix C, however, the commercial plant is expected to operate in the zero-discharge mode for a larger part of the time. In addition, design of the commercial plant will take advantage of the knowledge and experience gained from demonstration plant operation. The reliability of wastewater treatment systems will be better understood. If operation of the demonstration plant has revealed problems caused by a particular contaminant, (e.g., bioaccumulation of heavy metals), specific treatment processes for control can be incorporated into the commercial plant design.

Impacts related to mothballing and decommissioning

The aquatic biota of the Monongahela River and watercourses on or near the site would not be adversely affected by mothballing or decommissioning operations if careful measures are taken to (1) seal and revegetate slag disposal areas; (2) remove coal, other raw materials, process intermediates, by-products, and products; and (3) properly dispose of retention pond contents and wastes generated from shutdown operations. If an alternative industry is developed at the site, necessary precautions will have to be taken to protect aquatic communities. Modification of the facility site may produce impacts similar to those described for demonstration plant construction operations (Sect. 4.2.2.4).

4.2.3 Air

This section discusses the construction and operational impacts predicted for the proposed site on air quality and noise. Section 4.5 discusses recommended construction and operational monitoring, and Sect. 4.6 discusses recommended mitigation measures.

4.2.3.1 Air quality

Construction impacts

Construction of the demonstration plant will generate air emissions as a result of land clearing, grading and excavation, operation of vehicles and mobile equipment, storage and transfer of fuels and other materials, and evaporation of solvents from paints and coatings. These emission sources, which are discussed in Appendix C, are common to major construction projects and, except for vehicle and equipment emissions, are primarily area or fugitive emission sources that may be effectively controlled only by implementing good management practices. As part of the detailed design, a project environmental plan will be developed; it is scheduled for delivery to DOE in early 1981. This plan will permit estimation of potential air quality impacts associated with construction. To minimize such impacts, six specific measures will be implemented:

1. scheduling of land clearing, grading, excavation, and other site preparation activities to minimize the area disturbed at any time,
2. using dust-suppression measures such as water sprays and polymer coatings to reduce fugitive dust from disturbed areas and stored materials such as topsoil and clay,
3. revegetating temporarily disturbed areas promptly,
4. using mobile equipment that meets applicable emission standards, and maintenance as required, to ensure continued compliance,
5. using, where feasible, alternatives to open burning for disposal of debris from land clearing, and
6. performing necessary open burning in accordance with applicable regulations and at times when meteorological conditions favor rapid dispersion of emissions.

It is impossible to accurately predict the actual uncontrolled emissions or to assess the effectiveness of available control measures. Emission sources are common to all major construction projects, and various demonstrated control techniques are available to minimize air quality impacts.

Operational impacts

Operation of the demonstration plant will result in the emission of criteria and noncriteria (unregulated) pollutants from both point and nonpoint sources. The significant point source emissions are summarized in Appendix C, Sect. C.4. Inspection of Appendix C indicates that the criteria pollutants of greatest concern are particulates and SO₂ and that the most significant sources are coal handling, the coal dissolver charge heaters, and the sulfur recovery unit.

Under normal operating conditions, process units will not emit a continuous stream of hydrocarbons. Hydrocarbon emissions are expected to result primarily from leaks in process equipment and piping and from maintenance of equipment involving release of process materials. Storage tanks will be equipped with vapor recovery systems, and emissions from process upsets will be routed to a

controlled-combustion system (Appendix C). A preliminary estimate of hydrocarbon emissions from the demonstration plant, based on petroleum refinery experience, is presented in Appendix C, Sect. C.4. Results of this analysis indicate that hydrocarbon emissions would be about 700 tons per year if no additional controls are implemented. Because the potential adverse health effects of some process materials are a source of concern, the design of the demonstration plant will incorporate measures to reduce fugitive hydrocarbon emissions to lower levels of about 95 tons per year (Appendix C, Sect. C.3). Because design of the demonstration plant is not yet final, control measures that will be used in each area are only generically specified at this time (Appendix C, Sect. C.3.5.1), and the degree of reduction can only be estimated based on experience in petroleum refineries (Appendix C, Sect. C.4.1.8). This subject, which has been identified as an area of concern, will be addressed in detail during detailed design. A preliminary estimate of the quantity of heavy hydrocarbons (600°F and higher boiling point) that would be emitted, based on the fugitive emission rate, is shown in Appendix C, Sect. C.4.1.8, to be about 4 tons per year. The total nonmethane hydrocarbons (NMHC) emitted by the demonstration plant would produce a maximum ground-level concentration of only about 0.2% of the hydrocarbons already present in the area; thus, the plant's contribution can be said to be quite small (see Table 4.5).

Air quality for the area around the proposed facility is now near the NAAQS for ozone. Though hydrocarbon emissions are thought to be the most important precursor pollutant in ozone formation, the atmospheric chemistry is complicated, time consuming, and not well understood. Generally, ozone formation due to hydrocarbon emissions occurs at considerable distances downstream from the emission point; therefore, these emissions from the demonstration plant will not add to the local ozone formation significantly.

The prediction of ozone in the plant area is hindered by limitations in the state of the art in (1) predicting ambient ozone concentrations resulting from long-range transport of urban reactive hydrocarbons and photochemical oxidants, (2) determining the frequency and severity of stratospheric ozone intrusions, and (3) understanding the atmospheric chemistry and kinetics that affect ozone formation. Because best available control technology (BACT) will be used in the proposed SRC-II plant to limit hydrocarbon emissions, these emissions will be comparatively low, and no significant impact on ozone locally is expected.

Reduced sulfur compound emissions (hydrogen sulfide, carbonyl sulfide, and carbon disulfide) will be controlled through recovery as elemental sulfur (Appendix C). Residual quantities of reduced sulfur compounds in the effluent from the sulfur recovery unit will be converted to sulfur dioxide (SO_2) by incineration before emission. Emissions from the sulfur recovery unit's tail-gas incinerator will constitute the major source of SO_2 emissions from the demonstration plant.

Sulfur dioxide emitted from the proposed SRC-II plant will oxidize to form suspended sulfate aerosols at rates dependent on ambient relative humidity, temperature, and ozone concentration. Generally, the reaction rates of SO_2 oxidation will be about 2 to 3% per hour. Relative humidity greater than 75% (such as would be the case during SO_2 plume interaction with cooling tower plumes, fog, or natural clouds) will cause higher reaction rates. When SO_2 contacts water droplets in cooling tower plumes, fog, or natural clouds, it reacts with the water to form H_2SO_3 , which is rapidly oxidized by oxygen or ozone to form sulfuric acid (H_2SO_4).

Generally, a significant portion of SO_2 emitted by the plant will not convert to sulfates until the distance traveled downwind is large [80 to 160 km (50 to 100 miles)].

Most of the particles emitted from the proposed facility will be fugitive losses from coal handling and storage. These fugitive emissions account for $6.6 \mu\text{g}/\text{m}^3$ of the peak 24-h total suspended particulate (TSP) concentrations calculated at the facility. Because particle diameters from these operations are generally large, they will quickly settle to the ground, making their impact a concern only within a few hundred meters of the facility.

Dolly Suds is the nearest Class I area, which is about 70 km to the SSE of the proposed site near Elkins, West Virginia. Since this nearest Class I area is a considerable distance from the site and the emissions of the SRC-II plant are small when compared on an area-wide basis, the plant is not expected to have a significant effect on the visibility at Dolly Suds.

Based on ambient air quality monitoring at the proposed site (Sect. 3.2.3.1) and the preliminary emission estimates indicated in Appendix C, dispersion modeling has been conducted to determine compliance with the National Ambient Air Quality Standards (NAAQS) and prevention of significant deterioration (PSD) increments. The results of this dispersion modeling are summarized in Table 4.5 and are discussed in Appendix Q.

The results of air quality modeling indicated that the SCOT burner and incinerator was the major contributor to the maximum 3- and 24-h SO_2 concentrations. The modeling also indicates 1-h CO

Table 4.5. Maximum pollutant concentration estimates for the proposed SRC-II demonstration facility

Values are in $\mu\text{g}/\text{m}^3$. Refinement in emission data is the result of additional design work since the DEIS was published in June 1980

Pollutant	Averaging time	Predicted ground-level maximum concentrations ^a	Observed background ^b	Federal standards			West Virginia ambient standards ^e	Percentage of PSD increment consumed
				NAAQS ^c		PSD ^d class II		
				Primary	Secondary			
SO ₂	3 h	52.9	705		1,300	512	1,300	10.3
	24 h	12.1	239	365		91	365	13.3
	Annual	3.7	44	80		20	80	18.5
NO ₂	Annual	23.4	29	100	100		100	
CO	1 h	1.1	2,587	40,000	40,000		40,000	
	8 h	1.0	1,508	10,000	10,000		10,000	
O ₃	1 h	None ^f	217	235	235		^e	
NMHC ^g	3 h	5.4	2,453	160	160		160	
TSP ^h	24 h	12.9	114	260	150	37	150	34.9
	Annual	6.3	42	75	60	19	60	33.2

^aDue to demonstration plant alone.

^bJuly 1978 through June 1979; computed at 329 m (1079 ft) and 25°C (77°F).

^cNational Ambient Air Quality Standards; maximum allowable concentrations, including background.

^dPrevention of significant deterioration; maximum allowable increases in concentrations above background.

^eWest Virginia standard will be changed to agree with NAAQS.

^fOzone, as such, is not emitted but is thought to be related to NMHC emissions after due time for conversion (see text Sect. 4.2.3).

^gNonmethane hydrocarbon; guideline only; maximum concentration between 0600 and 0900 local time; includes point sources and fugitive losses.

^hTotal suspended particulates.

concentrations to be quite low for the entire facility (see Table 4.5). The major contributors to NMHC concentrations were the coal dryer, the dissolver charge heater, and the various fugitive sources. The NMHC concentrations also were indicated to be comparatively low in concentration (see Table 4.5). Coal handling and coal storage were the major contributors to the 24-h particulate concentration. The maximum annual concentration of NO₂ occurred to the northeast of the site due to the prevailing southwest wind.

PSD consumption by the demonstration plant

The Clean Air Act Amendments of 1977 establish procedures for preventing significant deterioration of air quality in areas which currently meet the NAAQS. These procedures establish maximum allowable increases in ambient air concentrations of specific pollutants (PSD increments) based on the difference between current concentrations and the NAAQS with consideration of the amount of growth (increase in emissions) to be permitted in the area. Currently, PSD increments have been established for SO₂ and TSP.

Ambient air quality measurements at the proposed plant site indicate compliance with all NAAQS and availability of the full class II PSD increments. Based on conservative estimates of emissions (see Sect. 4.2.3.1 and Appendix C), dispersion modeling indicates consumption of about 13% of the 24-h concentration increment for SO₂ and 35% of the 24-h increment for particulates (see Table 4.5).

The results are from an independent analysis performed by DOE for this statement and are not the results of PSD permit application modeling. Both documents analyzed air quality independently of each other and used different models.

Comparison of air quality modeling results

Table 4.11 gives a comparison of air quality modeling results. The two sets of data reflect modeling results by DOE and those submitted in the PSD permit application. The differences are caused primarily by the different air quality dispersion models used in each case.

Table 4.11. Comparison of air quality modeling results

Criteria pollutant	Prediction of maximum ambient concentration ($\mu\text{g}/\text{m}^3$)		Prediction of maximum ambient concentration ($\mu\text{g}/\text{m}^3$)		PSD regulations class II
	PSD permit application	Percentage of increment consumed	EIS	Percentage of increment consumed	
SO ₂					
3 h	125.2	24.5	52.9	10.3	512
24 h	31.3	34.4	12.1	13.3	91
Annual	2.9	14.5	3.7	18.5	20
NO ₂					
Annual	19.3		23.4		
CO					
1 h	11.6		1.1		
8 h	7.7		1.0		
O ₃					
1 h	None		None		
NMHC					
3 h	18.2		5.9		
TSP					
24 h	15.4	41.6	12.9	34.9	37
Annual	7.8	41.1	6.3	33.2	19

For the PSD study, the EPA VALLEY model was used because the demonstration plant is located in hilly terrains. VALLEY is the only model that calculates pollution concentrations in hilly terrain with receptors higher than stack emission heights and is also listed in EPA's "Guideline on Air Quality." This guideline requires the use of the VALLEY model in PSD modeling.

VALLEY was developed for estimating the upper limits of 24-h average pollutant concentrations due to isolated sources in rural, complex terrain. It calculates pollutant concentrations for each frequency designated in an array defined by 6 stabilities, 16 wind directions, and 6 wind speed classes (a STAR program). Because VALLEY's primary use is to calculate the upper limits of concentration, it is considered a screening model. EPA screening models are conservatively designed with assumptions that tend to predict higher pollution concentrations than will actually occur, and for this reason they are called "screening" models. Although the more refined models are also conservative and tend to predict higher than actual concentrations, their results are more realistic in terms of actual measured pollutant concentrations. If a plant modeled with a screening model can be shown to comply with air quality regulations, there is no need to go on to modeling with the more expensive refined models, which would tend to predict lower pollutant concentrations.

The Industrial Source Complex (ISC) model is a more refined EPA model, and this is the model that results in the predicted concentrations presented here and in Appendix Q. It can be noted by comparison that the ISC results are lower than the VALLEY results (except for annual results). The results are lower because ISC's more refined model makes more precise assumptions than does the VALLEY screening model.

Even though VALLEY was able to show compliance with the PSD regulations, it did so at a receptor 3.65 km away on a hilltop. This point was picked because it was the highest elevated point in the near vicinity of the plant (at 1477 ft elevation) and would calculate the effect of such a terrain. The question then arises as to what the results might be closer to the sources in the plant where the emissions have much less travel distance to disperse.

To answer this question, the refined ISC model was run for receptors as close as 500 m from the SCOT burner and incinerator, the largest source of SO₂. The results showed compliance with regulations using this refined model at short distances.

One other comment should be made concerning the similarity of predicted concentrations for the ISC and VALLEY models for the annual average. This similarity results from a greater similarity of the models when computing in the annual mode. The ISC model actually consists of two computer programs: the ISCST (ST = Short-Term) and ISCLT (LT = Long-Term). The ISCLT program computes the annual concentration under ISC and uses a STAR program for meteorological data, the same meteorological data input used by VALLEY. The ISCST program does not use a STAR program but uses sequential hourly meteorological data of the EPA CRSTER program format.

Cooling tower operation. Operation of the proposed evaporative cooling system will release emissions to the atmosphere, thus affecting air quality. The heat rejection rate from the demonstration plant (about 1.6×10^9 Btu/h) will be less than 15% of the heat that is rejected from the hyperbolic cooling towers of the adjacent Fort Martin coal-fired power plant when it is operating at its rated capacity. As discussed in Appendix C, selection of a cooling system design involves balancing economic and environmental factors and affects the selection of a wastewater treatment system. The currently proposed cooling system is described in Appendix C.

Operation of an evaporative cooling system will result in the consumptive use of water and the continuous release of water vapor into the atmosphere. The release of water vapor will produce a visible plume of varying size, depending on ambient temperature and humidity. Localized increases in ground fog and occasional icing resulting from deposition of supercooled fog will occur. When the design for the cooling system is established, a detailed analysis of the potential for increased fogging and icing will be made, and the results of this analysis will be used to site the cooling towers. Increased fogging would be of greatest significance along Highway 53, which runs through the site west of the proposed process area. Because the prevailing wind is from the southwest, impacts on Highway 53 should be minimized.

However, the possible impacts of icing on the nearby electrical substation and transmission lines will also be considered. Preliminary analysis indicates that the impacts of increased fogging and icing due to deposition of supercooled fog can be reduced to acceptable levels through appropriate location, operation, and maintenance of the cooling towers.

Operation of the cooling towers will also release small droplets of circulating water (drift). As a result of evaporation that occurs in the system, the concentration of dissolved solids in the circulating water will be increased over that in the makeup water. Modern cooling towers are designed to reduce drift losses to extremely low levels, and essentially all the drift that does occur is deposited within about 1000 ft of the tower, with most of the deposition occurring within the first few hundred feet of the tower.⁴⁷ Depending on the location of the tower with respect to the process area, most of the drift may be deposited within the area from which surface runoff is diverted to the water reclamation system, which would further reduce the impact (see process area plot plan).

During operation, concentrations of various materials in the cooling water system will be measured, and emissions will be estimated from these measurements. Ambient concentrations will also be measured, and the accuracy of the emission estimates will be evaluated. The impacts of cooling system operation will also be evaluated with respect to drift deposition, increased fogging, and icing.

Startup and shutdown. Startup of the demonstration plant will be accomplished by sequentially placing various process units into operation at reduced feed rate, adjusting to achieve stable operation, and then gradually increasing the coal feed rate to the design level. During startup, SO_2 is the criteria pollutant of greatest concern because its emission rate depends on the efficiency of the acid-gas removal and sulfur recovery units. As a result of the reduced feed rate, SO_2 emissions during startup are expected to be less than those during normal operations, even when the sulfur recovery unit is operating at less than the design efficiency of 98.6%. Controlled shutdown of the plant will follow a similar sequential procedure, and emissions during shutdown are not expected to exceed those during normal operation. (Appendix C, Sect. C.4, discusses emissions during startup and shutdown.)

In some cases, problems during startup may require that process streams be vented to the controlled-combustion and flare system rather than being used as intended in the process design. Examples of such situations include (1) problems that require extended time to reach stable operation or (2) nonavailability of the acid-gas purification plant, which would require venting of the dissolver to maintain hydrogen partial pressure. Such problems would result in SO_2 emissions, as indicated in Table 4.12. Emissions of other controlled pollutants are expected at similar percentages of routine rates.

Emissions during upset and emergency conditions. Process upsets or equipment failures will probably occur that will require venting process materials to (1) relieve internal pressure in process vessels, (2) allow removal of equipment from service for maintenance or repair, or (3) prevent creation of immediate hazards to personnel safety. As discussed in Appendix C, Sect. C.3.5.4, these materials will be directed to a controlled-combustion and flare system to minimize the emission of hydrocarbons and reduced sulfur compounds.

Process upsets or operating difficulties may occur that are so severe that they require immediate pressure reduction to prevent loss of equipment or major fire and explosion hazards to personnel. Although alternative designs are now being considered (Appendix C, Sect. C.3.5.4), emergencies may result in process materials being directed to both the controlled combustion system and the elevated flare.

Table 4.12. Reduced-rate, controlled-startup SO₂ emissions from flarestack

Method	Rate ^a (g/s)	Total for each incident		Time (h)
		kg	lb	
Extended gasification startup	3	129	285	12
Dissolver purge to hold H ₂ partial pressure	0.3	26	57	24
Extended dissolver startup	0.6	519	1142	240
Gas purification plant lineout	1.3	225	495	48

^aFor comparison, average annual SO₂ emission rate = 34.6 g/s.

Emissions of process materials resulting from such an event cannot be predicted at this time. These streams will contain organic compounds and various compounds of sulfur. If flaring is incomplete, materials that present long-term health hazards may be released. Large quantities of SO₂ will be emitted, but for short duration (see Table C.15 in Appendix C). Emissions during flaring represent a potential health hazard. In a worst-case scenario (e.g., catastrophic failure of a reactor vessel), public exposures resulting from acute emergency conditions in the plant, though brief, could be significant (see Sect. 4.1). Appendix AA specifically addresses the likelihood of these events and the impacts that would result from them, should they occur.

Interactions with other facilities. Emissions from the proposed facility will interact with emissions from other facilities. Ground-level concentrations resulting from the operation of existing sources were measured at the monitoring location (Sect. 3.2.3.1). Near the proposed site is the Fort Martin steam plant of the Monongahela Power Company. This plant consists of two 560-MW-units that burn coal delivered by barge on the Monongahela River. The coal is a mix of low-sulfur (0.5%) coal from Kentucky and higher sulfur coal (3.6%) from around Morgantown, West Virginia, which is blended to result in about 2%-sulfur coal in firing. The plant currently uses electrostatic precipitators for the removal of particulates; under construction is \$37 million in additional electrostatic precipitators to improve particulate control. Each 560-MW unit has a 510-ft stack that reduces the cumulative local impact on air quality.

The additive effects of the nearby Fort Martin Steam Plant are included in this analysis through background air monitoring data collected and presented in Table 4.5 as observed background. The cumulative effects of the Fort Martin Plant and all existing sources are directly measured by this monitoring.

Other sources proposed to operate in the area will contribute to future ambient pollution concentrations. As of April 15, 1980, EPA region III notified DOE that three potential PSD sources in this region had submitted applications. These included the Fairmont Energy Corporation coke plant, a DOE fluidized-bed combustion project in Morgantown, and an asphalt plant in Morgantown. The coke plant is located 20 km southwest of the site. The cumulative effects of these three sources on the SRC-II site will be small. An analysis conducted for the proposed SRC-II demonstration plant PSD application estimated the contribution of these three sources to increment consumption at the SRC-II site. The effect of these sources and the demonstration plant on increment consumption is contained in Table 4.13.

Table 4.13. PSD increment consumption by the SRC-II demonstration plant and other potential PSD sources

Pollutant	Averaging time	Concentration ($\mu\text{g}/\text{m}^3$)			PSD class II	Percentage of increment consumed
		SRC-II	Others	Total		
SO ₂	3 h	52.9	14.0	66.9	512	13.1
	24 h	12.1	3.5	15.6	91	17.1
	Annual	3.7	0.1	3.8	20	19.0
TSP	24 h	12.9	0.6	13.5	37	36.5
	Annual	6.3	0.1	6.4	19	33.7

The analysis was done for the above-mentioned potential PSD sources. Since that time, the DOE fluidized-bed combustion project has been cancelled; thus, the cumulative effects on PSD increment consumption presented in Table 4.13 are slightly high, since the effects of the cancelled project have not been discounted.

Odors. Odorous compounds handled within the plant include hydrogen sulfide, ammonia, and hydrocarbons. Hydrogen sulfide (H_2S) is a toxic gas, and, with the exception of the CO_2 vent stack from the acid gas removal system, streams containing it will be incinerated before being released to the atmosphere. The concentration of H_2S in the CO_2 vent stack is low and does not represent a risk during normal operation (Appendix C, Sect. C.3.2.1). The incineration process will convert virtually all the H_2S to SO_2 , which is less toxic and has a higher threshold of odor detection. Only in the unlikely event of a failure of the incinerator would there be any significant potential for H_2S odors outside of the process area. The plant's treatment facilities will produce a concentrated ammonia stream from which liquid ammonia will be recovered for sale as a by-product. This is the primary means of ammonia odor control. Hydrocarbons are a broad category of compounds with varying types of odors and varying thresholds of detection. Fugitive releases are the predominant sources of nonmethane hydrocarbons, and extensive controls will be implemented to reduce their emission rates. In all likelihood, odors from these organic emissions will be detectable in the plant and at some offsite locations. The occurrence of odors will depend on the operating condition of the plant (e.g., startup, shutdown, normal operation, rate of operation, amount of fugitive emissions), meteorological conditions, threshold of odor detection, etc. The frequency, severity, and location of offsite odors cannot be predicted, given the information available on the composition of these emissions.

Impacts related to commercialization

The air quality impacts of expansion of the demonstration plant to a commercial facility were based on preliminary information on its emissions, which is contained in Appendix C (Sect. C.8). It was assumed that the contribution of each source to the increase in maximum ambient concentration above that produced by the demonstration plant would be in proportion to the increase in that source's emissions. Thus, the demonstration plant's impacts were scaled up to give projected commercial-scale impacts. It should be noted that this is an extremely conservative approach that should lead to high-side estimates of maximum ambient concentrations. The assumption made is that all the additional emissions occur at precisely the same locations as do the demonstration plant emissions and from the same release height. In all probability, the increased emissions would occur over a larger physical area, which would tend to reduce concentrations in the atmosphere from those calculated by merely scaling up emissions.

The results of these calculations for the commercial-scale facility appear in Table 4.14. The consumption of PSD increments is highlighted in Table 4.15. The emission estimates for the

Table 4.14. Maximum pollutant concentration estimates for the proposed SRC-II commercial-scale facility

Values are in $\mu g/m^3$

Pollutant	Averaging time	Predicted maximum concentration ^a	Observed background ^b	Federal standards			West Virginia ambient standards ^e	Percentage of PSD increment consumed
				NAAQS ^c		PSD ^d class II		
				Primary	Secondary			
SO ₂	3 h	116.9	705		1300	512	1300	22.8
	24 h	26.7	239	365		91	365	29.3
	Annual	8.2	44	80		20	80	41.0
NO ₂	Annual	57.6	29	100	100		100	
CO	1 h	2.9	2,587	40,000	40,000		40,000	
	8 h	2.6	1,508	10,000	10,000		10,000	
O ₃	1 h	<i>f</i>	217	235	235		<i>e</i>	
NMHC ^g	3 h	12.4	2,453	160	160		160	
TSP ^h	24 h	27.0	114	260	150	37	150	73.0
	Annual	13.2	42	75	60	19	60	69.5

^aDue to commercial plant alone.

^bJuly 1978 through June 1979; computed at 329 m (1079 ft) and 25°C (77°F).

^cNational Ambient Air Quality Standards; maximum allowable concentrations, including background.

^dPrevention of significant deterioration; maximum allowable increases in concentrations above background.

^eWest Virginia standard will be changed to agree with NAAQS.

^fOzone, as such, is not emitted but is thought to be related to NMHC emissions after due time for conversion (see text Sect. 4.2.3).

^gNonmethane hydrocarbon; guideline only; maximum concentration between 0600 and 0900 local time; includes point sources and fugitive losses.

^hTotal suspended particulates.

Table 4.15. PSD increment consumption by the SRC-II expanded commercial plant and other potential PSD sources

Pollutant	Averaging time	Concentration ($\mu\text{g}/\text{m}^3$)			PSD class II	Percentage of increment consumed
		SRC-II	Others	Total		
SO ₂	3 h	116.9	14.0	130.9	512	25.6
	24 h	26.7	3.5	30.2	91	33.2
	Annual	8.2	0.1	8.3	20	41.5
TSP	24 h	27.0	0.6	27.6	37	75.6
	Annual	13.2	0.1	13.3	19	70.0

commercial-scale plant can only be considered as preliminary. During operation of the demonstration plant, extensive source testing and area monitoring will be conducted to determine total emissions and resulting ambient concentrations and to provide appropriate emissions factors for use in design of the commercial facility.

Based on the concentrations predicted for the commercial-scale plant given in Tables 4.14 and 4.15, it is expected that the expanded plant will be in compliance with PSD regulations. It should be noted that the availability of PSD increments cannot be projected to the date of the commercial plant expansion.

Because the regionally available PSD increment is limited, a commercial plant would consume a portion of the PSD increment that could potentially be assigned to other industrial operations. The permitting of the emissions from the plant could, therefore, potentially result in the limiting of other future industrial development opportunities in the region. However, it should be noted that consumption of the PSD increments, especially the short-term (3 and 24 h) increments, is extremely local in nature. It is highly unlikely that the short-term maximum impacts of two separate emitting facilities will occur in the same location unless they are almost adjacent to each other and meteorological conditions are favorable to such an occurrence. It is doubtful that the SRC-II plant will constrain any future industrial growth in the area.

Impacts related to mothballing and decommissioning

If the plant is mothballed, emissions from the facility would cease. The air quality would return to the levels that would be experienced without the facility. That pollutant increment allotted to the facility by PSD review would remain unavailable to other industries for some time, probably 18 months.

If the plant is decommissioned and dismantled, air quality impacts would be similar to those experienced during construction. Upon revegetation or return to prior use, the air quality would return to those levels that would be experienced without the facility.

4.2.3.2 Noise

An extensive examination of the effects of construction and operation on noise impacts is presented in Appendix W.

Construction impacts

Construction of the plant will result in higher than current noise levels in the area. Most of the construction will be done far enough from receptors to expose them to no more than normally acceptable noise pressure levels [not exceeding 74 dB(A) at 60 ft], except where construction activity is within 60 ft of a sensitive receptor. Mitigation measures (temporary barriers) appear to be feasible in these areas.

Blasting operations in the area will require advance publicity to minimize the impact on the public. Reputable professional blasting contractors will do the work, and specifications will include the use of blasting mats for noise attenuation.

If decommissioning of the plant involves returning the site to current conditions, sound levels during decommissioning would be similar to those expected during plant construction.

Steam blowing, used as part of the plant commissioning process to clean the high-pressure piping systems, produces high noise levels of short duration. The A-weighted noise level is expected

to be 105 dB(A) measured at 304 m (1000 ft) and to last 2.5 min. This level will attenuate to 99 dB(A) at 2000 ft and to 90 dB(A) at 1 mile. Steam blowing may be repeated several times until target appearance indicates an acceptable cleanliness condition within the piping system. The blowout noise may startle people and will affect verbal communications during its short duration, but the impact can be minimized by use of steam silencers, notification of the local residents of the steam blowing schedule, and explanation of the operation and associated noise.

Operational impacts

Figure W.4 and Sect. W.3 of Appendix W show the area exposed to noise levels greater than the EPA mandated limit of $L_{dn} = 55$ dB(A). Some mitigation may be possible in the final plant design stage by providing sound-barrier panels near the components producing the greatest impact (especially valves in the gasification, hydrogen plant, gas purification, and coal dissolver sections).

Traffic noise could be as high as 63 dB(A) (L_{eq}) at 100 ft from the highway but can be reduced by lowering speed limits and by scheduling heavy trucks for off-peak periods.

Rail marshaling yard noise is principally from couplers (impulsive) and retarders. To achieve attenuation to 83 dB(A), receptors may have to be a minimum of 468 ft from the retarder location. To achieve reduction to 92 dB(A), 59 ft from coupling points to receptors is required.

4.2.4 Socioeconomic impacts

4.2.4.1 Construction impacts

Introduction

This section discusses the potential socioeconomic impacts of the construction of the demonstration facility. These impacts would be initiated during the 38 months allotted for construction activities but could extend over a longer time. Relevant categories of impacts considered include labor and employment, demographic change, income, prices, housing, public services, public finance, and transportation.

Labor force and employment

Labor availability is a factor in the socioeconomic impact assessment of large-scale construction projects. The size, composition, and distribution of the labor force used to construct and operate the proposed coal conversion facility are key determinants of the direction and degree of socioeconomic impact in local communities.

To assess the availability of local labor for construction of the SRC-II facility, the labor market area surrounding the proposed site is divided into geographical zones that have boundaries defined by one-way commuting times of 60 and 90 min. The 60-min zone defines the maximum distance for daily commuters, whereas the 90-min zone delineates the area around the plant into which permanent movers will relocate. The weekly traveling zone extends from the 90-min commuting zone to a limit of about 6 h driving time. Anything more than 6 h driving time will involve moving permanently to a location near the site.

Existing labor supply is estimated on the basis of an analysis of current government labor statistics and a survey of selected labor unions having jurisdictions encompassing the proposed site. Labor demand associated with other large projects in the above commuting zones is compiled from government, labor, and industry sources. The work force required to construct and operate the SRC-II facility is compared with the labor force estimated to be available within the commuting zones in order to determine labor availability.

Details on the composition of the SRC-II impact area labor force by occupation and industry as well as recent employment conditions were discussed in 3.2.4.2. The emphasis in this section is directed at the supply of labor in the specific skills necessary for SRC-II construction and operation.

Demand for construction labor

The Draft Environmental Impact Statement (DEIS) estimated that construction of the SRC-II plant would require a peak construction work force of about 3200 workers. This estimate was based on the best available information at the time. Since that time, however, a revised work force projection has been made. The current analysis is based on the revised estimate of an approximate 3700 worker peak construction labor force. Combined with about 100 general and administrative (G&A) personnel, this brings the total peak labor force to about 3800 persons.

The skills and quantities of labor demanded for construction and operation of the SRC-II demonstration plant are detailed in Table 4.16 and Appendix V (Tables V.4 and V.5). In general, the skill profile needed for SRC-II is not unlike that used in chemical or refinery construction.

Table 4.16. Estimated demand for construction labor (3800) for SRC-II demonstration plant

	Quarter												
	1	2	3	4	5	6	7	8	9	10	11	12	13
Craft													
Boilermaker					54	90	130	200	242	217	147	64	6
Carpenter		2	13	26	71	94	133	202	256	230	155	68	11
Electrician		6	11	27	61	85	122	183	231	207	144	61	80
Finisher		2	3	5	15	19	30	40	50	45	30	14	2
Insulator						32	46	75	87	73	60	40	11
Ironworker		8	12	26	105	147	209	313	398	356	230	111	5
Laborer	21	30	58	56	107	148	211	316	401	359	232	105	19
Millwright					26	36	51	88	97	87	60	26	15
Painter							80	122	144	129	85	38	10
Operator	42	41	46	77	46	152	78	230	412	367	238	40	23
Pipefitter		5	24	166	562	689	920	1143	1359	1324	810	487	99
Teamster	18	17	28	37	28	22	6	8	5	6	6	9	16
Average craft manpower per quarter	81	111	195	420	1085	1487	2020	2920	3682	3400	2197	1063	297
General and Administrative (G&A)													
Construction Managers	0	3	3	3	3	3	3	3	3	3	3	3	3
Superintendents	0	15	15	15	15	15	15	15	15	15	15	15	15
Field engineers	0	20	20	20	20	20	20	20	20	20	20	20	20
Systems personnel	0	15	15	15	15	15	15	15	15	15	15	15	15
Inspectors	0	15	15	15	15	15	15	15	15	15	15	15	15
Secretaries	0	20	20	20	20	20	20	20	20	20	20	20	20
Purchasing agents	0	15	15	15	15	15	15	15	15	15	15	15	15
Accountants	0	20	20	20	20	20	20	20	20	20	20	20	20
Average G&A manpower per quarter		123	123	123	123	123	123	123	123	123	123	123	123
Total average manpower per quarter	81	234	318	543	1208	1610	2143	3043	3805	3523	2320	1186	420

It should be recognized that the work force figures are only projections and that actual work force requirements for large-scale construction projects often deviate substantially from projections for a variety of reasons. As an example, a recent study⁴⁸ of nuclear power plant construction work forces revealed that all 33 plants selected for analysis experienced larger manpower requirements than had been originally projected; 14 of the plants exceeded projections by between 100 and 300%. Given this history of underprojections for a relatively "known" technology, it is not unreasonable to believe that the projected SRC-II peak force work estimate may be low. The estimated duration of the construction phase of the project is 38 months; however, this period must also be regarded as subject to the uncertainties of large-scale construction efforts, including such factors as weather, delivery of components, design changes, regulatory considerations, strikes, and financing considerations.

For these reasons, a second, higher peak work force estimate of 5000 has been developed in order to provide estimates of a range of likely impacts. The skills and quantities of labor demanded for construction of the SRC-II demonstration plant are detailed in Table 4.17. The 3800 and 5000 figures are both used in the following analysis.

General and administrative personnel

For the 3800 work force case, it is estimated that about 125 general and administrative (G&A) personnel will be required to manage and support the construction effort. For the 5000 work force case, about 170 G&A personnel will be needed.

Virtually this entire staff will be required for the full 38 months of the construction phase of the project following site preparation. Typical staffing practice suggests that most of the personnel in four of the required skills will be transferred by the construction contractor(s) from the home office or other locations. These types include construction managers, field

Table 4.17. Estimated demand for construction labor (5000) for SRC-II demonstration plant

	Quarter												
	1	2	3	4	5	6	7	8	9	10	11	12	13
Craft													
Boilermaker					70	117	169	259	314	282	191	83	8
Carpenter		3	17	34	92	122	173	262	332	298	201	88	14
Electrician		8	14	35	79	110	158	237	300	269	187	79	104
Finisher		3	4	6	19	25	39	52	65	58	39	18	3
Insulator						42	60	97	113	95	78	52	14
Ironworker		10	16	34	136	191	271	406	516	462	298	144	6
Laborer	27	39	75	73	139	192	274	410	520	466	301	136	25
Millwright					34	47	66	114	126	113	78	34	19
Painter							104	158	187	167	110	49	13
Operator	54	53	60	100	60	197	95	298	535	476	309	52	30
Pipefitter		6	31	215	729	790	1194	1483	1763	1718	1051	632	128
Teamster	23	22	36	48	36	29	8	10	6	8	8	12	21
Average craft manpower per quarter	104	144	253	545	1394	1862	2611	3786	4777	4412	2851	1379	385
General and Administrative (G&A)													
Construction manager		4	4	4	4	4	4	4	4	4	4	4	4
Superintendents		21	21	21	21	21	21	21	21	21	21	21	21
Field engineers		28	28	28	28	28	28	28	28	28	28	28	28
Systems personnel		21	21	21	21	21	21	21	21	21	21	21	21
Inspectors		21	21	21	21	21	21	21	21	21	21	21	21
Secretaries		28	28	28	28	28	28	28	28	28	28	28	28
Purchasing agents		21	21	21	21	21	21	21	21	21	21	21	21
Accountants		28	28	28	28	28	28	28	28	28	28	28	28
Average G&A manpower per quarter		172	172	172	172	172	172	172	172	172	172	172	172
Total average manpower per quarter	104	316	425	717	1566	2034	2783	3958	4949	4584	3023	1551	557

engineers, systems personnel, and accountants. These categories constitute about one-half the G&A personnel. The other one-half, consisting of superintendents, inspectors, purchasing agents, and secretaries, will be recruited in the local area.

Construction craftsmen

Total work force demand over the entire 38-month construction period for each of the 12 required crafts is shown, by average quarterly demand, in Tables 4.16 and 4.17. It is estimated that demand for craftsmen will peak at about 3700 construction workers in one case and about 4800 in the other, 24 months after the start of construction. At the peak of construction, the demand for 1350 pipefitters in the 3800 work force case or 1750 in the 5000 work force case is much greater than for any other craft and represents about one-third of total projected demand. It is expected that all required craftsmen will be referred to the construction contractor(s) by local unions and/or councils having jurisdiction over projects sited in Monongalia County.

Estimated availability of craft-specific construction labor

The availability of labor within commuting distance of the SRC-II facility must be established in order to accurately project the level of impacts on local communities. Because of the substantial work force required for the project and the importance of maintaining adequate public services in the local region, DOE commissioned two extensively detailed studies designed to provide basic data on labor availability. Although the two studies use different methodologies and somewhat different data, their principal conclusions are essentially the same.

The best estimates of construction labor availability in the two commuting zones around the SRC-II site are given in Table 3.15, zone definitions are shown in Fig. 3.7. In almost every craft category, the bulk of the skilled craftsmen live outside the 60-min but within the 90-min daily commuting range of SRC-II. This residential pattern is largely due to the influence of the Pittsburgh standard metropolitan statistical area (SMSA).

Craft labor shortages

A comparison of SRC-II peak labor requirements and availability of labor by craft within commuting range of the plant site is made. An analysis by the Oak Ridge Associated Universities reveals that adequate numbers of workers are available in 6 of the 12 crafts for both the 3800 and 5000 cases. These crafts include carpenters, concrete finishers, laborers, operating engineers, painters, and teamsters. These workers could be drawn from the ranks of unemployed workers and/or a variety of area sources. Most of these workers are expected to commute to the project site daily from their existing places of residence.

The supply of pipefitters, ironworkers, boilermakers, insulators, electricians, and millwrights within the 90-min commuting range will not be sufficient to meet project demands. Project requirements for these crafts will need to increase by about 30 to 200% for the 3800 case and 35 to 250% for the 5000 case over the respective numbers of workers currently employed in the daily commuting zone (Tables 4.18 and V.6). These indicators suggest that a substantial number of these crafts will have to be supplied by individuals who move to within a relatively short commuting distance of the SRC-II site.

**Table 4.18. Construction crafts requiring large increases
in manpower to satisfy estimated 90-min zone
and SRC-II peak demand in 1983**

Craft	3800 case		5000 case	
	Number increase	Percentage increase 1979-1983	Number increase	Percentage increase 1979-1983
Insulators	387	88	413	95
Boilermakers	409	197	481	232
Electricians	933	29	1002	31
Ironworkers	408	40	526	51
Millwrights	104	50	133	64
Pipefitters	1287	45	1691	59

If, however, an adequate supply of such craftsmen cannot be attracted to the SRC-II site, the construction schedule may be delayed and extended to accommodate the craft shortage. This supply problem could be especially problematic in the case of boilermakers, whose demand is likely to be 3 to 3.5 times the current number employed in the area.

A survey of craft unions representing the six skills where regional shortages may occur provides evidence in support of these general conclusions drawn from government labor statistics. Although union officials are not able to predict with certainty how many of their union members might be available for work at the project site, membership and employment data obtained from unions representing both geographical zones suggest that, in principle, all the required craftsmen could be referred from their memberships. For a variety of reasons, however, this is not likely to occur, and some craftsmen will be drawn from the memberships of local unions outside the 90-min driving zone and will either relocate permanently or on a weekly basis in the vicinity of the plant.

Competing demands for construction labor

The five-state region surrounding the SRC-II site (West Virginia, Virginia, Ohio, Maryland, and Pennsylvania) was examined to determine existing or potential sources of competing labor demands that may influence the ability of the SRC-II contractors to obtain skilled craftsmen not available from within the specified commuting zones.

Extensive examination of current secondary data sources and interviews with local officials did not reveal any other major construction projects that are or would be likely to represent any significant competing demand for skilled construction labor in the five-state region. This examination considered refinery construction and/or major maintenance, the often proposed Lake-Front Steel Mill in Ohio, the retrofitting of various power plants for air pollution control, governmentally mandated conversion of oil- and gas-fired power plants to coal burning, the DOE Gas Centrifuge Plant, general power plant construction, and the Fairmont Energy Corporation coke plant near Morgantown.

Another procedure undertaken to ascertain labor demand in the five-state region was specifically in regard to power plant construction and involved projections made by the Construction Labor Demand System (CLDS) developed by the U.S. Departments of Energy and Labor.

These projections are by craft and indicate that from 1979 to 1983 large numbers of skilled construction workers will become available for employment as the anticipated level of power plant construction declines in the five-state region. Barring a substantial, unanticipated increase in power plant construction, it appears that no critical skill shortages are likely, with the possible exception of boilermakers. Any decline in activity from that utilized for CLDS projections would only reinforce this finding. The most likely situation currently is that even a significant increase in labor requirements over current projections should not create insurmountable labor shortages in the five-state region.

Summary

Project labor force requirements for both the 3800 and 5000 cases are shown in Tables 4.16 and 4.17. Construction of the demonstration facility is estimated to last for 38 months. Direct construction and management manpower requirements are projected to peak between 3800 and 5000 employees in the twenty-fourth month of construction. Occupational requirements identified in Sect. 3.2.4.2 and availability of labor estimated above suggest that several skills will experience shortages of labor within the 90-min commuting zone surrounding SRC-II. These labor shortages, as well as traditional experience with recruiting large construction labor forces, indicate that worker in-migration can be anticipated. Competing labor demand in a five-state area is not so great as to adversely affect the requirements of the proposed facility.

Labor force in-migration

Experience gained at a variety of recent large TVA construction projects in the eastern United States has led to the development of systematic estimation procedures to determine, on a county by county basis, a likely magnitude and pattern of project labor force distribution.⁴⁹ The application of this technique can provide estimates of the spatial distribution of the SRC-II labor force.

Table 4.19 shows the results of this analysis for SRC-II *peak* construction employment in the 3800-worker case. The results predict that about 2350 of the workers can be recruited from within commuting distance of the proposed facility; about 730 will be weekly travelers from outside the daily 90-min commuting zone; and about 600 will move (more or less permanently) into the 60-min commuting zone. In addition, based on earlier analysis, it can be assumed that about 30% of the 125 G&A personnel will be commuters, 20% will be travelers, and 50% will be movers. Thus, of the total work force, about 37%, or 1400 workers, will in-migrate to the commuting zone.

Table 4.20 summarizes the spatial characteristics of the 3800 total labor force and of the labor force from the five counties expected to receive the largest numbers of in-migrating workers. Overall, the local commuting zone is predicted to supply 63% of the labor — 20% will be weekly residents, returning home on weekends (travelers), and 17% will move into the local commuting zone. Together, the five counties are expected to account for about 3000 (79%) of the employees and will accommodate about 1250 of the in-migrating workers. Monongalia County will experience, by far, the bulk of the in-migration impact, accounting for about 950, and 68%, of the incoming SRC-II workers.

Table 4.21 shows the results of the same analysis for a peak employment of 5000 workers. The results estimate that about 3150 workers can be recruited from within commuting distance of the proposed facility; about 980 will be weekly travelers from outside the daily commuting zone; and about 850 will move into the commuting zone.

Table 4.22 summarizes the spatial characteristics of the 5000 worker labor force for the five counties expected to receive the largest numbers of in-migrating workers. The proportions of commuters, travelers, and movers is expected to be about the same as in the 3800 worker case. The five counties will account for about 3900 (77%) of the employees and will accommodate about 1530 of the in-migrating workers. Monongalia County will still experience the greatest number of in-migrants, absorbing 1150 (63%) of the incoming SRC-II workers. Compared with the 3800 case, this means that while the total number of in-migrants to Monongalia County will be greater, the percentage of in-migrants locating in the county will be slightly lower when compared with the other four counties.

Table 4.19. Estimated distribution of commuters, travelers, and movers by county, peak construction-phase employment (3800) in 1983

County	Commuters ^a		Travelers ^b		Movers ^c		Total	
	No.	%	No.	%	No.	%	No.	%
Monongalia, W.Va.	874	37.2	491	67.1	394	65.8	1759	47.8
Marion, W.Va.	174	7.4	32	4.4	27	4.5	233	6.3
Preston, W.Va.	61	2.6	16	2.2	14	2.3	91	2.5
Harrison, W.Va.	73	3.1	16	2.2	13	2.1	102	2.8
Taylor, W.Va.	42	1.8	16	2.2	14	2.3	72	2.0
Garret, Md.	45	1.9	0	0	1	0	46	1.3
Green, Pa.	68	2.9	16	2.2	14	2.3	98	2.7
Washington, Pa.	94	4.0	16	2.2	13	2.1	123	3.4
Fayette, Pa.	364	15.5	62	8.4	50	8.3	476	12.9
Brooke, W.Va.	15	0.6	0		1	0	15	0.4
Ohio, W.Va.	22	0.9	3	0.3	1	0	26	0.7
Marshall, W.Va.	35	1.5	0		1	0	36	1.0
Wetzel, W.Va.	15	0.6	0		1	0	16	0.4
Doddridge, W.Va.	8	0.3	0		1	0	9	0.3
Lewis, W.Va.	15	0.6	0		1	0	16	0.4
Barbour, W.Va.	22	0.9	3	0.3	1	0	26	0.7
Allegany, Md.	22	0.9	0		1	0	22	0.6
Westmoreland, Pa.	130	5.5	16	2.2	13	2.1	159	4.3
Allegheny, Pa.	219	9.3	45	6.2	36	6.0	300	8.1
Somerset, Pa.	50	2.1	0		1	0	51	1.4
Total	2350	100.0	732	100.0	598	100.0	3682	100.0

^a Local commuters were residents of county prior to SRC-II employment and drive daily to work and back home.

^b Movers were not county residents prior to SRC-II employment but moved permanent residence there subsequent to employment.

^c Travelers live in county during the week, maintain a permanent address outside the 90-min (70-mile) zone, who commute home on weekends or less often.

Table 4.20. Estimated distribution of SRC-II workers (3800 peak employment) in the five-county impact region

County	Commuters	Travelers	Movers	Total
Total	2387 (63%)	757 (20%)	663 (17%)	3807 (100%)
Monongalia	888	507	437	1832
Fayette	370	64	55	489
Allegheny	222	47	40	309
Marion	177	33	30	240
Westmoreland	131	17	14	162
Five-county total	1788	668	576	3032
Remaining area	599	89	87	775

Table 4.21. Estimated distribution of commuters, travelers, and movers by county, peak construction-phase employment (5000) in 1983

County	Commuters ^a		Travelers ^b		Movers ^c		Total	
	No.	%	No.	%	No.	%	No.	%
Monongalia, W. Va.	1156	36.5	610	62.3	536	62.7	2175	43.5
Marion, W. Va.	230	7.3	43	4.4	38	4.4	302	6.0
Preston, W. Va.	80	2.5	29	3.0	25	2.9	128	2.6
Harrison, W. Va.	96	3.0	14	1.4	13	1.5	120	2.4
Taylor, W. Va.	55	1.7	15	1.5	13	1.5	80	1.6
Garret, Md.	60	1.9	14	1.4	12	1.4	83	1.7
Greene, Pa.	91	2.9	15	1.5	13	1.5	116	2.3
Washington, Pa.	126	4.0	14	1.4	13	1.5	150	3.0
Fayette, Pa.	481	15.2	82	8.4	71	8.3	617	12.3
Brooke, W. Va.	37	1.2	2	0.2	1	0.2	40	0.8
Ohio, W. Va.	29	0.9	14	1.4	12	1.4	52	1.0
Marshall, W. Va.	45	1.4	14	1.4	12	1.4	68	1.4
Wetzel, W. Va.	20	0.6	1	0.1	0	0	21	0.4
Doddridge, W. Va.	12	0.4	1	0.1	0	0	13	0.3
Lewis, W. Va.	20	0.6	1	0.1	0	0	21	0.4
Barbour, W. Va.	29	0.9	14	1.4	13	1.5	53	1.1
Allegany, Md.	79	2.5	1	0.1	0	0	80	1.6
Westmoreland, Pa.	169	5.3	28	2.9	24	2.8	215	4.3
Allegheny, Pa.	287	9.1	53	5.4	47	5.5	376	7.5
Somerset, Pa.	64	2.0	14	1.4	12	1.4	87	1.7
Total	3166	100.0	979	100.0	855	100.0	5000	100.0

^aLocal commuters were residents of county prior to SRC-II employment and drive daily to work and back home.

^bTravelers live in county during the week, maintain a permanent address outside the county, and commute home on weekends or less often.

^cMovers were not county residents prior to SRC-II employment but moved permanent residence there subsequent to employment.

Table 4.22. Estimated distribution of SRC-II workers (5000 peak employment) in the five-county impact region

County	Commuters	Travelers	Movers	Total
Total	3166 (63%)	979 (20%)	855 (17%)	5000
Monongalia	1156	610	536	2302
Fayette	481	82	71	634
Allegheny	287	53	47	387
Marion	230	43	38	311
Westmoreland	169	28	24	221
Five-county total	2323	816	716	3855
Remaining area	843	163	139	1145

Indirect employment

At peak construction employment, about 1600 additional indirect jobs are expected to result from the direct employment of the estimated 3800 persons at the SRC-II project site. The distribution of these indirect jobs among the counties is shown in Table 4.23. Table 4.24 gives estimates the indirect jobs created by an estimated 5000 peak work force.

Table 4.23. Estimated SRC-II indirect employment at peak construction employment phase (3800) in 1983

County	Area	Secondary employment
1	Monongalia County, W.Va.	568
2	Marion County, W.Va.	81
3	Preston County, W.Va.	46
4	Harrison County, W.Va.	40.6
5	Taylor County, W.Va.	40.6
6	Garret County, Md.	17
7	Greene County, Pa.	34.8
8	Fayette County, Pa.	208.7
	Sum of counties 1-8	1206
	Sum of counties 1-8 plus	
	Brooke County, W.Va.	
	Ohio County, W.Va.	
	Marshall County, W.Va.	
	Wetzel County, W.Va.	
	Doddridge, County, W.Va.	
	Lewis County, W.Va.	
	Barbour County, W.Va.	
	Allegheny County, Md., and	
	Somerset County, Pa.	1322
	Sum of Allegheny County, Pa.	
	Westmoreland County, Pa.	
	and Washington County, Pa.	267
Total		1589.0

Table 4.24. Estimated indirect employment (5000 peak) of SRC-II demonstration phase construction, 1983

County	Area	Secondary employment
1	Monongalia, W.Va.	1037
2	Marion, W.Va.	158
3	Preston, W.Va.	70
4	Harrison, W.Va.	70
5	Taylor, W.Va.	67
6	Garret, Md.	45
7	Greene, Pa.	65
8	Fayette, Pa.	391
	Sum of counties 1-8	1903
	Sum of counties 1-8 plus	2184
	Brooke, W.Va., Ohio, W.Va., Marshall, W.Va.,	
	Wetzel, W.Va., Doddridge, W.Va., Lewis, W.Va.,	
	Barbour, W.Va., Allegheny, Md., and Somerset, Pa.	
	Sum of Westmoreland, Pa., Alleghney, Pa.,	490
	and Washington, Pa.	
Total		2674

Indirect job estimates are derived from RIMS multipliers (adjusted and localized), which were presented in the baseline environmental section (Table 3.17). Indirect employment at peak construction may be somewhat larger if there is a significant amount of local purchase of construction materials and plant equipment.

Demographic change

The availability of a labor force willing and able to commute daily to the project work site is expected to be relatively large in both the 3800 and 5000 cases. The relatively brief duration of the construction phase of the project can be expected to stimulate daily commuting and weekly traveling (part-time movers) and lead to a minimum of permanent movers. This is especially true among construction craftsmen, most of whom are on the payroll for only part of the construction period. On the other hand, if the availability of fuel for commuting and traveling becomes increasingly problematic, more workers may find it desirable to relocate permanently to the local area rather than continue to commute home on weekends. Implementing and promoting commuter buses from major population centers and/or car or van pooling could maintain or increase the proportion of commuters, even under these conditions.

When the factors of labor availability, site accessibility, and job work-phase characteristics are considered jointly for the construction phase of the project, migration patterns of SRC-II workers can be estimated. The results of this examination are presented in Tables 4.19 and 4.20 for the 3800 case and Tables 4.21 and 4.22 for the 5000 case.

To determine change in population, it is possible to utilize an employment to population ratio to adjust for those laborers who in-migrate with their families. A series of recent studies of TVA's nuclear power plant construction program indicate that about 65% of movers bring families and that the average construction worker family size is 3.2. Because of TVA's geographic proximity and recent experience, these factors were used to estimate SRC-II area population growth for 1983, the currently expected peak construction year. On this basis, estimated population in-migration to all local communities is about 2400 new residents in the 3800 case and 3100 in the 5000 case. Monongalia County, which is the primary impact county, is projected to receive 1575 in-migrants in the 3800 case and 1925 in the 5000 case. This increase amounts to only 2.0% in the 3800 case and 2.5% in the 5000 case of the county's expected population in 1985. The distribution among affected counties of total SRC-II-induced population growth would be expected to follow the same distribution of construction labor in-migrants as shown in Tables 4.20 (3800) and 4.22 (5000).

Income

Estimates of construction-phase payroll expenditures are given in Appendix V Tables V.6 and V.7, for construction noncraft and crafts, respectively. During the peak construction year, total payrolls are estimated to generate income of over \$100 million for the 3800 worker case and \$130 million for the 5000 case. Based on the number of SRC-II employees per county, allowing for outside leakage from income, and applying the multipliers from Table 3.18, county estimates of the income generated at peak construction employment are made. These estimates are shown in Tables 4.25 and 4.26.

Prices

The 2.0 to 2.5% temporary increase in population in Monongalia County and 2400 to 3100 persons for all counties is not expected to cause prices of most goods and services to rise beyond normal inflation. The prices for goods such as food, clothing, and automobiles are established in wider regional markets that should absorb the new demand by construction workers without affecting prices. Utility rates are rising and will continue to rise, but this increase will not be due to the SRC-II project. It is not anticipated that either the elderly or moderate- to low-income groups will, in general, experience adverse economic impacts due to the location of SRC-II in Morgantown. Increased competition for moderate- to lower-priced dwellings and rental units may, however, have an inflationary effect on that segment of the housing market, since housing prices are influenced by local conditions. This could adversely impact moderate- to low-income and elderly people.

Housing

The previously reported analysis estimated that, for the 3800 case, about 1250 workers will migrate into the five-county project area during the construction phase of the SRC-II plant.

Table 4.25. Income (1980 dollars) from SRC-II direct employment (3800 peak) by county, peak construction employment, 1983

County	Total consumption demand (10 ³ \$)	PCE ^a multiplier	Income (10 ³ \$)
Monongalia, W.Va.	21,455	2.0369	43,702
Marion, W.Va.	3,153	1.8470	5,824
Preston, W.Va.	1,190	1.8359	2,185
Harrison, W.Va.	1,346	2.1473	2,890
Taylor, W.Va.	912	2.0676	1,886
Garret, Md.	662	1.7501	1,159
Greene, Pa.	1,294	2.5339	3,279
Washington, Pa.	1,620	2.7557	4,464
Fayette, Pa.	6,443	2.1337	13,747
Brooke, W.Va.	210		
Ohio, W.Va.	313		
Marshall, W.Va.	523		
Wetzel, W.Va.	210	2.3531	5,170
Doddridge, W.Va.	105		
Lewis, W.Va.	210		
Barbour, W.Va.	313		
Allegany, Md.	313		
Westmoreland, W.Va.	2,179	2.7557	6,005
Allegheny, Pa.	3,991	2.7557	10,998
Somerset, Pa.	731	2.3531	1,720
Total	47,012	2.1694 ^b	101,987

^aPCE = personal consumption expenditure.

^bImplicit.

This includes about 575 full-time residents and 670 traveling workers who will return to homes outside the five-county area on weekends. Monongalia County will receive the largest number of the in-migrants, a predicted 450 permanent residents and 500 travelers (Table 4.20).

Based on TVA's experience with nuclear power plant construction, 50% of all in-migrating workers would select single-family houses; 24% would select mobile homes; and 26% would select apartments, campers, or sleeping rooms. If these percentages held true for the 3800 worker case, it would be expected that 475 workers would select single-family houses in Monongalia County; 220 would select mobile homes; and 250 would rent apartments. Of those seeking single-family houses, 67% (315 workers) would buy and 33% (160 workers) would rent. In the 5000 case, 575 workers would select houses; 275, mobile homes; and 300, apartments. Of those seeking houses, 385 would buy and 190 would rent.

For several reasons, the proportion of in-migrants seeking houses appears to be too high for the SRC-II project. First, TVA's experience is with nuclear power plants, which take about ten years to construct, as compared with the estimated three years for SRC-II. The shorter construction period will entail a much more transient work force, which is less likely to buy housing. Second, high interest rates and lack of available mortgage monies will further discourage buying housing and will encourage workers to consider buying cheaper mobile homes or renting apartments. Third, since 1975, mobile home sitings have almost equaled construction of single-family houses. Given the financing situation mentioned above, it is not unreasonable to assume that mobile home sitings will continue to parallel, if not surpass, new housing starts. This, too, will encourage more construction workers to select this type of housing.

Based on these assumptions, the housing demand resulting from project employment for the five-county area and Monongalia County are shown in Table 4.27 for the 3800 case. These figures represent an estimated 25% of the in-migrants seeking single-family housing for either purchase or rent; 35% seeking mobile home space; and 40% seeking apartments, sleeping rooms, or the like. This distribution would not be expected to change under the higher work force scenario. TVA's experience suggests there will be little sharing of housing among workers.

Table 4.26. Secondary income (1980 dollars) from SRC-II direct employment (5000 peak) by county, peak construction employment, 1983

County	Total final consumption demand (10 ³ \$)	PCE ^a multiplier	Secondary income (10 ³ \$)
Monongalia, W.Va.	25,675	2.0369	52,297
Marion, W.Va.	3,944	1.8470	7,284
Preston, W.Va.	1,591	1.8359	2,920
Harrison, W.Va.	1,592	2.1473	3,419
Taylor, W.Va.	1,031	2.0676	2,133
Garret, Md.	1,045	1.7501	1,830
Greene, Pa.	1,517	2.5339	3,844
Washington, Pa.	2,006	2.7557	5,528
Fayette, Pa.	8,131	2.1337	17,350
Brooke, W.Va.	533	2.3531	1,253
Ohio, W.Va.	627	2.3531	1,475
Marshall, W.Va.	838	2.3531	1,970
Wetzel, W.Va.	267	2.3531	628
Doddridge, W.Va.	197	2.3531	462
Lewis, W.Va.	267	2.3531	628
Barbour, W.Va.	630	2.3531	1,481
Allegany, Md.	1,161	2.3531	2,731
Westmoreland, Pa.	2,842	2.7557	7,833
Alleghney, Pa.	4,888	2.7557	13,467
Somerset, Pa.	1,113	2.3531	2,617
Total	59,900	2.1694 ^b	131,150

^aPCE = personal consumption expenditure.

^bImplicit.

Table 4.27. Predicted housing demand resulting from in-migrating SRC-II construction workers (3800) to the primary impact area and Monongalia County

Type housing sought	Five-county impact area	Monongalia County
Houses	315	240
Mobile homes	435	330
Apartments, sleeping rooms, campers, etc.	<u>500</u>	<u>380</u>
Total	1250	950

It was estimated that about 3% (514 units) of the single-family houses in Monongalia County were offered for sale in 1980 (Sect. 3.2.4.4). About 20 to 25% were priced below \$40,000. In addition, an unspecified number will be available for rent. Based on these estimates it can be concluded that, after excluding normal demand, a sufficient number of single-family dwellings exist to meet SRC-II-generated demands in the 3800 case. However, taking into account the limited amount of low to moderately priced stock and likely demands by current residents seeking to break into that market, an excess demand for the low-cost units in Monongalia County may occur. Further, it is not expected that SRC-II-related demand for single-family housing will be a problem in the other counties.

In the 3800 worker scenario, it is estimated that there will be sufficient apartments, rooms, and hotel and motel accommodations to meet total projected demands (Sect. 3.2.4.4, Table 3.20). These rental properties, however, are not all of equal quality, and some may not be habitable. One potential problem could arise from competition for the available low-price rental units among workers, college students, and those on fixed incomes, particularly in August and September when demand by students is the greatest. This may drive up rents, especially in lower-priced stock, the portion of housing stock traditionally in greatest demand by students and those on fixed incomes. The project, given its associated short-term demands on housing, is not likely to stimulate the construction of new rental units to alleviate potential shortages.

Because of their income, construction workers will have a competitive edge over students and those on fixed incomes in seeking rental housing. Given this competitive disadvantage, students and those on fixed incomes will be forced to either pay higher rent or accept lower quality housing.

The most serious shortage of housing in the 3800 case will likely be in the mobile home category. This problem is addressed in the Region VI housing analysis study done by the Planning and Development Council. Representatives of the local mobile home industry estimate that there are currently 100 to 150 mobile home rental spaces available in Monongalia County and another 200 lots that are potentially suitable for mobile homes. Consequently, it is considered likely that the local mobile home industry can meet a portion of the anticipated mobile home demand. Unless it is demonstrated that a permanent demand for mobile homes will continue past 1983, it is unlikely that new mobile home parks will be developed. If sufficient mobile home spaces are not available in the Monongalia County area, workers will be forced to seek alternative housing types, exacerbating the problems with other lower-priced or rental units.

Overall, in-migrating construction workers will exert pressure in the housing market in the impact area; shortages in certain housing types will be experienced; and prices may be inflated beyond their normal rates of increase. Section 4.6.2 addresses mitigating measures that will be taken in the area of housing.

The expected housing demand associated with in-migration, assuming a work force of 5000, are summarized in Table 4.28. A total of 1150 new units will be needed in Monongalia County at peak demand, and 1530 will be needed in the five-county impact area. The marginal increases in demands over the 3800 case are likely to exacerbate the impacts noted for the smaller work force. It is unlikely that the single-family-home market will be more seriously affected. The situation, however, will worsen in the lower-priced rental and mobile home markets. With even greater demands, prices will be inflated, and low-income families and students could be negatively affected by the greater bidding power of the construction work force. The situation warrants mitigating actions to protect the current occupants of rental units and mobile homes. Temporary housing for workers could help alleviate the potential problems.

Table 4.28. Predicted housing demand resulting from in-migrating SRC-II construction workers (5000) to the primary impact area and Monongalia County

Type housing sought	Five-county impact area	Monongalia County
Houses	385	290
Mobile homes	535	400
Apartments, sleeping rooms, campers, etc.	610	460
Total	1530	1150

Public services

One of the primary focal points in analyzing impacts of the proposed facility is public services. The analysis that follows examines on a more specific basis the possible impacts on various services offered by Morgantown and by Monongalia County. The analysis concludes that local communities will not experience the magnitude of impacts associated with a classic "boom-town" situation. In the United States, boom-towns are typically experienced in the Rocky Mountain and Upper Great Plains states, where small communities (several hundred to several thousand people) having very little private and public infrastructure are overwhelmed by the in-migration of several thousand workers and dependents.⁵⁰⁻⁵² This situation does not exist in the Morgantown area, where the current population is substantial and the infrastructure highly developed in comparison with boom-town communities. In addition to being a much larger community, the availability of much greater numbers of workers within daily commuting distance of the proposed facility reduces greatly the level of project in-migration to the Morgantown area in both relative and absolute terms in comparison with boom-town situations. These factors tend to reduce the potential for increased crime and alcoholism rates often unfairly and incorrectly associated with construction workers. Thus, the possible occurrence of severe, unmanageable public service impacts in Morgantown and in Monongalia County, as a result of construction or operation of the proposed facility, cannot be projected.

The public service impacts likely to occur in all communities experiencing in-migration of SRC-II workers are of a more subtle, incremental nature. Such impacts originate in local, State, and Federal taxation policies, and they anticipate the inability of the resulting revenues to compensate for costs of local services extended to in-migrants. Whereas various sources of revenue do exist, the inability of all local jurisdictions, for either geographical or legal reasons, to levy a property tax on the proposed facility eliminates an essential revenue source that normally assists local governments in paying the costs of public services to the family unit. (For an extensive cost/benefit analysis of this issue in respect to another proposed Federal facility, see ref. 53.) In effect, the subsidization of services to single family units normally provided through property taxes on shortfall in revenue, although it is expected to be a relatively small proportion of each community's aggregate local budget, will have to be made up either through revenue from other local or state sources or through a modest reduction in services, such as higher student to teacher ratios or lower police to per thousand population ratios.

Schools

Construction-phase impacts on local school systems will result from in-migrating movers with families. This impact will be centered in Monongalia County, where about 65% of the permanent movers are expected to bring families (Table 4.29). Assuming an average construction worker family size of 3.2 persons, Monongalia will receive about 340 in-migrating children in the 3800 case scenario. Based on 13 TVA power plant construction surveys, 50% of these children (170) will be of primary school age, and 14% (about 50 children) will be of high school age. Baseline projections (Sect. 3.2.4.5) indicate that Monongalia County schools possess an excess capacity for about 1900 students in the elementary schools, about 400 students in the junior high schools, and about 30 students in the high schools. It is unclear, however, if the addition of the predicted 50 high school students would significantly add to the problems of overcrowding currently existing at some of the high schools.

Table 4.29. Predicted family composition of in-migrating SRC-II construction workers to the primary impact area and Monongalia County

	3800 case		5000 case	
	Five-county impact area	Monongalia County	Five-county impact area	Monongalia County
Movers with families	370	285	465	350
Number of children	450	340	560	420
Primary school children	225	170	280	210
High school children	65	50	80	60

A positive outcome of the in-migrating students will be the county's increased revenues from the State of West Virginia for about 220 additional school children in the past year. County Board of Education per pupil expenditure for the 1980-1981 school year is \$1786, of which the state supports 65%. The additional students resulting from in-migration to the county would, therefore, in the peak year, generate an additional \$250,000 to be used by the Board of Education. Because of the excess student capacity below the high school level, much of the state support could be used to upgrade the high schools to accommodate the expected 50 additional in-migrating students.

Additionally, monies may be available through PL 81-874, which mandates payments to reimburse local schools for the cost of educating children whose parents live and/or work at Federal installations. Federal aid to schools is discussed in Appendix V, Sect. V.5.

In the 5000 worker case, Monongalia County is predicted to receive 420 in-migrating children. (Table 4.29). About 210 will be of primary school age and 60 of high school age. Monongalia County primary schools will not be significantly affected by this difference, but greater stress will be placed on the high schools.

In the 5000 worker case, an additional \$60,000 of State student support would be generated in the peak year. Again, these funds could be used to alleviate problems due to overcrowding in the high schools.

Public finance

Because DOE will own the SRC-II facility through the construction and demonstration phases, no county property taxes will be generated. This will result in a minor net decrease in county property tax revenues through the removal of this land from the tax rolls. DOE may, however, elect to make in-lieu-of-tax payments. An increase in county property tax revenue may result from construction workers purchasing newly constructed houses or from increased property values caused by increased demand from SRC-II workers.

Because of state tax exemptions, business and occupation (B&O) and sales taxes will not be collected directly from the plant during the construction and demonstration phases. B&O taxes are anticipated to be collected indirectly from subcontractors during plant construction. This is estimated to amount to \$11 million that would accrue to the State of West Virginia. The City of Morgantown will also collect B&O taxes from SRC-II subcontractors located within its boundaries. State sales tax will be collected for purchases made by SRC-II workers. Also, SRC-II workers and indirect job holders will pay in excess of \$11 million in State income taxes over the course of construction, ranging from \$45,000 the first year to \$3.5 million at the peak.

Police and fire

Based on the estimates of population increase stemming from the construction of SRC-II, the growth in demands for police and fire protection should be relatively small, particularly outside Monongalia County. Currently, the City of Morgantown has a police force of 48, with authorization for 2 more officers. The Monongalia Sheriff's Department consists of 17 deputies in addition to the sheriff (Sect. 3.2.4.5). The ratio of law enforcement personnel to population for Morgantown is 1.74 per 1000 people and 1.3 for the county. For the 3800 worker case, assuming that these ratios are a desirable level of protection and assuming an expected population increase of 1575 in the county, it would require the addition of 2 policemen and/or deputies. Increased traffic in the vicinity of the project site from construction activities, however, may require additional personnel. Overall, although some increase in staff may be necessary, the quality of police services would not be seriously threatened.

A similar situation is found regarding fire protection. Morgantown has 47 fire fighters with adequate equipment. Monongalia County relies on 13 volunteer groups. Again, a small increase in personnel may be warranted. Emergency ambulance services for the area are currently felt to be highly adequate, and new in-migrants will not strain that service.

For the 5000 worker case, the preservation of the police to population ratio would require 3 additional law-enforcement officers. Greater levels of assistance in traffic control would probably be needed. Similar increases in fire personnel may be warranted.

Health care

Monongalia County has a bed space to population ratio of about 10 beds for every 1000 persons and an occupancy rate of about 85%. The doctor to population ratio is about 5 doctors for every 1000 persons. These levels are considered by local health officials to be adequate. The additional in-migrants should not strain the system, in either the 3800 or 5000 worker case.

Water

Currently, 70,000 people are serviced by the water supply. Average use is 6.5 million gpd; peak loads reach 8 million gpd. The existing water system demand is about 50% of capacity. The current average per capita use rate is 115 gpd during peak demand; average demand is 93 gpd. For the 3800 worker case, in-migration to Monongalia County as a result of SRC-II is projected to peak in 1983 with 1575 individuals. This represents a potential increase in demand of 181,125 gpd during the peak water demand period and 146,475 gpd on the average.

With an increase in demand of less than 2% and plant excess capacity at 50%, in-migrants due to SRC-II would present no supply problems. Increased demand would be welcomed because it would reduce unit costs. Further, because new service is paid for by the owner or developer, additional lines or taps required for new construction will be no expense for the Water Commission.

For the 5000 worker case, in-migration to Monongalia County is expected to peak at 1925 people. This amounts to an increased demand of about 220,000 gpd during peaks and 180,000 gpd on the average. This again presents no supply problem.

Sewage

Sewage treatment capacity for Monongalia County is 6 million gpd. Currently, 3.5 million gpd is processed. Repairs to an interceptor sewer are scheduled for completion by September 1981. This interceptor sewer has a 1.5 million gpd capacity and will increase sewage treatment to 5 million gpd. Upon repair of the interceptor sewer, 30,000 people will be serviced by the sewer system. This indicates an average per capita use of 167 gpd.

For the 3800 worker case, in-migration to Monongalia County as a result of SRC-II is expected to peak in 1983 with 1575 individuals. This would result in a maximum potential increase of 263,025 gpd, which would be well within existing capacity. Currently, no sewage service is offered in the vicinity of the project site. Some workers are expected to reside in trailers in this area, and they will require package treatment facilities for sewage treatment. If utilized, this will lessen the future demand placed on the Morgantown system.

Inasmuch as a new service is paid for by the individual, the use of excess capacity will have a deflationary effect on rates by reducing per unit costs. Currently, the Morgantown Sanitary Board is eager to commit any excess capacity. SRC-II-related demands would present no significant burden, because they should represent only slightly more than 25% of the available excess capacity at any time. This assumes, however, that in-migrants move to an area with adequate access to existing capacity and that the available excess capacity is not fully committed to current area residents who are not currently served. The degree of strain on the existing system will depend on the extent to which these conditions are realized.

Maximum estimated demand for sewage service in the 5000 worker case amounts to 321,500 gpd. With a current 1 million gpd excess capacity, adequate sewage capacity exists to handle SRC-II-induced needs, subject to the assumption noted above.

Transportation

Major regional routes leading to the site vicinity, such as Interstate 79, would be adequate for commuters. However, the local road network (see Fig. 3.1) in the immediate site vicinity consists of rural state and county roads that are structurally inadequate to accommodate materials movement to the site. Furthermore, these roads are inadequate in capacity to accommodate the work force commuting traffic. Substantial upgrading of roads and bridges will be necessary. Failure to do so before construction would create many problems, including congestion, safety hazards, increased air pollution, and greater levels of road maintenance.

The West Virginia Department of Highways fully recognizes that the structural and operational capacity of existing local road networks is inadequate to accommodate the traffic in workers and materials required for construction of the proposed SRC-II project in either scenario and has developed a series of studies to fulfill a commitment to provide adequate access to the industrial site (personal communication, Charles L. Miller, West Virginia Traffic Commissioner, July 2, 1980).

The first of the studies has been directed toward design and contract plans for temporary improvements to existing roadways between I-79 Westover Interchange and the site. Included in these studies are sections of Co. 49 from U.S. 19 to I-79 Westover Interchange, W.V. 100 from Granville to the junction of Alt. W.V. 7 at Scotts Run, W.V. 7 at Scotts Run to Jct. Co. 53 at Wade School,

and Co. 53 from Wade School to Fort Martin. The improvements will be made over 8.1 miles of highway. Repaving and widening, drainage modifications, roadway acquisition, utility relocation, strengthening of concrete T-beams for bridges, replacing bridges, structure borings, erosion control, and maintenance of traffic are under consideration for each of these sections. Final plans are expected for completion of the temporary work in January 1981; construction is planned for spring 1981. This temporary access will accommodate the beginning stages of SRC-II construction but will not accommodate peak-phase needs.

Four alternatives for permanent access to the site are also under study. The study will be completed by March 1981. The alternatives include a road connection between I-79 Mount Morris (Pa.) Interchange and W.V. 100 and I-79 interchange at U.S. 19 in the vicinity of Pleasant Valley Church, with upgrading of W.V. 100; a road connection from I-79 Osage Interchange to W.V. 100; and relocation of Co. 53. Various combinations of these alternatives would provide one or two additional access routes to the site. These routes, plus the temporary one, would provide both a north and south route to the site and would reduce the congestion and use of either one to a reasonable flow.

Construction of permanent roads is planned to be completed to accommodate the SRC-II 1983 and 1984 peak construction period.

Historic, archaeological, and paleontological impacts

Section 3.2.4.7 describes the historic and cultural features of the site surrounding the proposed SRC-II plant. This section discusses the impacts of SRC-II on these features.

On November 11, 1980, the Keeper of the National Register within the Heritage Conservation and Recreation Service of the Department of the Interior issued a "Determination of Eligibility Notification" (E.O. 11593) advising that the Belldina's Bottom, Van Voorhis Farm, and Fort Martin archaeological sites are eligible for inclusion in the National Register of Historic Places. In a letter of September 10, 1980, West Virginia's State Historic Preservation Officer (SHPO) indicated to the Keeper of the National Register that, in his opinion, Belldina's Bottom, Van Voorhis Farm, and Gingrich House were eligible. On January 13, 1981, the Keeper of the National Register issued a "Determination of Eligibility Notification" advising that the Gingrich House and the Fort Martin School/Community Center are eligible for inclusion in the National Register of Historic Places. This correspondence is reproduced in Appendix U, p. U-61.

Subsequently, consultation between the Department of Energy, the West Virginia SHPO, SRC International, Inc., and the Advisory Council on Historic Preservation took place. It was determined that the construction and operation of the SRC-II plant would have an adverse effect on Belldina's Bottom, Van Voorhis Farm, Gingrich House, Fort Martin School, and Fort Martin archaeological sites.

A Draft Memorandum of Agreement (DMOA) has been prepared by the Advisory Council on Historic Preservation (see Appendix U). The DMOA stipulates that DOE will ensure that the measures described below are carried out.

Archaeology

Before initiating any construction activities that could affect the archaeological sites, a data recovery program for the Belldina's Bottom (46 Mg 75), Van Voorhis Farm (46 Mg 77), and Fort Martin (46 Mg 72) archaeological sites will be developed and carried out in accordance with the council's "Recommendations for Archaeological Data Recovery Programs" (Archaeological Recommendations; Attachment 1).

Data recovery plans for the three archaeological sites will be developed consistent with the council's Archaeological Recommendations. Before implementing the plans, DOE will submit them to the council and the West Virginia SHPO for review in accordance with the Executive Director's "Policy for Review of Proposals for Archaeological Data Recovery" (Attachment 2). Should neither the council nor the West Virginia SHPO object within 30 days after receipt of the plans, DOE will ensure that the plans are implemented; if either party objects, DOE will consult with the West Virginia SHPO and the council in an effort to resolve the objections.

Historic structures

DOE will relocate the Fort Martin School/Community Center to a location agreed on by the West Virginia SHPO and DOE.

Before moving the Fort Martin School/Community Center, DOE will ensure that it is properly recorded so that there will be a permanent record of its existence at that location. DOE will first contact the National Architectural and Engineering Record (NAER) [Heritage Conservation and Recreation Service, Department of the Interior, Washington, DC 20243 (202-343-6217)] to determine the level of documentation required. All documentation must be accepted by NAER before the relocation.

Before the building's relocation, the SHPO will be given an opportunity to review and concur with the site to which the building will be moved and the procedures by which the move will be accomplished.

Within 30 days after the relocation of the School/Community Center, DOE will provide the SHPO with any documentation he may require concerning the condition of the building on its new site so that the SHPO may notify the National Register of the status of the property.

The SHPO will, within 90 days after the relocation of the School/Community Center, notify the National Register of the relocation and provide the Register with his opinion, and supporting documentation, on whether the property is still eligible for the National Register.

The Gingrich House will be adapted at its current location for reuse by DOE. Any renovation, alteration, or rehabilitation of the Gingrich House will be undertaken in accordance with the Secretary of the Interior's "Standards for Rehabilitation" (Standards; Attachment 4). Application of the standards will be done in consultation with the West Virginia SHPO.

If the work to be done cannot be carried out in accordance with the standards, plans for the Gingrich House will be submitted, at the design development stage, to the West Virginia SHPO for review and comment. If, after review of the plans, the West Virginia SHPO is of the opinion that the reuse will adversely affect the Gingrich House, DOE will request further comments of the council in accordance with Sect. 800.4(d) of the council's regulations and will take no further action until the comments of the council have been obtained.

DOE will ensure that the Fort Martin School/Community Center and the Gingrich House are preserved and maintained in accordance with the Secretary's standards. Any future sale or transfer of the property containing the Gingrich House and/or the Fort Martin School/Community Center will include preservation covenants (Attachment 5) providing for the continued preservation and maintenance of the properties as a condition of the sale or transfer.

Additional stipulations

Failure to carry out the terms of the agreement requires that DOE again request the council's comments in accordance with 36 CFR Part 800. If DOE cannot carry out the terms of the agreement, it shall not take or sanction any action or make any irreversible commitment that would result in an adverse effect with respect to National Register or eligible properties covered by the agreement or that would foreclose the council's consideration of modifications or alternatives to the SRC-II plant and associated facilities that could avoid or mitigate the adverse effect until the commenting process has been completed.

In accordance with National Register Procedures (36 CFR Part 1202), DOE will forward documentation concerning the condition and significance of all listed or eligible sites to the Keeper of the National Register within two years following the completion of data recovery or alterations so that nominations, boundary changes, or eligibility status will be kept current.

If any of the signatories to this agreement determines that the terms of the agreement cannot be met or believes a change is necessary, that signatory shall immediately request the consulting parties to consider an amendment or addendum to the agreement. Such an amendment or addendum shall be executed in the same manner as the original agreement.

Within 90 days after carrying out the terms of the agreement, DOE shall provide a written report to all signatories to the agreement on the actions taken to fulfill the terms of the agreement.

All archaeological work called for in the first two stipulations above will be conducted under the direct supervision of an archaeologist or archaeologists who meet, at a minimum, the appropriate qualifications set forth in 36 CFR Part 1210 (formerly 36 CFR Part 66), Appendix C (Attachment 3), and who have appropriate knowledge and experience in relevant prehistoric or historic archaeological work.

All archaeological materials, along with field notes, maps, drawings, and photographic records, will be curated at a suitable repository agreed on by the West Virginia SHPO and DOE. Material recovered under this agreement and not initially stored within the State of West Virginia may be recalled for curation within the State of West Virginia at such time as adequate facilities are

made available. DOE will have access to all archaeological materials recovered as part of this project for public display purposes and will ensure that all such materials are made available for future research by qualified scholars and students.

Copies of the final reports of archaeological data recovery will be supplied to the West Virginia SHPO and the council. A brief, nontechnical account of the results of the archaeological work will be provided to DOE and SRC International, Inc., for local public dissemination at the plant information center. In addition, a copy of any final technical report will be furnished to Interagency Archaeological Services (Heritage Conservation and Recreation Service, Department of the Interior, Washington, DC 20243) for possible submission to the National Technical Information Service (NTIS). Any precise locational data should appear in a separate appendix and may be withheld from NTIS publication pursuant to Sect. 11 of the General Authorities Act of 1970, as amended (PL 94-458).

4.2.4.2 Operational impacts

Demand for labor

Demand for operations labor at the proposed coal conversion demonstration project is summarized in Appendix V (Table V.5). Three general kinds of operations labor are estimated to be required by the coal conversion project, totaling about 460 workers. This total consists of about 200 G&A personnel, 150 plant operators, and 110 maintenance craftsmen. It is expected that operations will begin in late 1983 or early 1984 and that labor requirements will reach these levels at that time.

Plant operators are expected to number about 150. As shown in Appendix V (Table V.5), three grades, or skill levels, are required. Typical staffing practice suggests that all or most of these operators will be recruited from the ranks of experienced operators currently employed at other related kinds of facilities across the country. The 70 grade C operators are basically inexperienced workers who are trained on the job. Most of them will be hired from local and regional labor pools.

As shown in Appendix V (Table V.5), 110 craftsmen in 15 separate crafts are required to maintain the proposed coal conversion plant. No one craft is needed in very large numbers. Recruitment is expected to be local.

Demography and labor force

The anticipated recruitment of the required 460 operations employees is outlined in Appendix Table V.11 and clearly reveals that the magnitude of any possible labor immigration would be minor compared with that associated with the construction phase. About 260 new resident employees are expected for the operation phase. SRC-II in-migrating population would *decrease* from the estimated 2400-3100 in 1983 to about 975; 650 of these people would likely reside in Monongalia County. In addition, an estimated 465 people would be employed in secondary employment positions compared with between 1600 and 2700 secondary jobs during the construction phase. This rapid drop in employment could impose hardships on a small segment of the labor force and could lead to a short-term increase in the level of unemployment compensations.

Housing, schools, and public finance

During operation, the SRC-II demonstration plant in-migration is expected to decrease by between 1400 and 2100 people. Consequently, in comparison with the construction phase, housing and classroom availability should be more than adequate. State income tax collections will fall from over \$1 million to \$2 million annually during construction to between \$170,000 and \$200,000 annually from 1984-1987. This includes revenue generated by indirect employment. Other state tax collections will likely be unchanged from the construction phase.

Construction and operations impact monitoring and mitigation

The objective of socioeconomic monitoring (Sect. 4.5.3.5) is to determine (1) the employment, population, and land-use changes actually resulting from the construction of the plant; (2) the wages, taxes, and local purchases generated by construction; and (3) the impacts of these population, employment, and fiscal changes on community infrastructure such as housing, schools, and transportation. To achieve these objectives, a series of surveys and interviews with SRC-II workers and local public officials will be conducted quarterly during construction and the first quarter of operation. The study area will consist of the local commuting zone within a 60-min

radius of the site, with special emphasis on those individual communities impacted by construction worker relocation. Where significant negative impacts are confirmed, recommendations in the form of additional monitoring or mitigating measures will be made by DOE to local government and planning agencies. Specific mitigation measures for housing are given in Sect. 4.6.2. Because most of the impacts of the project are predicted to occur during construction, operational monitoring will not be needed beyond the first quarter of operation.

4.2.4.3 Impacts related to commercialization

Introduction

As in the analysis of the impacts during the demonstration phase, a range of work force estimates is used to assess potential impacts during commercialization. The current best available estimate of the work force needed to construct the commercial plant is about 20 million man-hours over a 60-month period, with a peak work force of 5000 in the fourth year. A higher estimate is based on the current best available estimate of the work force needed to construct the Tri-State SASOL plant in Henderson, Kentucky.⁵⁴ Currently, the projection is for a 15,000 peak work force during the 52 months scheduled for construction. Allowing for the fact that the SASOL plant is somewhat larger and more complex and will be built in a slightly shorter time, a 10,000 worker peak construction force for a commercial SRC-II plant is not unreasonable. This higher work force estimate represents a man-hour to Btu ratio equivalent to that of the Tri-State plant. Thus, the range used for this analysis is 5000 and 10,000.

Population increase, housing, public services, and taxes are assessed to determine potential impacts from the construction and operation of the expanded commercial plant. A great deal of uncertainty is necessarily involved in the analysis of the commercial plant because of the extended time frame. Especially problematic for this analysis will be changes in public services offered between now and the start of construction for the commercial plant.

For the 5000 worker case, the impacts would not be much different from those already discussed for the same size work force in the demonstration phase, except that they would extend over a longer period. In the absence of advance planning, the construction of the expanded commercial plant would strain community housing and schools during peak construction. This strain, however, could be lessened by mitigating measures taken during construction of the demonstration plant and subsequent area development. The ensuing discussion deals primarily with the possible impacts of a 10,000 worker peak labor force.

Demographics and labor force

It is estimated that, at maximum, it would require 47.5 million man-hours over a 60-month period to construct the expanded commercial plant. The work force would probably peak at about 10,000 in the third or fourth year and would average 5700 employees over the 5-year period.

It is estimated that the local commuting labor pool could supply a maximum of 30% of the labor requirements, on the average. Another 20% of the work force would be travelers, coming into the commuting zone on a weekly basis. Thus, it is assumed that about 50% of the labor force would move into the local area. Table 4.30 summarizes the expected demographic change associated with these labor requirements.

Because no actual work schedule is available for SRC-II commercialization, with a 10,000 peak work force, a hypothetical schedule was derived based on that expected for the demonstration plant. Table 4.30 shows that the peak in-migration in any 6-month period will be about 4250, with a yearly peak of about 6600 new residents. Cumulative population increase will peak in the fourth year, with a total net increase of over 14,000 people. Dramatic out-migrations are expected in the fifth year and after project completion.

In computing the population increase associated with this work force, the following assumptions were made. First, that 65% of the in-migrating workers would bring families with an average size of 3.2 persons. Second, indirect employment would be generated by construction employment under the same assumptions used for the demonstration plant. Third, about 90% of indirect employment would be filled by local residents and 10% by in-migrants. Fourth, an indirect employment in-migration would occur in the 6-month period following the change in new work force employment.

Studies of energy-project-related impacts by the Denver Research Institute⁵⁵ indicate that annual population growth attributable to a specific project that does not exceed about 5% ("impact threshold") of the projected baseline population can be accommodated. The Denver

Table 4.30. Demographic change from SRC-II commercialization

Year	Total work force	Change in work force	Movers	Number of movers with families	Movers and families	Singles	Travelers	Migration from indirect employment	Total change in population	Cumulative population change
1987 ¹	500	500	250	162	518	88	100	0	706	706
1987 ²	1,500	1,000	500	325	1,040	175	200	49	1,464	2,170
1988 ¹	3,000	1,500	750	487	1,560	263	300	98	2,221	4,391
1988 ²	6,000	3,000	1,500	975	3,120	525	600	147	4,392	8,783
1989 ¹	8,000	2,000	1,000	650	2,080	350	400	294	3,124	11,907
1989 ²	9,000	1,000	500	325	1,040	175	200	196	1,611	13,518
1990 ¹	10,000	1,000	500	325	1,040	175	200	98	1,513	15,031
1990 ²	10,000	0	0	0	0	0	0	98	98	15,129
1991 ¹	7,000	-3,000	-1,500	-975	-3,120	-525	-600	0	-4,245	10,884
1991 ²	2,000	-5,000	-2,500	-1,625	-5,200	-875	-1,000	-414	-7,479	3,405

Research Institute studies report that growth rates of up to 5% are considered stable or moderate. The limit of the community growth process, however, is not known. It does appear, though, that in unmanaged growth situations, an annual population growth rate of 10% strains local service capabilities. A rate of 15-20% seems to cause breakdowns in local and regional institutions, such as the housing and labor markets.

Table 4.31 compares the population growth attributable to SRC-II commercialization, using a 10,000 worker peak labor force, with the projected baseline population growth in Monongalia County. Applying the Denver Research Institute guidelines, it can be seen that 5% growth is slightly exceeded in the second year of construction. Some community services may experience noticeable impacts, and some disruptions to the social environment may occur. If the current situation continues, housing will be severely strained. Planning and development before construction of the commercial plant could help ameliorate the impacts.

Table 4.31. SRC-II commercialization: comparison of population projection and in-migration for Monongalia County

Year	Projected base population ^a	Projected in-migration	Migration as percentage of baseline
1987	80,667	1,453	(0.018) 2%
1988	81,474	4,430	(0.054) 5%
1989	82,288	3,172	(0.039) 4%
1990	83,111	1,079	(0.013) 1%
1991	83,942	7,855	(0.094) -9%

^aBased on an average annual growth of 1% from 1980 base.

Also of significance is the predicted out-migration at a rate of 9% as the project nears completion. This rate of out-migration may cause strains on the local infrastructure. The most likely impact would be a sharp jump in local unemployment from the loss of indirect jobs in support of construction. This would continue until adjustments were made in the local market. If the housing stock grows too rapidly during the construction period, a surplus could result, with negative effects on the local housing market. This kind of overbuilding is a problem in the public service sector as well, where expensive facilities may become underused as local population declines after the rapid growth of the construction phase. Advance planning and/or a less dramatic phasing-down of construction would lessen these impacts.

Operation of the commercial plant would require about 900 workers, including the 460 operational-phase staff, who would remain, and 400 additional⁵⁶ workers. It has been estimated that 65% of the required general and administrative (G&A) personnel and skilled operators and 30% of maintenance craftsmen could be movers, the same percentage estimated for the operational-phase staff. Assuming that the average family size is 3.2 and that 65% of these movers will have families, the population increase would be about 535 persons.

To estimate indirect employment, it is assumed that if the sectoral employment multiplier developed for petroleum and coal products (2.76) by the Regional Economic Analysis Division of the U.S. Department of Commerce is a close approximation of the synfuels multiplier,⁵⁷ about 400 new secondary jobs would be created in the community. Assuming that 90% of these jobs would be filled by local residents and 65% of the secondary employment movers have families of 3.2 persons, the estimated population increase due to secondary employment would be about 95 persons. Estimated total population increase under these assumptions would be 630.

Housing

The estimated new demands by SRC-II workers and indirect employees in-migrating to Monongalia County are shown in Table 4.32. The predicted levels of demand for the three categories of housing are based on the same assumptions used in the demonstration facility analysis. The cumulative total of nearly 4000 new workers and second-year peak of 1665 imply havoc in the housing market. The current supply of housing is greatly inadequate to meet these projected demands. Although it would be desirable if the private sector would respond to the demand, the relatively short duration of the project will act as deterrent to private investment in new housing. It is likely that a substantial amount of temporary housing will be required. Some of this could be converted to elderly or low-income housing following project completion.

Table 4.32. New demands for housing in Monongalia County from SRC-II commercialization-induced in-migration

Year	Single family		Mobile home		Apartments/rooms		Total	
	Yearly	Cumulative	Yearly	Cumulative	Yearly	Cumulative	Yearly	Cumulative
1987	134	134	187	187	214	214	535	535
1988	416	550	583	770	665	880	1665	2200
1989	333	883	466	1236	531	1411	1330	3530
1990	116	999	163	1399	186	1597	465	3995
1991 ^a								
Peak total	999		1399		1597		3995	

^aCannot be estimated.

Water and sewage

The increase in population due to the commercial plant would increase the demand for water and sewage treatment facilities. Currently, the water treatment capacity for Monongalia County (Morgantown Water Commission) is 16 million gpd. Some 70,000 people are serviced. Average daily use is 6.5 million gal, with peak loads reaching 8 million gal, about 50% of capacity. Assuming unchanging consumption patterns, the water system has the capacity to serve almost double the current population. The peak population increase of 10,000 persons due to SRC-II represents increased demand of only 14%. The water system appears more than adequate.

Sewage treatment capacity of 6 million gpd in Monongalia County is somewhat inadequate to serve the current 1980 population. There are plans to increase capacity to 9 million gpd by 1983; this will meet current projected demands. (Monongalia County has filed for EPA Federal assistance funds for expansion plans.) This assumes, however, that in-migrants move to an area with adequate access to existing capacity and that the available excess capacity is not fully committed to current area residents who are not currently served. The degree of strain on the existing system will depend on the extent to which these conditions are realized. The inadequacy of sewage treatment facilities in the 10,000-worker case represents an obstacle for housing development and limits the capacity of the area to respond to growth related to SRC-II commercialization.

Schools

Historical data show population shifts within the county, but relatively little change in school enrollment for the past 10 years; predictions for the future, without new industrial development, indicate stable school enrollment for Monongalia County schools. Current plans for expansion are based on these data.⁵⁸ About 10,500 students are currently enrolled for the 1980-1981 school year; enrollment capacity is 12,500 students. A possible peak increase of 1560 elementary and 435 high school students during construction and 150 students during operation of the SRC-II commercial expansion, in addition to expected enrollment growth, could not be accommodated by the county schools, given the current expansion plan. In the long run, increased property tax revenues due to private ownership of SRC-II would allow for expanded facilities; in the short run, overcrowding will occur in the high schools, and some overcrowding could occur in the elementary schools. However, the 5-year lead time (i.e., the time between the end of construction for the demonstration plant and peak construction for the commercial plant) could be advantageously used to avoid the impact, especially in providing for a temporary expansion of classroom space.

Taxes

Commercialization of SRC-II would provide significant increased tax revenues to the county (property tax) and the State (business and occupation tax). However, any time lag between the need for these revenues and their availability could cause some negative budgetary impacts in the short run, particularly during the construction phase. The City of Morgantown would receive no direct tax payments from the plant. Increased city business and occupation tax revenues due to secondary employment would be an indirect economic benefit.

Summary

Impacts resulting from the construction phase of the commercial SRC-II facility would likely be more than double those of the construction phase of the demonstration facility. Housing and classroom availability could present significant problems beginning in the late 1980s, if lead time opportunities are not fully exploited. The precise magnitude of these problems is difficult to predict at this time due to uncertainties associated with local population growth, economic growth, and public facilities improvements, as well as with uncertainties associated with plant design and construction scheduling.

Impacts associated with the operation of the commercial facility will not differ greatly from the impacts associated with the operation of the demonstration plant, with the exception of the generation of state and local tax revenues. At this time, the county will begin to collect property taxes and the State B&O and sales taxes. The amount of these revenues cannot currently be calculated because of inadequate data on plant and product value and assessment rates.

Potentially competing large construction projects

It is known that four other potential coal conversion plants are being considered for West Virginia. Currently (Jan. 1981), all are in the preliminary stage; grant proposals for funds to support feasibility studies have been submitted to DOE. However, at this time, DOE has made no funding decisions on any of these proposals. Actual construction would be some years off at the earliest, and these plants are not considered likely to overlap the construction phase of the SRC-II demonstration plant; they may possibly compete with SRC-II commercialization construction in the later half of the 1980s. The four projects are:

1. Ohio Synfuels Inc., Point Pleasant, West Virginia
2. Co-Gas Development Co., Buffalo, West Virginia
3. ITT Corp., Nitro, West Virginia
4. Westinghouse Inc., Fairmont, West Virginia

4.2.4.4 Impacts related to mothballing and decommissioning

Because the land and facility would remain under DOE ownership, anticipated tax revenues could not be collected for use of the site. The mothballed facility would provide no economic benefits, but it would also preclude other industrial development capable of providing tax revenue. During the mothballed period, the majority of the operation labor force of 460 would be laid off, with the probable loss of an indeterminate number of secondary support jobs as well. This implies a local loss of income in excess of \$12 million per year (1980 dollars).

4.3 ALTERNATIVE SITE — EQUALITY, KENTUCKY

This section identifies the impact issues that could arise should the Equality site be the location of the proposed SRC-II demonstration plant. This evaluation was conducted to determine whether the Equality site offers potential for appreciably reduced impacts. Impacts on the Equality site are based on general site characteristics, without a plant layout or detailed monitoring data.

4.3.1 Land

4.3.1.1 Land use and development

Construction impacts

More than three-fourths of the 405-ha (1000-acre) Equality site consists of prime farmland; some of it is currently used for corn production and pastureland and some is wooded. This area of Green River bottomland could be severely affected by the construction of the proposed SRC-II plant. Occurring could be losses of farm soils through development on portions of the prime acreage, reduced soil productivity because of compaction and grading, and erosion. Considerable earth moving and forest clearing can be expected to occur on the remaining portions of the Equality site. The ten residences located in the hilly portion of the site are likely to be destroyed or seriously affected as a result of construction-phase activities.

Additional land use changes can be expected because of the increased urbanization of Ohio, Daviess, McLean, and Muhlenberg counties resulting from the influx of plant employees and their families. Considerable amounts of housing and commercial construction will be required to support this increase in population. Some agricultural and forest acreage will be converted to residential and commercial uses to make these accommodations.

Operational impacts

In areas of maximum air pollutant concentrations, slightly reduced productivity of certain sensitive species such as soybeans and pasture grasses may result from plant operation. Corn, which is resistant to air pollutants, should experience only minor effects, if any. The residential and commercial expansion that occurred during the construction period will leave a certain percentage of former farm acreage unarable. There is a possibility that some additional surrounding lands may be cleared and developed if complementary industrial or commercial facilities move into the Equality area.

4.3.1.2 Geology and soils

Construction impacts

Soils at the Equality site are of variable texture, ranging from sandy alluvium to silty clay on upland slopes. Depending on the site layout, the volume of soil lost by erosion during construction may be the same as or less than that at the proposed site; however, the quality of soils at the Equality site is greater than at the proposed site. Sediment eroded during construction could be retained on the site in retention ponds to minimize sedimentation of local streams and the Green River. Soil erosion may be mitigated by limiting exposed areas and stabilizing the cut slopes with vegetation, bulkheads, or asphalt-sprayed hay. It may be necessary to import fill from off site or another area within the site should the upland loess soils prove unstable near foundations and embankments.

Operational impacts

Geology and soils in the Equality area are more prone to earthquakes and liquefaction of the soils but less susceptible to landslides than the proposed site. (Liquefaction is the changing of soil to a liquid state because of high water content or the application of stress to the soils.) If the loess soil capping the hillsides is extensive, preloading of the site soils or extension of foundations to bedrock would be required. If areas of the site are to be excavated and filled, additional fill material would have to be imported because of the unsuitability of the loess soils.

The Equality site is located near the border of seismic risk zones 2 and 3. Designation of the site as zone 3 would necessitate more careful construction techniques and would imply increased

risk of disrupting solid and liquid waste storage areas or process pipelines. If loess soils are extensive, instabilities may be increased by the potential for soil liquefaction. Due to the higher seismic risk and relatively steep terrain, the Equality site is considered less favorable than the proposed site.

4.3.1.3 Terrestrial ecology

Construction impacts

Construction on the Equality site would destroy a mixture of upland, floodplain, and swamp hardwood forests with scattered cornfields, and active and abandoned pasture. This mixture of plant communities creates high-quality habitat for a large variety of wildlife, including game species such as deer, grey and fox squirrel, woodcock, quail, and wood duck. Filling the swamps and marshy floodplain forests for plant construction would destroy potential habitat for seven animal species that are rare in Kentucky.

Construction of the plant in the hilly portion of the site would require that large volumes of earth be moved. Silt from this activity could cause temporary damage to the adjoining floodplain and wetlands, which are more extensive and ecologically valuable than those at the proposed site. Also, some forest or cropland on the floodplain would still be destroyed by construction of a coal conveyor, water lines, and a road to the barge landings. Before plant construction at this site, DOE would, pursuant to Executive Orders 11988 and 11990, make a determination that there exist no practicable alternatives to floodplain and wetlands encroachment. (The Equality site is discussed in the floodplain/wetlands assessment presented in Appendix D.)

Compared with the proposed site, the Equality site is significantly more productive of wildlife because of the higher ratio of forest to other land, the presence of good flood-retreat habitat for swamp species, the division of cropland into small parcels by old hedgerows, and the generally low level of human activity in the area. Although construction at the proposed site would result in the destruction of valuable wildlife habitat, the extent of this habitat is relatively limited, and the adverse impacts at the Equality site are believed to be more significant than at the proposed site.

Operational impacts

Atmospheric pollutant effects on terrestrial ecology depend on the location of the plant on the Equality site. Placement of the plant on the uplands rather than on the floodplain would reduce the likelihood that high pollutant concentrations would occur at ground level. In that case, air pollution effects would probably be equivalent for both this site and the proposed site.

If the sloughs and marshy lowlands were not filled, they might serve as sinks for toxic materials from coal pile or solid waste leachate if the leachates enter surface drainage areas or shallow groundwater as a result of accidental release. In that case, the toxic substances could be accumulated by waterfowl and other animals. This concern is considered more significant at the Equality site than at the proposed site.

4.3.2 Water

4.3.2.1 Surface water hydrology

Construction impacts

Grading and excavation during the construction period will remove the protective vegetative ground cover, reduce percolation rates, and increase the amount of rainfall and the amount of topsoil removed. Such runoff, high in suspended solids, may accelerate channel scouring in the small streams on the site. Use of sedimentation basins would reduce the impact on streams below the basin. The potential impacts are considered to be of the same magnitude as at the proposed site.

If construction occurs at the lower elevations, erosion and increased suspended solids during flooding could occur. The impact can be reduced by scheduling floodplain construction during periods of low rainfall probability and by using temporary dikes to protect the structures while they are being built. Although construction impacts would occur on the Monongahela River floodplain of the proposed site, adverse impacts on the Green River floodplain are considered more significant in terms of the size of the area affected and its ecological significance.

Operational impacts

Depending on the final plant layout at the Equality site, a significant percentage of onsite stream drainage areas may be graded or paved. Such alteration of the drainage may reduce flow in the streams by diverting runoff into the plant's drainage collection system. This impact could be more significant than that at the proposed site because of several creeks and a slough on the Equality site, which support a variety of aquatic life.

Siting plant facilities at the lower elevations of the Equality site would significantly increase the risk of flood damage and possible release of toxic process material or wastes into the Green River. Mitigation measures include building dikes, increasing the elevation of the land surface, and relocating critical structures in the uplands above the probable maximum flood elevation (see Sect. 4.8 and Appendix D). This risk is considerably more significant than that at the proposed site, where only minor encroachment is proposed.

The proposed facility would require an estimated water consumption of 0.23 m³/s (8.0 cfs), which would amount to 2.4% of the low flow of 9.5 m³/s. A commercial SRC facility would consume about 0.8 m³/s (28 cfs), or 8.4% of the low flow. These quantities of low-flow consumption at the Equality site are approximately equal to those at the proposed site.

4.3.2.2 Groundwater

Construction impacts

Significant alteration of groundwater flow or quality is not expected if construction occurs on this site. Small local effects may occur from changes in infiltration rates during soil compaction, spills of small quantities of fuel oils or other liquids, removal of vegetation, or grading operations. This could be more significant at the Equality site than at the proposed site because of the presence of aquifers below the site, which are actively used as drinking water supplies.

Operational impacts

Groundwater quality at the Equality site could be affected by leachates from solid waste storage or by spills of process liquids in the event of confinement failure. Site conditions affecting the probability and magnitude of the impact include chemical and physical properties and depth of the soils and the nature of aquifers and caprocks below the site.

An alluvial aquifer containing water of acceptable drinking water quality exists along the floodplain of the Green River. Bedrock aquifers may also occur in the area, but the nature of the caprock, flow direction, and water quality is unknown. Generally, in this area of Kentucky, bedrock aquifers have low yields and variable water quality accompanied by increases in salinity with depth. Although yields may be low, these aquifers may be the sole source of drinking water for rural residences. Adverse impact on drinking water aquifers may occur. However, because of the lack of site-specific information, the potential cannot be quantified. This potential is considered to be more significant at the Equality site because the aquifers are a more significant source of drinking water than they are at the proposed site.

Soils at the Equality site contain a layer of dense, compacted material that slows drainage and reduces the amount of infiltration to bedrock aquifers. These layers may also form perched water tables. If leachate containment systems fail to operate effectively, accumulation of waste leachate could occur with eventual drainage through springs into the Green River. Concentrations of iron and manganese hydrous oxides may increase the soil's ability to absorb trace elements from leachates or spills. Use of control measures like those proposed for the Fort Martin site are anticipated at this site to reduce potential impact (Sect. 4.2.2.2). Recharge level reduction resulting from soil compaction and paving may be decreased in the immediate area of the facilities, but the effect is not likely to extend beyond plant boundaries.

4.3.2.3 Surface water quality and aquatic ecology

Construction impacts

Potential impacts on surface water quality and aquatic ecology from construction of the proposed SRC-II facility at the Equality site include (1) effects of constructing the water intake, wastewater discharge structure, barge facilities, and pipelines; (2) site runoff into the Green River

(and smaller streams, including Williams Creek and tributary and the small onsite pond); (3) disturbance and/or destruction of various drainage basins; and (4) shoreline disturbance of the Green River during site preparation.

Destruction or degradation of onsite streams and sloughs during construction would reduce the local aquatic habitat. Sampling data presented in Sect. 3.3.2.3 indicate that these hydrologic features serve as spawning, nursing, and refuge areas in the Green River ecological system. Additional sediment loading of the Green River would aggravate current water quality problems (Sect. 3.3.2.3). The extent of construction impacts would depend on the amount of site preparation required, mitigation measures employed, and the exact location of facilities on the site.

Operational impacts

Operational impacts of the proposed SRC-II facility, if sited at Equality, would include water withdrawal intake, discharge of treated wastewater, leachate containment system failure, and discharge of contaminated runoff from storms exceeding the 10-year, 24-h precipitation event.

To estimate the potential for water quality degradation (and consequent biotic effects) from the discharge of wastewater into the Green River, the dilution of water quality constituents was calculated (Table 4.33). It was assumed that the ambient concentration of each constituent would be the maximum recorded (Sect. 3.3.2.3), that wastewater concentration and flow would be at their maxima, and that the effluent would be completely mixed in the 7-d, 10-year low flow of the Green River (Sect. 3.3.2.3). These calculations, although based on several simplifying worst-case assumptions, do provide an approximation of potential effects.

Table 4.33. Mixing of SRC-II effluent with 7-d, 10-year low flow of Green River, Equality site (9500 liters/s)^a

Constituent	Water quality standard (mg/liter)	Maximum ambient concentration ^b (mg/liter)	Fully mixed concentration (mg/liter)	Compliance with standard (mg/liter)
Arsenic	0.05	<0.01 ^c	0.01	Yes
Cadmium	0.0012	0.004	0.004	No ^d
Chromium	0.05	0.001	0.003	Yes
Copper	1.0	0.014	0.014	Yes
Cyanide	0.005	Assume 0	0.013	No ^e
Iron	0.3	3.72	3.70	No ^d
Lead	0.05	0.075	0.07	No ^d
Manganese	0.05	0.475	0.47	No ^d
Mercury	0.00005	0.0002	0.0003	No ^d
Phenol	0.001	Assume 0	0.008	No ^d
Selenium	0.01	0.001	0.0012	Yes
Total suspended solids		230	228	
Zinc	5.0	0.06	0.06	Yes

^aSee Table 4.8, Sect. 4.2.2.3, for mixing formulae and maximum effluent concentrations.

^bFrom Table 3.27, Sect. 3.3.3.3.

^cWhere values were reported as "less than" some concentration, it was assumed that the concentration was equal to that value.

^dMaximum ambient concentrations of these constituents exceeded the standard.

^eMaximum ambient concentrations did not exceed standards; significant water quality degradation attributable to SRC-II discharge.

Water intake effects on the Green River would depend on design of the intake structure and its location relative to the distribution of biota. In all probability, raw water withdrawal for the proposed plant would not significantly affect aquatic biota, especially because the Green River fishery is characterized by low productivity (Sect. 3.3.2.3). However, a commercial-scale SRC-II facility at the Equality site might cause significant loss of ichthyoplankton during certain flow conditions. The expected adverse impacts on aquatic ecology would be slightly more severe at the proposed site than they would be at the Equality site.

Barge traffic and coal spillage resulting from the proposed SRC-II facility at Equality would produce only minor impacts on water quality or aquatic ecology. Site preparation, construction, or operation of the proposed facility at the Equality site is not expected to have any adverse effects on aquatic species designated as endangered, threatened, or otherwise of concern by Federal or State authorities (Sect. 3.3.2.3). These impacts are roughly equivalent to those at the proposed site.

4.3.3 Air quality

4.3.3.1 Construction impacts

The hilly terrain in rural Ohio County, Kentucky, would tend to inhibit the dilution of pollutants emitted by the proposed facility. The area now has fairly good air quality and complies with applicable air quality regulations, except for total suspended particulates (TSP). Sources of fugitive dust have caused ambient TSP standards to be exceeded for both short-term and annual average time periods.

Because of the hilly terrain, the Equality site would probably require extensive earth-moving activity, just as at the proposed site. Fugitive emissions during this activity would worsen the particulate problem measured in the area. Although wind and precipitation regimes are similar to those at the proposed site, impacts of fugitive dust generation from construction would be somewhat greater at the Equality site.

The Tennessee Valley Authority's Paradise steam plant, which is located near the Equality, Kentucky, site, has sulfur dioxide (SO_2) monitors to the north of its plant that show SO_2 concentrations to be in compliance. Monitoring site No. 23 of Paradise steam plant recorded an annual average of $23 \mu\text{g}/\text{m}^3$, a second highest 3-h reading of $950 \mu\text{g}/\text{m}^3$, and second highest of the 24-h recorded at $275 \mu\text{g}/\text{m}^3$. Although these currently do not violate National Ambient Air Quality Standards, there are higher levels at the Equality site for the 24- and 3-h standards as compared with the proposed site at Fort Martin, West Virginia.*

4.3.3.2 Operational impacts

Routine emissions from use of the Equality site would result in about the same ground-level concentrations as those predicted at the proposed site. The Equality site will have a lesser regional impact than the proposed action because Equality is further removed from other major emission sources. Fugitive emissions from the coal storage areas would be similar at both sites.

4.3.4 Economic, social, and cultural impacts

4.3.4.1 Population

Construction impacts

A relatively large increase in the populations of Ohio, Daviess, McLean, and Muhlenberg counties can be anticipated during the construction phase of the SRC-II facility. Peak construction will be reached about 18 months after construction begins; project completion is expected about 18 months after that date. About 3800 workers are projected to be required during the peak construction period.†

A worker relocation projection model from recent (post-1976) experiences with TVA nuclear power plant construction workers was used to analyze the spatial distribution of this anticipated work force. The model, which is discussed in more detail in Sect. 4.2.4.1, is used to predict the number of construction workers who will come from the existing labor force for each county within 116 km (70 miles) of the site and the number of workers who will migrate to each of these same counties. In-migrants are classified as either movers or travelers (Sect. 4.2.4.1), and current area residents are referred to as commuters. Estimates of the total number of employees

* Air Monitoring Data Summary, 1979 TVA Paradise Steam Plant.

† The analysis presented here was performed using only the current best available estimate of construction work force at both the Equality and Fort Martin sites. The analysis indicates that the Fort Martin site is preferable to the Equality site using this size work force, and that this judgment would only be reinforced with a larger work force.

in each of these categories anticipated during the peak construction phase of the SRC-II facility are given in Table 4.34.

Table 4.34. Estimated number of commuters, travelers, and movers for peak construction employment at the SRC-II demonstration plant, 1982

County	Commuters from county ^a		Travelers locating in county ^b		Movers to county ^c		Total	
	No.	Percentage	No.	Percentage	No.	Percentage	No.	Percentage
Ohio	165	11.3	315	22.3	210	22.5	690	18.1
Daviess	210	14.7	135	9.5	90	9.5	435	11.5
McLean	95	6.4	130	9.3	85	9.2	310	8.2
Muhlenberg	275	18.8	270	19.1	180	19.1	720	19.0
Outside impact area	700	48.8	560	39.8	375	39.7	1640	43.2
Total	1445	100.0	1410	100.0	940	100.0	3800	100.0

^aCommuters are residents of county before SRC-II who drive to and from work daily.

^bTravelers live in county during the week but maintain a permanent residence elsewhere.

^cMovers relocate permanent residence when they start employment at SRC-II.

Note that 745 workers, or about 20% of the anticipated labor force, will come from the existing population of the four-county Equality impact area. Within the first two years of project construction, this same area will have to absorb 850 travelers and 570 resident laborers. The TVA worker relocation experiences show that about 65% of the movers will bring families averaging 3.2 persons. For the four-county impact area, this brings the in-migrant population to a total of about 2250; 1400 people seek relatively permanent housing and 850 will seek strictly temporary housing accommodations.

In addition to the anticipated population increase from direct plant employment there will be a certain amount of indirect employment increase during the construction phase. Table 4.35 gives the estimates derived from the relocation model.

Table 4.35. Estimated indirect employment during SRC-II peak construction period, 1982

Ohio	420
Daviess	300
McLean	200
Muhlenberg	480
Outside impact area	<u>1100</u>
Total	2500

The figures in Table 4.35 represent jobs in the support and service industries that will be generated by the influx of population associated with plant construction. Because the project area is rural, about 10% of these employees will be in-movers. Calculation of the total number of in-movers, using the same assumptions about the proportion of workers with families and average family size that were used for direct movers, shows that another 340 people will be added to the population of the impact region due to indirect employment. When added to the in-movers and travelers anticipated from direct plant employment, the total potential population increase for the four-county area is about 2600.

Table 4.36 gives a breakdown of the estimated in-migrants for each county in the Equality impact area.

Table 4.36. In-migration to the Equality, Kentucky, impact area

County	1980 population	Total travelers, direct and indirect ^a	Total direct movers ^b	Total indirect movers ^b	Total in-migration	In-migration as percentage of current population
Ohio	21,845	315	515	100	930	4.0%
Daviess	81,941	135	220	75	430	0.5
McLean	11,058	130	210	50	390	3.5
Muhlenberg	32,315	270	440	120	830	2.5
Total	147,159	850	1385	345	2580	1.8

^a Assuming all travelers come alone.

^b Assuming 65% of movers come with families of 3.2 average size.

Ohio County is estimated to receive a substantial increase in population during the approximate 18-month period from start of plant construction to the anticipated peak. Other counties in the impact area, with the exception of Daviess, can expect similarly large and rapid influxes of people, as indicated in Table 4.36.

It seems reasonable to assume that a large portion of these in-migrants will congregate in the more urbanized areas of the counties, because of the greater number and immediate availability of services. In Ohio County, the two most populous towns are Beaver Dam (6867 population) and Hartford (3752). If all the in-migrants to Ohio County settled in these two areas, in numbers proportional to their current populations, Beaver Dam would experience an increase of 605 people, or 9% of its population, and Hartford would gain 325 people or, gain, 9% of its current number. During an 18-month period, this influx would create numerous problems for the affected towns in the areas of housing, services, transportation, and other socioeconomic issues. In most cases, measures would have to be taken in advance to mitigate potentially damaging impacts. These measures will be discussed in the following sections.

Operational impacts

The operational period of the SRC-II facility is expected to begin about two years after construction begins. After the facility is completed, about 460 personnel will be required for full plant operation, which represents slightly more than 12% of the peak construction employment. The net change in population of the Equality impact area during the operational phase is therefore likely to be a negative one. It can be anticipated that some supportive and/or service industry jobs will remain after the construction phase, especially if other complementary industries develop in the immediate area. Other members of the construction population may decide to remain in the area and become absorbed into other sectors of the local economy. Still, the primary effect to be expected during the operational phase is that of a scaling down of the employment and population levels reached during plant construction. A relatively sizable amount of disposable income may disappear from the impact area when construction of the SRC-II facility is completed, and an economic downswing could result unless anticipatory steps are taken to counteract the loss of employment in the area.

4.3.4.2 Housing

Construction impacts

The unavailability of housing in the Equality impact area presents a major obstacle in the area's ability to support the projected in-moving population. As described in Sect. 3.3.4.2, housing stock in the four-county impact area is already falling short of demand. Overcrowding and generally poor conditions exist in at least 10% of the area's housing. Planning authorities indicate that the area lacks an adequate construction labor force to handle current growth.

TVA's observations of construction worker relocation behavior indicate that the housing mix shown in Table 4.37 might be required by project-induced in-migrants.

**Table 4.37. Percentage of total in-migrants
(movers and travelers) demanding various
housing types**

Single-family homes	50.3
Mobile homes	24.3
Apartments, sleeping rooms, campers, and other	25.4

Of the approximate 1500 households (as opposed to total population) expected to relocate in the impact region, 775 are expected to purchase or rent single-family homes; about 380 are projected to move into mobile homes; and about 390 will live in apartments or rented rooms. Because a certain lag time can be expected before new units become available, temporary housing is likely to be needed to accommodate the initial influx of population. Mobile home and camper "villages" may be set up, and overcrowding in available units could occur. Workers may have to reside at more distant locations if housing demands cannot be met.

Although it is likely that there will be some short-term housing pressure in the Morgantown area, it is not expected to be as problematic as that at the Equality site.

Operational impacts

The reduction in population to a net increase of 460 workers (some with families) more than the pre-SRC-II population may have an effect on the housing market opposite to that of the construction-phase population influx. A possibility exists of construction-phase overbuilding, in which the impact-area housing market may effectively be flooded. This could produce negative effects on the area economy.

4.3.4.3 Public services

Construction impacts

Impacts on the public services could feasibly be as severe as those expected in the housing market. Current system capacities for much of the impact region are close to being met in all three areas of public services discussed in the profile section (Sect. 3.3.4.3). Water supplies in the four-county area are almost fully utilized, and the majority of the area's sewage systems are approaching design capacity. Major expansion projects would have to be undertaken to accommodate the demand on these systems that is expected to accompany project-induced in-migration.

Morgantown currently has a surplus water and sewage capacity.

The school systems throughout the impact area, except for those in Daviess County, are similarly operating near capacity, but there are several expansion projects under way or under consideration by local officials. TVA observations predict that 49% of in-movers' children will be of primary school age; 14% will seek space in the high schools. This influx of students would most likely require larger expansion projects than those that are currently under consideration. Another far less expensive and less permanent solution for meeting incoming student needs would be to set up temporary schools in the areas of highest demand during the construction phase.

Morgantown currently has available spaces below the high school level, but some high schools are at capacity. No expansion is considered necessary, but some upgrading of existing facilities may be required.

Operational impacts

The potential problem of overbuilding, mentioned earlier in the context of housing, could also apply to expansions of the water and sewerage systems in the Equality impact area. Should population decline after construction, local residents may be left with a large bill for underused service facilities. One possible mitigating measure may be for the site area to seek Federal aid for at least partial funding of the minimum expansions required for water and sewage systems.

If the county school systems accommodated construction-phase students with minor expansions and temporary schools, the operational phase could be adjusted to relatively easily. Temporary schools could be closed and any minor expansions made might be effectively used by operational-phase children and growth in the area unrelated to the plant. If this approach is not followed, the same problems of overbuilding discussed above could result.

4.3.4.4 Transportation

Construction impacts

The major adverse impact on the Equality site area will result from the increased number of vehicles using the local road system. These roads currently do not experience heavy use, and their estimated capacities indicate that they could not support the traffic expected during the peak of the construction phase.

During peak construction, about 3100 vehicles are expected to use the final link of road to the Equality site during rush-hour periods. Table 4.38 gives the estimated number of vehicle round trips to be expected on the various sections of road described in Sect. 3.3.4.4.

Table 4.38. Construction-induced traffic and road capacities for the Equality, Kentucky, site

Road section	Current peak hourly count	Project-induced vehicles at peak hours	Total	Level of service E hourly capacities
Equality road	50	3100	3150	1070
State Route 85	210	1325	1535	1070
U.S. 62 (Central City to 85)	330	1325	1655	1600
State Route 69 (Centertown to Hartford)	250	1625	1875	1150
State Route 69 (Hartford to Green River Parkway)	440	1200	1640	1600

Source: David Docter, Green River Area Development District, Dec. 2, 1980; traffic analysis performed by Jeff Rexhausen, Oak Ridge National Laboratory, Oak Ridge, Tenn.

The hourly capacities are given for each section of road for level of service "E." These capacities represent the maximum number of vehicles traveling in both directions that can be accommodated by a given section of road. At the E level of service, traffic flow is subject to breakdown because of the minimal spacing between vehicles. This is not a desirable level of design, because it leaves little room for error. All the roads are without shoulders and run over rolling hills, which leaves little room for passing.

Table 4.38 shows that all except one of the sections of two-lane highway could not accommodate the predicted volume of traffic at reasonable levels of service. The Equality road, State Route 69 between Centertown and Hartford, and State Route 85 all have a projected vehicle count that far exceeds their "E" capacities. U.S. Route 62 shows traffic projected at capacity, and State Route 69 between Hartford and the Green River Parkway has an estimated traffic volume

that approaches its design limit. It is obvious from these figures that peak traffic volumes cannot feasibly be accommodated by the existing road system. If material deliveries are made by truck, the road problem will be aggravated. Current use by trucks of the road sections listed in Table 4.38 is 6% of all traffic (see Sect. 3.3.4.4).

Figure 4.2 illustrates the impact area's anticipated commuter traffic. The number of vehicles using selected sections of the highway system surrounding the Equality site are given to present a picture of expected commuting patterns. Values shown are based on a work force of 3800. Names of counties are given in capital letters and relevant towns are given in lowercase letters. The lettered road sections closest to the Equality site (represented by a star) refer to the sections listed in Table 4.38. As vehicles from outlying areas converge on the roads leading to the Equality site, capacities begin to be exceeded.

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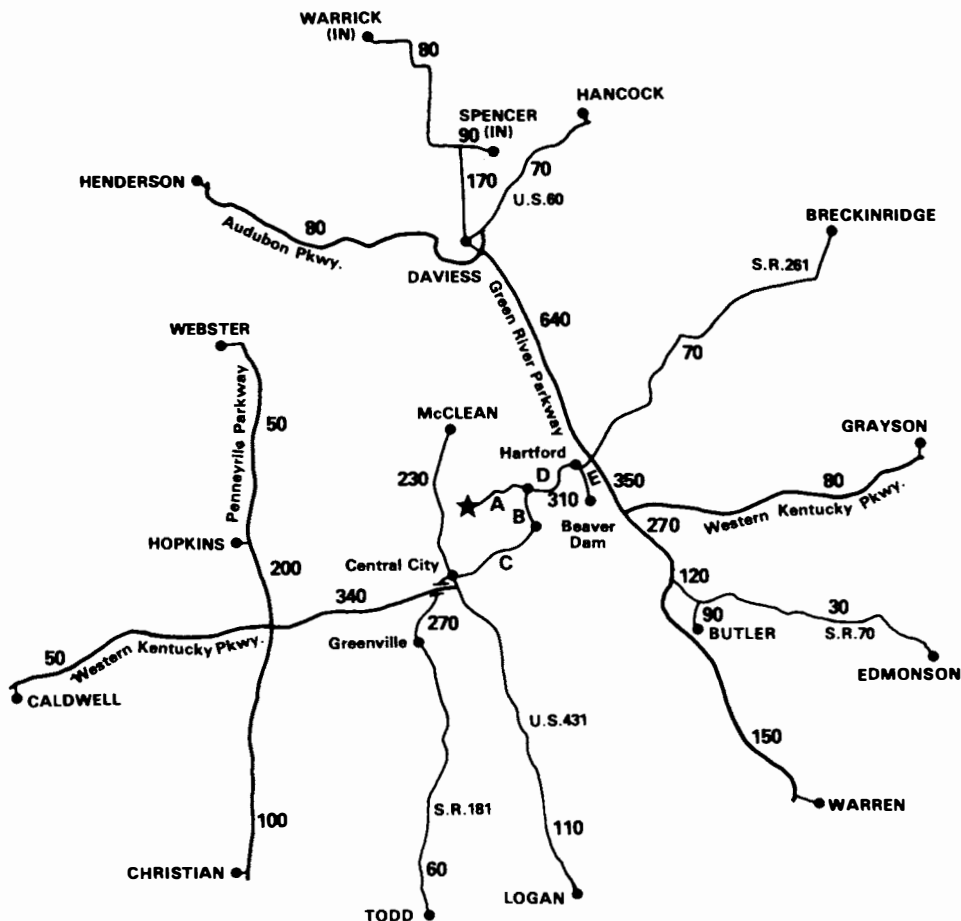


Fig. 4.2. Estimated number of commuter vehicle round trips on selected road sections: Equality impact region.

Mitigating measures will have to be taken to avoid damage to the road systems and to accommodate the predicted traffic. Truck traffic from construction equipment deliveries could be reduced by transporting materials to the site by rail or barge. Rail lines may need to be improved to support this activity, but the Green River system should be able to handle the traffic. Staggering work hours on the single shift that is currently envisioned by project planners could provide a small reduction in traffic congestion, but it is not likely to eliminate the serious overcrowding expected. Other mitigating measures that may be more effective in reducing or accommodating project-induced traffic include instituting bus service, encouraging car and van

pooling, and funding road expansion and improvements for the most heavily affected sections of road near the site. Implementation of the above program, particularly the road improvements, could be expensive.

Currently, access roads in the area of the Fort Martin site are structurally inadequate and are also inadequate for the volume of traffic. The State of West Virginia is committed to upgrading the roads.

Operational impacts

Although truck traffic on area roads may increase somewhat over preconstruction levels, it is not expected to reach serious proportions, because rail and barge lines are the preferred means for delivery of feedstocks to and the removal of processed materials from the proposed facility. Similarly, the peak commuter traffic count projected for the 460-employee operational phase is not likely to seriously affect area roads.

4.3.4.5 Economic base

Construction impacts

An increased level of activity in the service and support industries will develop in response to demand from the construction labor population (see Sect. 4.3.2.1). Spending by construction employees for local goods and services will provide increased revenues to local businesses. It is expected that the vast majority of indirect jobs will be filled by workers already resident in the counties. These workers will come from the unemployed sector or will transfer from other occupations. A decrease in agricultural activity or a switch to part-time farming may result. Thus, the economic base may to some degree shift from that of a primarily agricultural/mining base to more of an industrial (direct plant employment) and service (indirect employment) base.

A possible negative impact that may result from project employment during the construction phase is that of project-induced inflation in the immediate impact area. Construction worker wages are likely to be significantly higher than those of the existing labor force in all types of employment. This could put pressure on employers to raise their wage rates to keep their employees. Also, the rapidly increased demand for housing, goods, and services will probably have an inflationary effect on the local economies. This could severely affect residents on fixed incomes.

Because prices on most goods are determined from a much wider region, no project-induced inflation is expected at the Fort Martin site. Cost of housing may become inflated because of increased competition.

Operational impacts

A certain number of service jobs created during the construction phase will probably remain as a significant part of the area economy. These positions will be needed to serve the demands of operational-phase employees and the normal growth experienced by the impact area during construction. Some workers may return to their previous occupations, which would result in some reversion from part-time farming and working in a commercial establishment to full-time farming. The industrial sector, however, could remain a significant part of the area economy beyond the operational phase if complementary industries relocate to the impact area. Planning agencies in the broader Green River area maintain policies favorable to increased industrial growth in the region.

4.3.4.6 Labor and income

Construction impacts

It can be anticipated that the unemployment rate will decrease in the impact area during the construction phase, because many direct and indirect jobs will be filled by area residents. The TVA relocation analysis of direct plant employment presented in Sect. 4.2.4 estimated that about 20% of the required labor during peak construction would come from the immediate four-county area. A much higher percentage of the 1400 indirect jobs created in the four-county area can be expected to be filled by this same labor force.

Spending of primary income by the construction labor force (construction payroll) will result in the generation of secondary incomes received by local businesses in the respective counties. Total secondary incomes generated are given in Table 4.39.

Table 4.39. Secondary incomes received by counties as a result of construction employment spending, peak employment period
(1980 dollars)

Ohio	17,637,000
Daviess	12,703,000
McLean	8,294,000
Muhlenberg	20,052,000
Total for impact area	58,686,000

Operational impacts

A sizable portion of the workers employed during the construction phase of the SRC-II facility will most likely leave the area when the plant is completed. Among those remaining, a certain increase in unemployment may result, at least temporarily; this impact is not expected to be as pronounced in the more urbanized primary site region. If complementary industries enter the Equality area, this effect could be minimized.

4.3.4.7 Local government taxation and spending

Construction impacts

Local governments of the four-county Equality impact area will experience some increase in property tax revenues resulting from expansion in the residential and commercial sectors, which is expected to accompany project-induced population growth. These property tax revenues, however, will not be sufficient to cover the substantial local expenditures that will be required for the expansion of public services during the construction phase. Since the SRC-II plant will be held in title by the Federal government, the project will be exempt from property taxation. Although there are both sales and income taxes in Kentucky, these revenues are not returned to the locales in which they were collected. The net fiscal impact on local governments resulting from the need to make capital-intensive expansions in public services and the minor increases in revenues available for the expansions could be severe.

Operational impacts

Federal ownership of the facility is expected to be continued during the demonstration phase, thus maintaining the tax-exempt status of the plant.

Because of the local government expenditures required during the construction phase, any loss of tax dollars could worsen the problem of recovering those capital investments. Direct financial assistance to pay for needed services in a timely fashion should be investigated as a means of limiting local fiscal impacts. New residential and commercial properties added to the local tax rolls during the construction phase will continue to contribute to local revenues, but there could be some loss of revenue if mobile homes are removed from the area or if property abandonment results from overbuilding during the construction phase.

4.3.4.8 Historic and archaeological resources

Construction impacts

No known historic sites will be affected by construction of the SRC-II facility, but several archaeologically significant sites may be affected. At least two sites in the Ohio County area are being considered for inclusion in the National Register, and it is estimated by state

archaeologists that up to 30 other sites of major significance may exist in the Ohio County portions of the Green River bottomlands (see Sect. 3.3.4.8). If these or other sites of importance would be irreparably disturbed by plant construction, excavation of the sites before construction should be considered.

Five sites at Fort Martin that are eligible for listing by the National Register of Historic Places have had appropriate mitigating strategies proposed and agreed upon.

Operational impacts

No further impacts on historic or archaeologically significant sites are anticipated during the operational phase of the plant.

4.3.4.9 Impacts of commercialization or decommissioning

Commercialization of the SRC-II plant after the demonstration phase will require an eight-year construction period with a peak work force of about 5000. It is anticipated that the impacts occurring in the four-county region during that period will be much the same as those outlined above, but on a larger scale. The capacities of local housing, public service, and transportation systems would be increasingly strained by commercialization, and the previously discussed fiscal impacts stemming from the need to make significant expenditures for public services without a corresponding increase in tax revenues would be magnified. Ohio County alone would receive substantial tax revenues from the plant if ownership is transferred to the private sector at the onset of commercial operations. All other impact-area jurisdictions, including the Ohio County municipalities of Hartford and Beaver Dam, will not be empowered to tax the facility and will receive no tax revenues.

If the plant were decommissioned after the demonstration phase, a temporary period of unemployment and economic adjustment, possibly accompanied by some out-migration, would most likely result.

4.3.4.10 Cumulative impacts

A number of other construction projects planned for the area within about 116 km (70 miles) of the proposed Equality site could combine with the construction of the SRC-II facility to produce significant cumulative impacts in the impact region. Up to 20,000 new construction jobs could be created in the general area through planned or projected power plant and synthetic fuel facility construction (Sect. 4.2.4). It is expected that a very large proportion of this work force would be in-movers. The previous impacts projected to accompany the peak work force of 3800 for the SRC-II facility could be increased dramatically by this combined work force to about six times the SRC-II figure. Although it is not likely that all these projects will materialize, a serious evaluation of their impacts combined with the SRC-II impacts should be made. No cumulative impacts are expected at the Fort Martin site.

4.4 ALTERNATIVE SITE — RAVENSWOOD, WEST VIRGINIA

This section identifies the impact issues that could arise should the Ravenswood site be the location of the proposed SRC-II demonstration plant. This evaluation was conducted to determine whether the Ravenswood alternative site offered the potential for appreciably reduced impacts. Impacts on the Ravenswood site are based on general site characteristics, without a plant layout or detailed monitoring data.

4.4.1 Land

4.4.1.1 Land use

Construction impacts

The agricultural, forest, and recreational uses to which the site is currently subject (Sect. 3.4.1.2) are likely to be displaced by plant construction. Specifically, this means that a sizable parcel of prime farmland and the locally utilized Keraland recreation area will both probably be lost to use. The proposed plant may also adversely affect the nearby Kera Lakes area and the neighboring residential community of Ripley Landing, because of noise, additional traffic, and heightened industrial character, which are likely to result in the vicinity of the

site. In addition, air pollution resulting from plant operations could have some effect on sensitive agricultural plants, such as soybeans and pasture grasses, in the vicinity of the site. The maximum effect would probably be slightly reduced agricultural productivity in areas of maximum air pollutant concentration.

In the larger socioeconomic impact region, conflicts between new and existing land uses could also occur. The influx of project workers and their families, which is expected to result from construction of the proposed plant (Sect. 4.4.4.1), will probably be accompanied by expansion of the residential and commercial sectors, which could compete with agricultural uses for available land. It is also possible that, in the upcoming period of rapid growth, residential and commercial uses could be hastily placed in areas in which they are not appropriate. However, because of recent trends in the impact area toward expansion of the residential and commercial sectors (Sect. 3.4.1.2), it is not expected that any land use conflicts resulting from this project will be completely unprecedented or unanticipated.

Operational impacts

Although there will be no new surge of population growth during this period, which indicates basic stability in the residential and commercial land use sectors, and, although the facility will have already been built, the changes engendered during the construction phase will remain. In addition, however, it is possible that, even in the absence of generalized new growth, those land use conflicts caused by the expanding residential and commercial sectors may continue to cause land conversion in specific areas in which sensitive land uses are affected by their neighbors on an ongoing basis.

4.4.1.2 Geology and soils

Construction impacts

Erosion of topsoil during construction activities could result in permanent loss of soils. Some soil loss is unavoidable, but the magnitude of this impact can be reduced by maintaining vegetation on areas not actually necessary for construction. Also, use of sediment retention structures during construction and maintaining cover over stockpiled soils will reduce soil losses. The same mitigating measures discussed in Sect. 4.2.1.2 would be applicable to the Ravenswood site.

Because of the coarser soil texture and gentler slopes, the quantity of soil that would be lost during construction would probably be less than at the proposed site, depending on plant layout. Construction in the areas of sandy and gravelly loams would probably result in less erosion and transport than in areas of silty deposits. Clays and silt loams are more prevalent at the Monongalia County site. Grading and compaction of soils that result in reduced permeability and destruction of soil structure are expected to limit productivity of the soils for future agricultural use. This impact is unavoidable in preparing the site for construction. If the facility is decommissioned and removed, soils would take years to redevelop current productivity. Because of higher quality of soils at Ravenswood, the effects of soil loss would be more significant than they would be at the proposed site.

Operational impacts

Operational effects related to geology are (1) unavailability of mineral resources of the site, (2) possible foundation settlement, and (3) reduction in soil productivity.

During the time the facility operates, sand and gravel deposits would not be available for production. Gravel pits are in operation in other local areas, and large reserves of this commodity are in the region. Development of any existing gas or oil reserves beneath the site would be complicated by the existence of an industrial facility on the site. The proposed site is underlaid by coal and possibly other developable resources and would be similarly affected by the presence of the SRC-II plant.

Foundation conditions on the site are unknown, and comparison with the proposed site is not possible. If poorly consolidated or clayey sediment underlie the site, prevention of foundation settlement may require preconsolidation.

Chemical spills, fuel spills, or leakage of leachate through liners of coal or waste storage areas may result in gradual accumulation of undesirable materials. This situation could limit

future productivity of the soils. Deposition of particulates and cooling tower drift on soils may alter soil chemistry slightly and affect soil fertility by altering microbial conversion of certain nutrients. The magnitude of this impact depends largely on precautionary measures used in plant operation coupled with an effective environmental monitoring program during operation. The higher quality of soils and farmland at this site make these effects more significant than they would be at the proposed site.

4.4.1.3 Terrestrial ecology

Construction impacts

Construction at the Ravenswood site would displace cultivation of prime farmland. In addition, both the forest along Spring Creek and the Keraland recreation area, which are used for recreational purposes by Kaiser employees, might be destroyed. The Spring Creek forest appears to be an important ecological resource because this forest type is rare. If construction could be largely limited to the farmlands, the botanical value of the forest and the forest's value to most wildlife would be preserved. The ecological values of this site are greater than those of the proposed site.

Operational impacts

Although emissions of air pollutants would be identical at all sites, the potential for ecological effects of air pollution appears to be greater at the Ravenswood site. Forested hills that rise to 100 m (328 ft) above the site immediately to the east and west could experience relatively frequent contact with plumes of air pollutants from the plant.

No endangered species are known to occur on the Ravenswood site, although habitat conducive to the Indiana bat, which is Federally designated as endangered, may be present in riparian forests on the site.

4.4.2 Water

4.4.2.1 Surface water hydrology

Construction impacts

Potential construction impacts on hydrology at the Ravenswood site are (1) increased runoff and siltation in Spring Creek and (2) alteration of site drainage affecting flows in Spring Creek. If a substantial fraction of the Spring Creek watershed is disturbed during construction, runoff from the site may be substantially increased. If controls are not effectively employed, this runoff could result in increased local flooding and greater erosion and sediment loads. Clearing of vegetation on site, soil disturbance, and compaction will tend to increase surface runoff. Much of the site is drained by Spring Creek, which would receive increased flows. Erosion of soils from the site could result in siltation of the Spring Creek watershed and embayment. This impact can be minimized by maintaining a buffer zone of undisturbed vegetation, use of settling basins to reduce suspended sediment load, and maintaining grass cover when possible. Due to the presence of valuable ecological areas and their relationship to the existing site drainage pattern, the hydrologic impacts at the Ravenswood site during construction are considered to be more significant than those at the proposed site.

Operational impacts

The compaction of soils and paving of the plant area will result in reduced infiltration of precipitation and increased runoff. Generally, design requires collection and treatment of runoff from storms of a frequency of 10 years (24-h storm duration) or less. After treatment, the runoff water may be routed to the Ohio River or used within the plant. These options would result in lower flows in Spring Creek, particularly during storm events.

Site elevations are generally above the 100-year frequency flood event estimated by the U.S. Army Corps of Engineers. However, some flood damage may occur to barge or pipeline facilities located near the river. (The Ravenswood site is discussed in the floodplain/wetlands assessment presented in Appendix D.)

The proposed SRC-II facility would consume about 0.23 m³/s (8.0 cfs), which would represent 0.08% of the 7-d, 10-year low flow of 300 m³/s (Sect. 3.4.2.1). A commercial SRC facility would consume

about 0.8 m³/s (28 cfs), or 0.3% of the 7-d, 10-year low flow. Consumption of river water is considerably more significant at the proposed site than at the Ravenswood site.

Location of the proposed SRC-II plant at the Ravenswood site would encroach on the Ohio River floodplain. This encroachment would be larger and more significant than at the proposed site.

4.4.2.2 Groundwater

Construction impacts

Location of plant facilities near the Ohio River could require extensive dewatering during construction of foundations. Such dewatering would lower groundwater levels in the alluvial aquifer and could affect well yields in neighboring areas. This is not considered a potential issue at the proposed site.

Water levels would probably return to normal levels after construction ceases unless extensive compaction of the soil or alluvium occurs. Little impact on groundwater quality is likely to occur during construction.

Operational impacts

At the Ravenswood site the Ohio River alluvium contains a valuable aquifer that is widely developed for municipal and industrial water supplies. Sources of groundwater contamination are similar to those discussed in Sect. 4.2.2.2. The impacts of spills or leachate penetration are likely to be greater at the Ravenswood site than at the proposed site because (1) the soils are coarser in texture, which reduces the amount of contaminant absorption and increases the infiltration rate, and (2) the flow in the alluvial aquifer may carry the contaminants toward the groundwater users. Faster groundwater flow rates in the alluvium facilitate dilution of contaminants but could also decrease the amount of time available for the cleanup operation should contamination occur. Site-specific groundwater flow studies are required to determine more precisely the nature of the impact.

Ohio River alluvium yields large volumes of water to wells in the area, and yields to individual radial collector wells utilizing induced filtration may range from 4543 to 7192 liters/min (1200 to 1900 gpm). Use of the alluvial aquifer as a source of process water may cause serious drawdowns unless wells are located near the river and are equipped for induced filtration. Groundwater availability at the proposed site is insufficient to meet process water consumption requirements. Reduced infiltration of rainfall caused by paving or soil compaction may lower local groundwater levels. However, such decreases would probably be of a small magnitude and would only be noticeable directly below buildings.

4.4.2.3 Surface water quality and aquatic ecology

Construction impacts

Potential construction impacts on surface water quality and aquatic ecology at the Ravenswood site include effects of constructing the water intake and treated wastewater discharge structures and temporary barge facilities, site runoff into the Ohio River (and the Spring Creek drainage if it remains intact once construction has commenced), disturbance and/or destruction of the Spring Creek Basin, and shoreline disturbance of the Ohio River during site preparation. The adverse impacts to onsite water bodies are considered to be more significant at this site than at the proposed site.

Although Spring Creek appeared moderately sedimented on site (Sect. 3.4.2.3), the slough on site may serve as a spawning habitat, nursery, or refuge for Ohio River biota. The creek and slough are also of importance from the standpoint of terrestrial ecology (Sect. 3.4.1.3). The extent of construction impacts would depend on the amount of site preparation required and the exact location of facilities on the site. Site runoff during construction would represent a small incremental source of sediments and dissolved solids added to the already turbid Ohio River. Site runoff at the proposed site would add dissolved solids to the Monongahela River, which is an existing concern, especially during low flow.

Operational impacts

Operational impacts of the proposed SRC-II facility, if sited at Ravenswood, would include effects of water intake (impingement and entrainment of aquatic biota), the treated wastewater discharge, barge traffic and associated activities, and spillage of coal or other materials. Water intake effects on Ohio River biota would depend on the design of the intake structure and its location relative to the distribution of biota, but it would appear to be of low significance in comparison with impacts on the Monongahela River at the proposed site. Barge traffic and coal spillage related to the proposed SRC-II facility at Ravenswood would produce only minor impacts on water quality or aquatic ecology. Barge traffic is a concern at the proposed site, especially as it relates to lock capacity and the water required for lock operation. Site preparation, construction, or operation of the facility at the Ravenswood site is not expected to have any adverse effects on aquatic species designated as endangered, threatened, or otherwise of concern to Federal or State authorities (Sect. 3.4.2.3).

Impacts resulting from wastewater discharge to the Ohio River are analyzed in Table 4.40 (structure of analysis and assumptions are similar to analysis in Sect. 4.3.2.2). Because of the large dilution capacity available in the Ohio River, the SRC-II discharge would appear to have no significant impact on water quality. When the effluent is fully mixed, the only water quality constituents not in compliance are those for which ambient water quality exceeded the recommended level.

Table 4.40. Mixing of SRC-II effluent with 7-d, 10-year low flow of Ohio River, Ravenswood site (194,000 liters/s)^a

Constituent	Water quality standard (mg/liter)	Maximum ambient concentration ^b (mg/liter)	Fully mixed concentration (mg/liter)	Compliance with standard (mg/liter)
Arsenic	0.05	<0.01 ^c	<0.01	Yes
Cadmium	0.0012	0.007	0.007	No ^d
	in hard water			
Chromium	0.05	0.016	0.016	Yes
Copper	1.0	0.06	0.06	Yes
Cyanide	0.005	Assume 0	0.0001	Yes
Iron	0.3	9.0	9.0	No
Lead	0.05	0.05	0.05	Borderline ^d
Manganese	0.05	0.62	0.62	No ^d
Mercury	0.00005	0.0008	0.0008	No ^d
Phenol	0.001	Assume 0	0.0003	Yes
Selenium	0.01	<0.005 ^c	0.005	Yes
Total suspended solids		306	306	Yes
Zinc	5.0	0.19	0.19	Yes

^aSee Table 4.8, Sect. 4.2.2.3, for mixing formulae and maximum effluent concentrations.

^bFrom Table 3.36, Sect. 3.4.3.3.

^cWhere values were reported as "less than" some concentration, it was assumed that the concentration was equal to that value.

^dMaximum ambient concentrations of these constituents exceeded the standard.

4.4.3 Air quality

4.4.3.1 Construction impacts

The proximity of Ravenswood to the Kaiser facility could produce significant air quality impacts on currently undeveloped areas. The Ravenswood area currently enjoys better air quality than does the proposed site, and the Ravenswood alternative site is not close to major nonattainment areas.

Impacts of fugitive emissions during construction would probably be about equal to those predicted at the proposed site, because the Ravenswood site would require similar earth-moving activity. However, the Ravenswood site is expected to generate less fugitive dust because of lower wind speeds at the site.

4.4.3.2 Operational impacts

Routine emissions would be similar at both sites, but the poorer dispersion at the Ravenswood site would increase ground-level concentrations of pollutants emitted by the facility by perhaps 5%. Impacts of pollutant releases during accidents could be greater at the Ravenswood site because of the proximity to the Kaiser facility. Were the winds to carry the accidentally released pollutants to the Kaiser facility, the impacts from toxic gases under worst-case conditions could pose a health threat. If winds blow in any other direction, the impact from an accident would be less at the Ravenswood site than at the proposed Fort Martin site.

4.4.4 Economic, social, and cultural impacts

As mentioned in Sect. 3.4.1.2, the primary share of the socioeconomic impacts generated by the proposed SRC-II facility will be experienced in the largely rural counties of Jackson and Mason, West Virginia, and Gallia and Meigs, Ohio. The following discussion will therefore focus on these four jurisdictions.

4.4.4.1 Population

Construction impacts

Direct construction employment will peak at about 3800 workers* halfway through the projected three-year construction phase. Using a computerized work force relocation model (discussed in more detail in Sect. 4.2.4.1), it was calculated that about 35% of the construction labor force will move into the area within 116 km (70 miles) of the proposed facility, whereas the remaining 65% of direct construction jobs will be filled by current area residents. Of the 1275 in-migrants, 785, or 62%, will relocate in the four-county impact area. These in-migrants can be separated into two distinct categories: movers and travelers. Table 4.41 shows the number of movers and travelers who will reside in the impact region during the peak construction period and the number of current residents from those four counties who will commute to work at the project.

Table 4.41. Estimated number of commuters, travelers, and movers at peak construction employment in socioeconomic impact region

County	Commuters from county ^a		Travelers locating in county ^b		Movers to county ^c		Total	
	No.	Percentage	No.	Percentage	No.	Percentage	No.	Percentage
Jackson, W. Va.	765	30.3	260	33.9	170	33.8	1190	31.4
Mason, W. Va.	365	14.4	120	15.3	80	15.4	550	14.7
Gallia, Ohio	145	5.7	60	7.5	35	7.4	225	6.3
Meigs, Ohio	175	6.9	55	7.3	35	7.4	265	7.1
Outside impact area	1075	42.7	280	36.0	210	42.6	1570	41.4
Total	2525	100.0	775	100.0	530	100.0	3800	100.0

^a Commuters are residents of county before SRC-II who drive to and from work daily.

^b Travelers live in county during the week but maintain a permanent residence elsewhere.

^c Movers relocate permanent residence when they start employment at SRC-II.

Population in the impact region will increase not just by the number of direct construction employees moving in, but also by those dependents that accompany workers to the area. In addition, construction activity will stimulate about 2900 indirect jobs in the service and support sectors of the economy due to the relatively rural nature of the area; about 10% of these jobs will be filled by in-movers. These 290 in-movers will also be accompanied by a certain number of dependents. Based on data gathered at 13 TVA power plant projects in the last four years, it is assumed that all travelers will come alone, but that 65% of movers will be accompanied by families of the average size.

*The analysis presented here was performed using only the current best available estimate of construction work force at both the Ravenswood and Fort Martin sites. The analysis indicates that the Fort Martin site is preferable to the Ravenswood site using this size work force, and that this judgment would only be reinforced with a larger work force.

Table 4.42 shows the total (direct and indirect) in-migration expected in the impact region, by county, during the peak construction phase. The proportion on in-migrants to current residents ranges from a low of 0.5% in Gallia County, Ohio, to a high of 3.5% in Jackson County, West Virginia. Comparing these in-mover figures with the existing population of the major urban centers in the impact region, however, where the majority of new residents are likely to settle, the magnitude of the influx becomes more substantial. In Jackson County, projected in-migration is equal to 12% of the current combined population of the municipalities of Ripley and Ravenswood. In Mason County, in-migration will amount to 7% of Point Pleasant's existing population. In Gallia County, Gallipolis' current size would increase by 3.5% if all in-movers settled there. Finally, in Meigs County, the total projected in-migration equals 3.5% of the combined populations of Pomeroy and Middleport. In the major municipalities of all four counties, therefore, and particularly in Jackson and Mason, project-induced population growth is likely to be sudden and relatively substantial. Specific impacts on community systems that are expected to accompany this growth will be discussed in the following sections.

Operational impacts

The total construction labor force will approach 3800 at the peak, but direct employment during the operational phase will amount to only 460 workers. Major population impacts engendered during this period will therefore be associated with population stabilization and possibly even decline, rather than with rapid growth as in the construction phase. A fair number of the indirect jobs created during the construction period may remain in the area, and the development of new commerce and industry may take up some of the slack in employment left by completion of SRC-II. Nevertheless, the operational phase is likely to be characterized by a scaling down of employment and population from the heights of the construction period.

4.4.4.2 Housing

Construction impacts

Within the four-county impact region, it is projected that in-moving workers (direct and indirect) will require about 1000 dwellings units (this figure is derived by taking the total number of direct travelers, direct movers, and indirect movers and assuming that each worker, single or with family, requires one unit of housing). In the same four counties, about 1200 to 1600 dwelling units are currently vacant (Table 3.38). However, despite this seeming surplus of housing, there may still be a noticeable housing shortage in some local areas. Further, this does not assume that all housing is of equal quality.

The explanation for the above is twofold. First, the demand for housing is not uniform for all housing types. Based on the observed demand of TVA construction workers at more than a dozen recent projects, it is expected that the total housing demand of 1000 units will break down into a need for 500 single-family homes, 245 mobile homes, and 255 apartments and sleeping rooms. It is probable that the required number of housing units by type will not be uniformly available in all four impact counties; providing the 255 apartments and sleeping rooms may prove a particularly difficult problem. Also, the number of vacant units of all types are not spread uniformly throughout the impact region. In Jackson County, where about 520 housing units will be required, only 280-467 will be available. If the lowest figure is used, the shortage could be significant, which would force workers to live in other areas, in nonpreferred housing types, or in crowded or substandard conditions. Rapid, unplanned housing growth and an inflated local housing market could result from a strong local demand for housing that outruns supply. The pressure is likely to be eased to some degree, however, by housing surpluses in neighboring Mason and Gallia counties. The current existence of a healthy and active residential construction sector in Jackson County may also mitigate some of these potential impacts. In addition to the situation discussed above, Table 4.43 also shows a probable housing shortage in Meigs County.

Although it is likely that there will be some short-term housing pressure in the Morgantown, West Virginia, area, it is not expected to be any more problematic than that at the Ravenswood site.

Operational impacts

Because of the stabilization and possible decline of population levels in the impact region during the operational phase, the housing stock in existence at that time should be more than adequate to accommodate demand. On the other hand, if the housing stock grows too rapidly during the

Table 4.42. Total in-migration for socioeconomic impact region

County	Population	Total travelers ^a (direct)	Direct movers			Indirect movers			Total in-migration	In-migration as percentage of current population
			Workers	Dependents ^b	Total	Workers	Dependents ^c	Total		
Jackson, W.Va.	25,597	260	170	240	410	90	125	215	885	3.5
Mason, W.Va.	26,763	120	80	115	195	45	65	110	425	1.5
Gallia, Ohio	30,152	60	35	50	85	15	20	35	180	0.5
Meigs, Ohio	23,641	55	35	50	85	20	30	50	190	1.0

^a Assuming all travelers come alone.

^b Assuming 65% of direct movers have families with average size of 3.2 persons.

^c Assuming 65% of indirect movers have families with average size of 3.2 persons.

Table 4.43. Housing supply and project-induced demand in the socioeconomic impact region, 1980

County	Vacancies	Project-induced demand	Surplus	Deficit
Jackson, W. Va.	280-470	520		50-240
Mason, W. Va.	> 500	250	> 250	
Gallia, Ohio	340-580	110	230-470	
Meigs, Ohio	< 90	110		> 20

construction phase, a surplus could result during the operational phase and could cause negative effects on the local housing market. This kind of overbuilding is also a danger in the public service and transportation sectors as well, in which expensive facilities may become underused as local population steadies or declines after the rapid growth of the construction phase. If the demonstration phase is followed by commercialization and the expanded work force that this entails, any additions and improvements to the local infrastructure made before that time are certain to receive continued use. Underuse could still occur, however, after this newest stimulus to local growth is removed.

4.4.4.3 Public services

Construction impacts

The 1680 new residents that are expected to settle in the four-county impact region as a result of SRC-II construction will add to existing demands on public services, many of which are already seriously strained (Sect. 3.4.4.3). In Jackson County, West Virginia, in which in-migration will be heaviest, the Ravenswood water system and the Ripley sewer system are currently operating at or over design capacity (Table 3.39). The addition of a significant project-induced demand will greatly worsen the situation unless those improvements currently being contemplated are actually made before peak construction. In Mason County, West Virginia, the major sewer system is also near capacity and is expected to be similarly strained by project-induced population growth unless planned improvements are made in a timely fashion. Gallia and Meigs counties, Ohio, are also likely to experience some degree of stress as a result of adding new demand to currently overloaded service systems. As described in Sect. 3.4.4.3, Gallia County's sewage treatment system, although nominally able to handle more demand, has frequent pump station failures and is generally obsolete. Currently, Morgantown has a surplus water and sewage capacity.

County schools are also at or near capacity but approval of an upcoming school bond could change this. In Meigs County, existing sewer and water systems cannot handle new growth without difficulty, which will necessitate improvements if project-induced demand is to be accommodated. Improvements are also likely to be required in several of the county's schools if new students are to be accommodated in a reasonable manner.

Morgantown currently has available spaces below the high school level, but some high schools are at capacity. No expansion is considered necessary, but some facilities may have to be upgraded.

Operational impacts

As in the housing market, no significant new demand for public services is expected as a result of operational-phase activities.

4.4.4.4 Transportation

Construction impacts

Project-induced automobile traffic will severely strain the capacities of several critical sections of roadway in the Ravenswood impact area. Table 4.44 shows that level of service "E" capacities will be exceeded during peak hours on State Route 2 between Ravenswood and Mount Alto (section B), on U.S. 33 between Ripley and Ripley Landing (section C), and on State Route 2 between Mount Alto and Point Pleasant (section F). Level of service E represents the peak

Table 4.44. Construction-induced traffic and road capacities for the Ravenswood site

Road section ^a	Current peak hourly count ^b	Project-induced vehicles at peak hours	Total construction-phase traffic	Level of service "E" hourly capacities ^c
(A) State Route 2 (I-77 to Ravenswood)		358		NA
(B) State Route 2 (Ravenswood to Mt. Alto)	600	855,1920,1099	1455,2520,1699	1800
(C) U.S. 33 (Ripley to Ripley Landing)	700	821	1521	1440
(D) U.S. 33 (Mount Alto to New Haven)	380	404	784	1800
(E) U.S. 33 (New Haven to Mason)	380	404	784	1600
(F) State Route (Mount Alto to Pt. Pleasant)	650	695	1345	1340

^aRoad sections are shown in Fig. 3.15.

^b1979-1980 actual traffic counts. The peak hour for section B is 3:00-4:00 PM and, for all other sections, 4:00-5:00 PM.

^cLevel of service "E" represents the peak number of vehicles traveling in both directions that can be accommodated by a given section of road.

number of vehicles traveling in both directions that can be accommodated by a given section of road. At this level of service, the smooth flow of traffic is subject to breakdown because vehicles are at minimum spacing. When this level is exceeded, as is expected for these three sections, the traffic flow is certain to break down, and substantial delays are likely to occur. Three figures are listed for section B, because projections were made for three separate subsections of this route. About 1450 vehicles are expected at the peak hour of traffic on the subsection of State Route 2 between Ravenswood and the proposed site; 2520 vehicles are forecast to use this route between the site and the small community of Ripley Landing; and 1700 vehicles are expected between Ripley Landing and Mount Alto. The figures show that the 1.6-km (1-mile) stretch of State Route 2 between Ripley Landing and the site will experience the most intense traffic congestion; the much longer sections C and F will also exceed their design capacity, but not by as large a margin. It should be remembered that the "E" level capacities shown in Table 4.44 are for two-way flow. Serious problems are likely to occur when even 70 to 75% of this peak number of vehicles are all traveling in the same direction. Accordingly, the entire length of section B is likely to be a problem area.

Figure 4.3 illustrates the location of all the communities mentioned above and the number of project-induced commuter vehicles that will be using area roads during the peak of the construction phase. These figures were calculated by the same method used from the Equality impact area (Sect. 4.3.4.4).

In addition to the automobile traffic discussed above, trucks carrying heavy equipment and building supplies are expected to add to congestion in the area. To mitigate the expected traffic problems (automobile and truck), staggered working hours should be considered, as should the option of widening and improving existing roads, instituting a commuter bus service, encouraging car and van pooling, and making deliveries of equipment and materials during off-peak hours.

Some of the additional strain to area roads caused by truck traffic could be reduced by using rail and barge service to transport heavy equipment and building materials to the site. Barge facilities are adequate to handle this load, and rail facilities are available but may require some improvements.

Currently, access roads to the Fort Martin site area are structurally inadequate and are also inadequate for the volume of traffic. The State of West Virginia is committed to upgrading the roads.

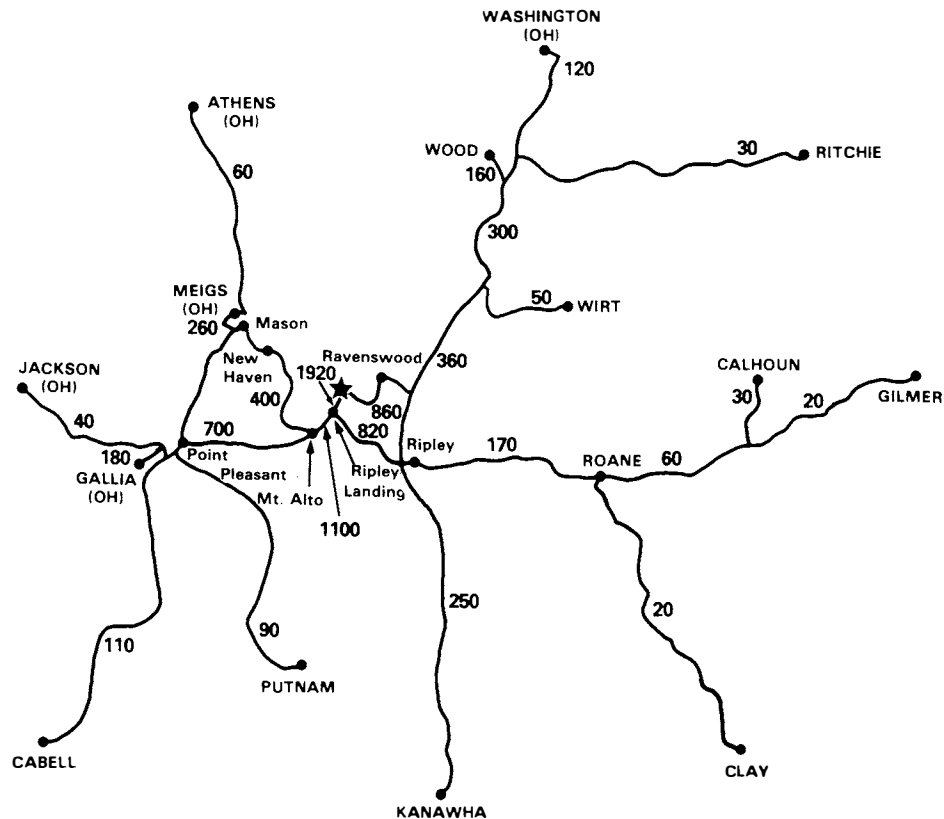


Fig. 4.3. Estimated number of commuter vehicle round trips on selected road sections: Ravenswood impact region.

Operational impacts

Automobile traffic will be dramatically reduced at the end of the construction phase, which will eliminate much of the stress to area roads identified above. Although there may be some increase in truck traffic because of the need to deliver materials and equipment to the plant, this should not be of major importance, because the facility's major transport need — the delivery of raw coal and the removal of finished products — will be served by rail and barge lines. Should coal deliveries be, in fact, made by truck, as may be the case if significant tonnage is obtained from neighboring counties, the adverse effect on area roads could be significant.

4.4.4.5 Economic base

Construction impacts

The economic character of the socioeconomic impact region will change somewhat during the construction phase as project-induced direct and indirect employment cause the construction and service sectors of the economy to expand. This will be particularly pronounced in Jackson County, in which more than 1200 new construction jobs and 900 service and support jobs will be created, and in Mason County, in which 550 new construction jobs and 450 service and support jobs are expected. In addition, retail trade in the entire four-county region is expected to increase with the influx of sizable numbers of highly paid construction workers.

Operational impacts

Although construction employment will drop dramatically after the project is completed and the number of service jobs may also decline, the operational phase is still expected to produce a somewhat different economic character than that existed before construction. The presence of the SRC-II facility in Jackson County will add to the industrialization of the area, and the demand for coal is likely to strengthen the importance of mining in this region, particularly in Gallia and Meigs counties. Retail trade volumes, although remaining higher than during the preconstruction phase, are not expected to grow beyond construction-phase levels as a result of operational activities.

4.4.4.6 Labor and income

Construction impacts

Unemployment rates in the entire four-county region are expected to decline significantly during the SRC-II construction phase. About 1450 construction jobs and 1700 service and support jobs will be filled by current residents of the impact area. In Jackson County, in which the unemployment rate of 7.2% is substantially higher than in the other three counties (Table 3.42), the decline in joblessness should be especially dramatic. Nearly 765 construction jobs and more than 800 service and support jobs will go to current Jackson County residents. Concurrent with the decline in unemployment area incomes should rise because of the addition of large numbers of high-paying construction jobs. The attractiveness of these wages could in turn bid up the wages paid by existing employers as they compete for workers. Another result of rapidly rising incomes could be the onset of local inflation in the prices of property, rents, and consumer goods, which would be particularly damaging to the poor and those on fixed incomes.

Because prices on most goods are determined on a much wider region, no project-induced inflation is expected at the Fort Martin site. Cost of housing, due to increased competition, may become inflated.

Operational impacts

When the SRC-II plant is built, the large number of high-paying construction jobs described above will disappear, as may some portion of the newly created service and support jobs. The most likely operational-phase impact, therefore, is that of a sharp jump in local unemployment, at least until adjustments can be made in the local labor market. Again, this is expected to be more pronounced here than at the proposed site. At the same time, income levels may decline, as may any local inflation that accompanied construction. By advance recruitment of new commercial and industrial enterprises to the area, local governments may avoid the most serious economic disruptions that could occur in the early years of the transition period from construction to operation.

4.4.4.7 Local government taxation and spending

Construction impacts

The proposed SRC-II facility represents a very large potential source of income to Jackson County, the jurisdiction in which the facility is to be located. The facility is not expected to be taxable during the demonstration phase, however, because it will be Federally owned. Still all four impact counties will receive some additional property taxes from new residential and commercial construction that is expected to accompany population growth. Although there is a state sales tax, no revenues from this source are returned directly to local governments based on the amount paid in. The same is true of the state income tax. Finally, Jackson County may be able to collect some in-lieu-of-tax payments from the Federal government, and all four impact-area counties are likely to be eligible for Federal energy impact assistance funds and Federal and State aid for education.

On the other side of the ledger, there are significant public expenditures that will be required of all four counties and their municipalities for the public service improvements needed to accommodate growth. Without property tax payments from the facility, project-induced expenditures are expected to outstrip any available revenues. Even if the facility eventually becomes taxable, it will be long after construction-phase public investments have been made, and the revenues will go only to the rural districts of Jackson County, not to the surrounding counties.

and municipalities that will share the project-induced impacts. To mitigate this situation, careful consideration should be given to all available options for providing assistance to affected jurisdictions to help provide, in advance, needed public service and transportation improvements.

Operational impacts

During the operational phase of the plant, there will still be no property taxes collected from the facility, but some Federal energy impact assistance or in-lieu-of-tax payments may become available. At the same time, new residential and commercial properties added to the area during construction will still be paying taxes, although there could be some revenue loss here if overbuilding and abandonment occur or if construction-phase mobile homes are removed from the area.

On the expenditures side, there should be no pronounced demand for new public services, but local governments will still be paying for any construction-phase public service improvements. At this stage, possible mitigating measures include direct reimbursements for local infrastructure expenditures if assistance has not already been provided, assistance in obtaining Federal energy impact assistance or in-lieu-of-tax payments, and the transfer of facility title to private ownership, so that property taxes can be paid. If this latter step is taken, revenue-sharing arrangements could be encouraged between Jackson County and all affected jurisdictions, and the State's seven-year tax exemption for demonstration facilities would have to be carefully examined to see if it applies to local property taxes.

4.4.4.8 Historic and archaeological impacts

Construction impacts

As described in Sect. 3.4.4.8, the proposed project area is very rich in archaeological sites. Accordingly, excavation and construction in the Ravenswood area may unearth additional archaeological findings, which could be damaged or destroyed if proper care is not taken. To prevent this happening, a thorough archaeological survey should be done, and any significant sites that are discovered should be excavated and cataloged before construction. It will, however, be more difficult to protect any archaeological sites that may be disturbed by project-induced growth and development outside the site boundaries in the larger impact region. There are no historic sites on the Ravenswood site, but those located in the larger impact area could likewise be disturbed by development in the four-county region.

There are five Fort Martin sites eligible for the National Register of Historic Places; appropriate mitigating strategies have been proposed.

Operational impacts

Because the rapid growth expected during the construction phase is not expected to continue past the completion of the SRC-II facility, any project-induced disturbances to historic and archaeological resources in the impact area should, for the most part, also end at this time. Where land conversion does continue (Sect. 4.4.1.1), however, the possibility of adverse impacts to historic and archaeological resources will continue as well.

4.4.4.9 Impacts of commercialization or decommissioning

Should the proposed SRC-II facility successfully complete operations as a demonstration project, conversion to a full-scale commercial plant may occur. In this eventuality, socioeconomic impacts will be about the same as those outlined above, but the scale will be larger. Instead of lasting three years with a peak work force of 3800, commercialization will require an eight-year construction period with a peak work force of about 5000. It is expected, therefore, that there will be a corresponding jump in in-migration to the area, although the county-by-county distribution of in-movers is likely to remain similar. Land use conflicts are expected to be more intense than those projected earlier, as pressure increases for residential and commercial growth in the impact region. Housing and public service demands will also be much greater than during the demonstration phase, and traffic congestion, predicted to be significant for a work force of 3800, could be much more intense. The severity of these impacts could be reduced, however, if significant improvements to the local infrastructure are made during the demonstration phase.

At the same time, the danger of overbuilding is heightened (Sect. 4.4.4.2). Changes in the economic base are likely to be more pronounced, as will be construction-phase inflation and the consequent disruption following project completion. Impacts on historic and archaeological resources are also likely to be more serious during commercialization.

A major difference in kind between the demonstration plant and the commercialized plant will occur in the area of government taxation and spending. Expenditures will be greater during commercial plant construction, because of the greater level of impacts, but property tax could also be paid on the commercial plant. Should full ownership pass to the private sector at this point, as is currently planned, Jackson County would begin to collect taxes on SRC-II. The assessed value of the demonstration plant is expected to be about \$467 million (assuming a market value of about \$1.4 billion) compared with a current total assessed value of \$211 million for all property in Jackson County. The assessed value of the commercial plant could be considerably higher. Based on current tax rates (Sect. 3.4.4.7) and assuming that the value of the commercial facility will not exceed \$1.4 billion, the SRC-II facility would be liable for \$11.8 million annually, compared with a 1979 total of \$2.68 million in tax revenues for all Jackson County rural districts. Because of an absence of revenue-sharing arrangements, all these funds would stay in Jackson County's rural districts; none would go to the municipalities of Ravenswood and Ripley or to any surrounding counties. Thus, unless some form of area-wide revenue sharing is instituted, any adverse fiscal impacts experienced by the nontaxing jurisdictions will not be relieved when the plant goes on the tax rolls.

If the plant is decommissioned at the end of the demonstration phase, a loss of jobs (both direct and indirect) is likely to occur, possibly followed by some degree of population out-migration from the impact area. As long as the plant site remains Federally owned, the land will be lost for the purpose of further development and eventual contribution to the local tax base.

4.4.4.10 Cumulative impacts

In addition to the proposed SRC-II facility, a number of other large construction projects are planned or proposed for the area within 116 km (70 miles) of the proposed site during the early to mid-1980s. The Gas Centrifuge Enrichment Plant in Pike County, Ohio, near the existing Portsmouth Gaseous Diffusion Plant, is located about 110 km from the Ravenswood site and will have a peak work force of 3500 in 1984. Slightly closer to the Ravenswood site is ITT Corporation's proposed coal conversion facility in Putnam County, West Virginia, near Nitro, which will also employ about 3500 construction workers at its peak. Within 65 km (40 miles) of the Ravenswood site is another synthetic fuels plant planned for Putnam County. This one, under the auspices of the Co-Gas Development Company, will be near the small town of Buffalo; it is also expected to employ about 3500 construction workers. Finally, Ohio Synfuels, Inc., is considering locating a facility near Point Pleasant, in Mason County, West Virginia, about 20 miles from the Ravenswood site. The projected work force here is also about the same as for the other projects. All three synthetic fuel plants are currently in preliminary stages of development; grant proposals have been submitted to DOE for feasibility study funds. At the earliest, construction would probably not start until the mid-1980s. Still, if all these projects are built, it will mean an additional 14,000 construction jobs for the area that could coincide with the end of the SRC-II construction phase or possibly the beginning of commercial plant construction.

If all, or even some, of the major construction projects just described are built to coincide with SRC-II construction activities, the cumulative impacts could be significant. The size of the combined work forces in the Ravenswood area would certainly magnify those impacts projected earlier concerning in-migration, land use, housing, and public services, transportation, and local government spending, among others.

No cumulative impacts are expected at the Fort Martin site.

4.5 MONITORING PROGRAM

4.5.1 Introduction

An extensive environmental monitoring program will take place during construction and operation of the proposed SRC-II demonstration plant. A substantial portion of the monitoring program is intended, as it would be for any large demonstration energy facility, to demonstrate that the plant is being constructed and operated in compliance with existing environmental quality standards. A portion of the monitoring program will focus on early detection of pollutants or contaminants in ambient and work place environments so that adverse effects can be avoided or mitigated. The remainder of the monitoring program will be used to acquire an understanding

of environmental and health effects caused by the presence or release of chemical substances from SRC technology for which no legislated standard exists. Obtaining this data is one of the fundamental purposes of the SRC-II demonstration project.

More than one year of monitoring has already been carried out at the proposed site to support the impact predictions in this document (ER, Vol. 1). Additional baseline monitoring will be performed before construction to establish a more thorough scientific understanding of the site before project activity begins.

4.5.2 Compliance monitoring

Environmental monitoring will be carried out to demonstrate that the facility is being constructed and operated in compliance with environmental standards and regulations. Environmental standards and other requirements for construction (Table 4.45) and operation (Table 4.46) include consideration of occupational safety and health, air quality, water quality, solid and hazardous waste disposal, spill prevention and cleanup, noise, endangered species, proper management of floodplains and wetlands, and preservation of national historic landmarks.

Table 4.45. Major standards and regulations applicable during construction

Standard or requirement	Responsible agency	Remarks
Air		
National Ambient Air Quality Standards	State/EPA ^a	Compliance enforced through permit program
State air pollution control regulations	State	Requirements generally applicable to major construction activities
Fugitive dust control		
Open burning restrictions		
Water		
Water quality standards	State	
Construction effluent quality	EPA/State	Permit(s) required
Construction in navigable waters	Corps of Engineers	Permit(s) required
Control of oil and hazardous materials	EPA/Coast Guard/State	
Solid waste		
Resource Conservation and Recovery Act	EPA/State	Permit(s) required
State solid waste disposal regulations	State	Permit(s) required
Other		
Noise	EPA	Guidelines only
Endangered Species Act	DOI ^b	
National Historic Preservation Act	State/ACHP ^c	
Floodplains/wetlands management	DOE/WRC ^d	Executive Orders 11988 and 11990
Safety and health		
Safety and health regulations for construction	DOL ^e /OSHA ^f	29 CFR 1926
Occupational Safety and Health Standards	DOL/OSHA	29 CFR 1910

^aEnvironmental Protection Agency.

^bDepartment of the Interior.

^cAdvisory Council on Historic Preservation.

^dWater Resources Council.

^eDepartment of Labor.

^fOccupational Safety and Health Administration.

EPA, the Corps of Engineers, and other Federal, State, and local agencies require DOE to obtain a variety of permits and licenses to construct and operate the facility. The status of the major permits and licenses can be found in Sect. 1.3.3 and Appendix R of this FEIS. In many cases,

Table 4.46. Major standards and regulations applicable during operation

Standard/regulation	Responsible agency	Remarks
Air		
National Ambient Air Quality Standards	State/EPA ^a	Compliance enforced through permit program
Prevention of significant deterioration	State/EPA	Limitations included in the permit
New source performance standards	State/EPA	Currently no specific standards for coal liquefaction. Standards applicable to certain unit operations
State air pollution control regulations	State	No specific standards for coal liquefaction; generally applicable to industrial emissions
Water		
Water quality standards	State/EPA	Compliance enforced through permit program. No standards for most liquefaction processes
Effluent guidelines	EPA/State	No specific standards for coal liquefaction processes
Spill prevention control and countermeasures plan; spill contingency plan	EPA/Coast Guard	Plan required
State effluent quality standards		No specific standards for coal liquefaction processes
Solid wastes		
Resource Conservation and Recovery Act (RCRA)	EPA/State	Regulations have been promulgated
State solid waste regulations	State	No specific standards for coal liquefaction wastes; will probably be replaced by RCRA program
Noise	EPA	Guidelines only
Safety and health		
Occupational Safety and Health Standards	DOL ^b /OSHA ^c	Standard industrial regulations. Standards specific to coal liquefaction currently under development
Toxic Substances Control Act	EPA	Applicability to SRC now being evaluated (See Appendix T)

^aEnvironmental Protection Agency.^bDepartment of Labor.^cOccupational Safety and Health Administration.

these permits serve as action-forcing documents in that they require monitoring. The permit process provides citizens the opportunity to examine the final permit and license documents.

4.5.3 Additional monitoring

One purpose of the SRC-II demonstration program is to identify any serious health and environmental risks associated with the demonstration plant itself and a future commercial SRC industry and to minimize these risks before the onset of adverse effects. To understand these risks, it is necessary to look beyond current and projected environmental quality standards (Sect. 4.1). This is true, in part, because current and projected standards do not yet exist for all the possible chemical compounds that could be generated by such a facility.

To establish a thorough baseline and then to determine the environmental effects of construction and operation, monitoring programs will include the study of (1) environmental and health effects; (2) air quality and meteorology; (3) surface water quality and hydrology; (4) groundwater quality, soils, geology, and geohydrology; (5) aquatic and terrestrial ecology; and (6) socioeconomics. In addition, operational monitoring will include monitoring the actual emission sources, monitoring occupational environments, and conducting medical surveillance of the work force.

4.5.3.1 Environmental and health effects

DOE will develop a program to (1) monitor routine, fugitive, and emergency emissions from the plant to characterize the actual contaminants leaving the plant; (2) monitor the ambient environment to carefully study impacts predicted in this FEIS and the effectiveness of measures to mitigate them, detect impacts that were not predicted, and generally identify how contaminants are transported through the environment and where they appear or accumulate; (3) monitor occupational environments to determine worker exposure to routine, toxic, and biologically active chemical compounds so that they may be controlled to within recommended limits; (4) conduct medical surveillance of the work force to enable early detection of any signs of stress or adverse effects related to occupational exposures; and (5) conduct research studies to help develop a fundamental understanding of how the physical and biological environments respond to the unique chemical contaminants that appear in and around the plant as a result of the project. Clearly, the emphasis of the monitoring program is on prevention of adverse impacts through early detection and mitigation.

DOE's industrial partner will develop a detailed construction and operational monitoring program that will be reviewed and modified as appropriate to adequately address item number 2 in the preceding paragraph.

The basic elements of the construction and operational monitoring program are outlined in the following paragraphs. In each case, an estimate is made of the source of contaminants and the monitoring locations, frequencies, and parameters. Until the plant design and site layout are finalized, the scope of the monitoring program must remain flexible and adapt to final decisions. In all cases, the reader is referred to the *Environmental Monitoring Handbook for Coal Conversion Facilities*⁵⁹ for an in-depth discussion of monitoring methods and principles. Health effects monitoring is presented in Sects. 4.1.3.6 and 4.6 and in Appendix Y.

4.5.3.2 Solid wastes

The solid waste disposal areas for gasifier slag, water-soluble salts, process sludges, and catalyst/sorbents will be designed to meet RCRA criteria for hazardous wastes. Water that has come in contact with solid wastes will be collected so that the leachate can be sampled and treated (see landfill design in Appendix C). Analysis of the leachates will include those parameters used in the original leaching studies and parameters for EPA Priority Pollutants, with emphasis on priority trace metals and the priority organic fraction that includes PNA compounds. Preliminary testing can be done on solid wastes obtained from SRC pilot plants, but testing will still have to be done on solid wastes obtained under actual demonstration plant operating conditions.

When the facility becomes operational, additional characterization of actual solid wastes generated by the facility will be included as part of operational monitoring. This characterization will include screening tests for hazardous materials as defined under current RCRA regulations. In addition, tests will be run on the leachates produced from contact with surface waters and groundwaters characteristic of this area. Samples of gasified vacuum bottoms from the Fort Lewis SRC pilot plant were determined to be nonhazardous under these regulations (Appendix K).⁶⁰ However, as a worst-case assumption, this slag will be treated as hazardous waste for disposal purposes. All other solid wastes generated, with the exception of raw water treatment sludge, will probably be classified as hazardous under RCRA. The baseline design therefore calls for storage of these wastes in hazardous waste landfills constructed and maintained in accordance with RCRA and other applicable Federal and State solid waste guidelines and regulations.

When the facility becomes operational, all solid wastes generated, including the gasifier slag, will be tested to verify current determinations regarding their hazardous or nonhazardous nature. In addition, tests will be run on the leachates produced from contact of surface waters and groundwaters that are characteristic of this area with the solid wastes.⁶¹ Analysis of the leachates will include those parameters used in the original leaching studies and EPA Priority Pollutants, with emphasis on priority trace metals and the priority organic fraction that includes PNA compounds.

In addition, tests will be performed to (1) determine the compatibility of clay and synthetic liners with leachates generated from stored solid wastes, (2) measure the engineering properties of soils below the landfills, and (3) evaluate the capability of soils below the landfills to attenuate contaminants in the leachates.

4.5.3.3 Groundwater

Several sources of materials that have the potential for causing contamination of groundwater will exist within the proposed SRC-II facility. These areas include:

- coal storage areas,
- solid waste storage areas (including storage areas for slag, water-soluble salts, process sludges, and catalyst/sorbents),
- product tankage and handling areas, and
- wastewater collection and retention facilities (including storage of brine produced when the wastewater treatment system is operating in the zero-discharge mode).

Assessment of the environmental impacts of the proposed SRC-II facility is a goal of the demonstration project and will include additional groundwater monitoring beyond compliance monitoring. The following areas will be considered in planning groundwater monitoring:

1. Water between the bottom of the clay liner and the top of the water table in coal and waste storage areas will be sampled and analyzed.
2. Leachate from within the solid waste disposal area will be sampled and analyzed to determine the quality of waters that would potentially recharge the groundwater in that area of the site in the event of liner failure.
3. Water will be sampled and analyzed from wells located upgradient and downgradient from the following areas:
 - a. waste disposal area (shallowest aquifer below the disposal area to detect the infiltration of leachates should liner failure occur),
 - b. product storage and loading area (to detect infiltration of spilled product and failure of the containment system) (downgradient only),
 - c. wastewater retention area (to detect infiltration of untreated wastewater), and
 - d. process area (to detect infiltration of process materials from leaks in process sewers and rainwater collection systems).

Sampling will be started as early as practicable during the construction phase (after earth-moving activities are completed) to establish background characteristics for each monitoring point. Seasonal sampling will be carried out during prestartup background monitoring, monthly monitoring during the first year of facility operation, and, if conditions prove to be stable, seasonal monitoring of groundwater wells.

In addition to the groundwater monitoring wells, natural springs and seeps near the coal storage pile will be monitored seasonally.

Parameters that will be included in the monitoring program include in situ measurement of temperature, pH, and conductivity. The following parameters will be included in laboratory testing of groundwater samples:

- major dissolved constituents,
- trace elements that are detected in process waste streams,
- appropriate EPA Priority Pollutants with emphasis on organic constituents (PNA), and
- priority trace elements designated by regulatory agencies.

4.5.3.4 Surface water quality and aquatic ecology

Construction impacts

Before the start of construction or concurrent with it, aquatic environments on or near the site will be sampled to supplement the baseline monitoring program. Automatic sampling equipment

will be installed on the river to monitor pH, conductivity (a measure of total dissolved solids), flow, and other parameters on a daily basis. These data are necessary to better establish the relationship between flow and water quality, thus providing a basis for predicting when zero discharge will be necessary. Dye-release studies or other appropriate studies will also be used to determine mixing within the river. Results of these investigations will provide a basis for locating and designing the effluent discharge structure. Investigations of ichthyoplankton will determine the relative densities along the shoreline and at midchannel and distribution of ichthyoplankton species. Further sampling of water chemistry and aquatic biota are already under way and will continue so that sufficient baseline information will be available for later comparison.

During construction the primary sources of aquatic impact are erosion and sedimentation. The discharge of the sedimentation basins will be monitored at least weekly for total suspended solids, oil and grease, and pH. Discharges will also be monitored during or immediately after rainfall events to determine the effectiveness of the sedimentation basins and other control measures. Other parameters and the frequencies of determination will be specified in the NPDES permit (see Sect. 1.3.3 and Appendix R). Onsite drainages (at the baseline stations discussed in Sect. 3.2.2.3 and ER, Vol. 1) will be monitored monthly for total suspended solids, oil and grease, nutrients and pH. If construction activities overlap with fish spawning seasons, the total suspended solids in and the turbidity of Crooked Run will be monitored more frequently.

Operational impacts

DOE will undertake extensive monitoring to determine the impacts of the wastewater discharge. Automatic equipment will provide data on flow, conductivity, dissolved oxygen concentration, and other constituents — not limited to phenols, PNAs, cyanide, sulfates, and metals. The characterization of these species in the river, when compared with the concentration in the discharge, will be used to determine when the discharge can be assimilated by the river and when the zero-discharge system should be activated. As specified in the *Environmental Monitoring Handbook*,⁵⁹ the concentrations of trace elements and various PNA will be monitored on at least a regular basis in the water column and the sediments; aquatic biota will also be sampled for these materials. Ecological monitoring will continue at key times throughout the year, focusing on population sizes and reproductive success of representative and important species. This monitoring will determine the extent of ecological change due to habitat loss and wastewater discharge and will determine the effectiveness of mitigating measures. Monitoring as described above will occur above the discharge, within the mixing zone, and at one or more points downstream.

Water and sediment in the vicinity of the barge unloading dock and the heavy fuel oil product storage area will be monitored for coal fines, trace elements, PNA compounds, and heavy fuel oil product, because these areas may be impacted by spillages from the coal barges and product storage tanks. Monitoring for these constituents will be conducted on a quarterly basis.

4.5.3.5 Terrestrial ecology

Before construction and operation are started, plants growing in the area to be subjected to maximum concentrations of air pollutants will be sampled and analyzed for visible evidence of air-pollutant stress. [The dispersion analysis on air quality impact (Sect. 4.2.3.1 and Appendix Q) identifies the areas of maximum ground-level concentration.] Also, plant communities in this area will be analyzed for the abundance of plant species known or thought to be sensitive to air pollutants. During construction and operation, these same routine analyses will be periodically carried out (e.g., bimonthly during growing season) to identify any impacts specific to the proposed project. The observations from this study will be related to the data generated by the meteorological and air quality monitoring programs. Such impacts could be visible signs of stress, reduced productivity, and reduction in abundance of sensitive plant species. In addition to routine monitoring, short-term studies will be made at appropriate times to detect impacts of high levels of pollutants that may be emitted during abnormal facility operations.

Results of this monitoring program will be reviewed periodically to compare them with the results of meteorological and air quality monitoring and to identify necessary additions or modifications to the program and to the control of air pollutant emission sources. This monitoring program, which will be carried out by the industrial partner in consultation with DOE, will be supplemented by research activities to be supported by DOE but carried out by biological or ecological research institutions other than the industrial partner.

4.5.3.6 Socioeconomic

The objective of socioeconomic monitoring is to determine (1) employment, population, and land-use changes actually resulting from the construction of the plant; (2) wages, taxes, and local purchases generated by construction; and (3) impacts of these population, employment, and fiscal changes on community infrastructure such as housing, schools, and transportation. To achieve these objectives, a series of surveys and interviews with workers and local public officials will be conducted quarterly during construction. The primary purpose of these surveys is to provide data with which to determine (1) employee distribution (in-migrant vs resident), (2) construction family characteristics, (3) housing characteristics, and (4) length of time required for in-migrating construction workers and dependents to make personal adjustments.

Monitoring results will be used to (1) determine the need and level of Federal and State public assistance funds that may be required to ameliorate stresses that may be experienced by local service districts and communities in response to meeting construction worker demands, (2) provide guidelines for current and long-range planning on the part of local government officials, and (3) compare actual construction worker characteristics with those predicted to calibrate models that were used in the impact analysis so that they may more closely reflect future conditions. The study area will consist of the local commuting zone within a 60-min radius of the site (see Fig. 3.1 and Sect. 3.2.4.6), with special emphasis on those individual communities affected by construction worker relocation. Monitoring of traffic on access roads to the site will be conducted to assess the levels of traffic impact and coordinate nonstructural mitigating measures; the road upgrading will be performed by the West Virginia Department of Transportation (see Sect. 4.2.4.1). When significant deviations from predicted impacts occur, recommendations in the form of additional monitoring or mitigating measures will be made by DOE to local government and planning agencies. DOE will conduct an annual per capita cost-benefit analysis for the five-county impact region to identify and to compensate for potential deficits in the aggregate cost of each jurisdiction's public services.

Because most of the socioeconomic impacts of the project are predicted to occur during construction and because the size of the operational work force is much smaller than the construction force, operational monitoring will not be needed beyond the first quarter of operation.

4.5.3.7 Noise

The noise monitoring program will repeat the preconstruction baseline surveys (see Sect. 3.2.3.2 and Vol. 1 of the ER). The purpose of these surveys is to quantify the noise effect of the plant. This noise monitoring will be done to verify predicted noise impacts of the plant and to identify any unexpected noise impacts. Noise levels due to plant construction or operation (see Sect. 4.2.3.2) will be mitigated if they are found to exceed residential guidelines.

4.5.3.8 Air quality and meteorology

Construction impacts

Air emissions will be generated by land clearing, grading and excavation, operation of personal and construction vehicles and mobile equipment, storage and transfer of fuels and other materials, and evaporation of solvents from paints and coatings. To monitor the impacts of construction on air quality, the program outlined below will be carried out during the construction phase beginning one month prior to site preparation.

Parameter	Frequency	Location
<i>Meteorological monitoring</i>		
Wind speed (60 m)	Continuously	At meteorological site used
Wind direction (60 m)	Continuously	In baseline program
Atmospheric stability	Continuously	In baseline program
Precipitation	Continuously	In baseline program
Atmospheric pressure	Continuously	In baseline program
Solar radiation	Continuously	In baseline program

Air quality monitoring

Total suspended particulates (TSP)	Every 3 d	Upwind and downwind of site
Sulfur dioxide (SO ₂)	Continuously	At meteorological site used
Nitrogen dioxide (NO ₂)	Continuously	In baseline program
Ozone (O ₃)	Continuously	In baseline program
Carbon monoxide (CO)	Continuously	In baseline program
Nonmethane hydrocarbons (NMHC)	Continuously	In baseline program
Trace elements, PNAs	Monthly	From TSP filters

Operational impacts

Operation of the demonstration plant will result in the emission of criteria and noncriteria (unregulated) pollutants from both point and nonpoint sources. To monitor the impacts of operation on air quality, the construction monitoring program will be continued throughout operation with the exception that TSP will be sampled upwind, downwind, and at a secondary downwind point from the plant.

4.5.4 Process monitoring

Environmental process monitoring has five basic objectives:

1. to identify and quantify pollutants in gaseous, liquid, and solid waste effluent streams from the plant;
2. to verify that the plant is operating in compliance with environmental control regulations;
3. to determine the pollutant removal effectiveness of environmental control systems used in the plant;
4. to characterize selected internal process streams that affect the plant effluent streams; and
5. to determine worker exposures in actual work place environments.

The monitoring effort will be considered in terms of three types of plant tests associated with the different environmental goals of (1) effluent characterization, (2) environmental control characterization, and (3) process unit characterization. The actual monitoring program will be based on the environmental requirements of the demonstration project and the operating schedule of the demonstration plant.

Effluent characterization entails the measurement of pollutants in plant effluent streams. The work involved will be extensive because of the number of effluent streams, the number of potential pollutants, and the number of plant operating conditions. To ensure compliance with environmental regulations, this type of characterization will involve all potential sources of pollutants.

In environmental control characterization, the operating performance of one or more pollutant control systems is investigated. The test will involve sampling both the input and effluent streams of selected environmental control equipment. At least one pollutant — often several — will be analyzed. The scope depends on the same factors influencing effluent characterization.

Process unit characterizations pertain to stream analysis at least one step earlier in the process than the environmental control systems. The output stream of the process units normally will be the input stream to the environmental control device. The performance of an environmental control system depends on the physical and chemical characteristics of the input streams. Process measurements will define the effect of process parameters on the performance of control modules. This will add another layer of analysis to environmental control characterization, and its scope depends on the same factors.

Examples of process streams to be monitored are:

1. process area runoff,
2. cooling tower recirculating water and makeup from the wastewater treatment system,
3. flue gas from the controlled combustor,
4. coal pile runoff,
5. leachates from all solid waste disposal areas,
6. tail gas from the sulfur recovery operation,
7. flue gas from fired heaters,
8. vent gas from baghouses,
9. carbon dioxide vent stack from acid-gas removal,
10. wastewater discharge,
11. fugitive process emissions (as part of the directed-maintenance program discussed in Appendix C), and
12. ambient concentrations of toxic gases such as carbon monoxide and hydrogen sulfide in the process area.

The monitoring program will verify the performance of the proposed mitigation and control techniques.

4.6 MITIGATING MEASURES

The following list of mitigation measures is indicative of site- and process-specific control measures that are responsive to real or perceived environmental concerns. Some mitigation measures cannot be specified in detail at this time. In some cases studies are currently under way or will soon be undertaken to determine the nature and magnitude of potential environmental problem areas. In other cases the detailed mitigation techniques will be developed along with the final plant design. The following commitments are made by DOE:

- DOE shall take the necessary mitigating actions, including those summarized in Sect. 4.6 of this FEIS, during construction and operation of the plant to avoid adverse environmental impacts.
- DOE shall maintain sufficient records to furnish evidence of compliance with all the environmental conditions herein.
- Before engaging in a construction or operational activity not evaluated in this FEIS, DOE shall prepare and record an environmental evaluation of such activity. When the evaluation indicates that such activity may result in a significant adverse environmental impact that was not evaluated or that is significantly greater than that evaluated in this FEIS, DOE shall provide a written evaluation of such activities. Supplements to the FEIS are discussed in Appendix X.
- In addition to the preoperational monitoring programs described in the ER, the DOE monitoring recommendations included in Sect. 4.5 of this document shall be followed.

4.6.1 Process controls

- The proposed plant design incorporates a sophisticated wastewater treatment system that emphasizes the removal of toxic metals and organic compounds from the wastewater before discharge to the Monongahela River. The plant will also be equipped with desalination and water reclamation equipment to enable total recycle of treated wastewater within the plant when discharge cannot occur without violating in-stream water quality standards. This system will collect and treat all process wastewaters, process area runoff, runoff from

product storage areas, leachates from the coal storage area and the slag disposal area, and blowdown from the cooling towers and boilers. Also, spills occurring at either the main process area or the product storage areas will be collected and recycled (Sect. 2.2.1.2 and Appendix C).

- A controlled-combustion device with a temperature and residence time sufficient for burning heavy hydrocarbons will be used to treat gaseous product emissions from anticipated upset conditions. During normal operations and anticipated upset conditions, all air emissions from sources that have significant concentrations of heavy organic compounds will be vented through this controlled-combustion system, which can ensure relatively complete destruction of organics (Sects. 2.2.1, 2.3.2.1, and 4.1 and Appendix C).
- Coal storage areas will have compacted clay liners. Coal leachate accumulation at the liner surface is collected at the perimeter of the coal storage area and is routed to wastewater treatment. Close supervision of foundation preparation will be carried out to ensure that the proposed liner will be adequate (Appendix C).
- To prevent release of biologically active materials from the wet-cooling towers, processing units that typically contain these materials will be equipped with indirect wet coolers (Sects. 2.2.1.2, 2.3.2.1, and 4.1.3.1 and Appendix C).
- Major spills occurring at the main process area and in the product storage and shipping areas will be contained to prevent them from reaching the water through surface runoff. Residues from clean-up operations from such spills will be recycled when possible and contained at the plant site in all cases. All storage areas will be provided with floors and dikes of an impermeable material (Sect. C.3.5.3).
- All wastewater handling areas will be lined to minimize direct infiltration of wastewater (Appendix C).
- If a major failure occurs in the wastewater treatment system that precludes both adequate treatment to enable discharge of a treated wastewater without violating in-stream water quality standards and recycle within the plant to achieve zero discharge of wastewater, DOE will shut the plant down and remedy the deficiency in the wastewater treatment plant before startup.
- The contract between DOE and the industrial partner for the design, construction, and operation of the SRC-II demonstration plant requires that the industrial participant prepare, during the design stage, a Plant Facility Maintenance Plan. A part of this plan will be a "directed" maintenance program. This program will include monitoring to determine when maintenance is required, procedures for performing such maintenance, and monitoring during the maintenance work to determine when sufficient corrective action has been performed. The program will emphasize procedures such as more frequent monitoring for those equipment items that have the potential for the largest leak rate of materials considered to have the greatest adverse health impacts (Sect. C.3.5.1).
- The SRC-II project will incorporate a formalized Hazards Evaluation Program, even though such formalized programs are not normally used in the hydrocarbon processing industries. The program is being prepared and will be described in a report entitled *Safety Program Summary*, which is scheduled to be submitted to DOE on January 31, 1981. This report will describe the elements of the formalized Hazards Evaluation Program, including the methods and procedures used for performing such evaluations at each stage of the program. Auditable documentation will also result from these safety reviews. This documentation will be assembled and analyzed after the piping and instrument drawing safety approval cycle and will be included in the safety analysis report to DOE. The report will contain the failure mode and effects analysis, fault tree analysis, event tree analysis, a quantitative assessment of the risks, and measures incorporated to eliminate, control, or mitigate the impacts.
- DOE will collaborate with the Coast Guard, EPA, and State and local agencies to develop strategies for minimizing the likelihood of spills and to develop plans for action should spills of SRC-II liquid occur (Appendix Z).
- DOE will comply with the provisions of the Toxic Substances Control Act (TSCA) when EPA defines the application of TSCA to the SRC process (Appendix T).

- Several water-related factors and features individually and collectively will affect the design, operability, and environmental effects of the SRC-II demonstration plant, including quantity of water withdrawn and released to the river and net water consumption; types of wastewater treatment; degrees of application of evaporative, dry, and indirect cooling; size and number of wastewater reservoirs; and methods for disposing of soluble salts. All these factors are linked together in the design of the plant. During the detailed design phase, all these features will be evaluated from the standpoint of reducing the overall adverse environmental impact of the plant.
- In the baseline design, all solid wastes and residues will be stored in hazardous waste landfills, with the exception of raw water treatment sludge. The design will incorporate the final RCRA design standards for landfills as soon as they are available. Until then, the proposed standards published on December 18, 1978, will be used as a design guide. Construction of the disposal facility cannot begin until the final design standards are in effect and the necessary RCRA permit has been granted by EPA or an approved State permitting authority. A cross-sectional diagram of the landfill is shown in Appendix C. The landfills will be constructed and maintained in accordance with applicable Federal and State solid waste guidelines and regulations. Several alternatives are under investigation for disposing of the biological sludge, the slop oil, and the spent activated carbon (Appendix C).
- Slag will be disposed of in a secure landfill designed and operated in accordance with the requirements of the RCRA regulations for hazardous waste (Sect. 2.2.1.2 and Appendix C).
- Fugitive hydrocarbon releases will be minimized through the use of a directed maintenance program (Sects. 2.2.1.2 and 4.1 and Appendix C).
- Industrial hygiene training and protective equipment for the work force and adherence to safe, proper maintenance procedures to minimize environmental release and personnel exposure (Sect. 4.1 and Appendix Y).
- Heavy product storage area on the Monongahela floodplain will be filled to raise the base of the tanks above the 500-year flood elevation. The tank area will also be diked and lined with impervious materials to hold the contents of the tank plus water from a 10-year, 24-h rainfall, and the water for use in the event of a fire. Pumps will return any of these liquids to the water reclamation area for treatment (Sects. 2.2.1.2 and 4.8 and Appendixes C and D).

4.6.2 Socioeconomic

- Access to the Fort Martin Church and the associated cemetery will be maintained and access to the private cemetery will be provided as appropriate.
- As a result of initial contacts between DOE, HUD, and other State and local agencies (particularly the Region VI Planning and Development Council), several items have been suggested by HUD and the Region VI Planning and Development Council (Appendix V.4) to alleviate housing problems predicted for SRC-II construction. These include:
 1. The need to develop new mobile home parks for workers in Monongalia County, on a well-planned and well-sited basis, with package water sewer system if public facilities are not accessible. After SRC-II construction, these parks could be continued or converted to single-family subdivisions.
 2. The need to develop a sufficient number of units of permanent rental housing to accommodate SRC-II in-migrants. After SRC-II construction, the units could be sold, by prearrangement, to an owner for market rate or to Sect. 8 low- to moderate-income tenants.
- Federal assistance programs that may provide impact assistance are presented in Appendix V.5.

DOE is committed to working with HUD and other State and local agencies to provide a mechanism for implementation of the measures needed to mitigate SRC-II construction problems in housing.

4.6.3 Historic, archaeological, and paleontological resources

Specific mitigation plans for each of the five cultural properties eligible for the National Register of Historic Places have been developed. Detailed discussion of these mitigation plans is given in Appendix U (Draft Memorandum of Agreement between DOE and the President's Advisory

Council on Historic Preservation). The general directions for each of the mitigation efforts are as follows:

1. Belldina's Bottom Lower Terrace Archaeological Site

Prompt data recovery will be proposed, hopefully to be completed during the 1981 survey season (April-November), with the extent of excavation to be determined in future discussions with the State Historic Preservation Office and the Advisory Council for Historic Preservation.

There appears to be a strong case for early and complete data recovery, rather than in situ preservation, because the site is currently threatened by bank erosion and soil chemistry instabilities, factors largely beyond the project's control.

2. Fort Martin Historical/Archaeological Site

Prompt data recovery for this site would also appear to be the most advantageous approach from the project's point of view. Although avoidance during demonstration plant construction and operations phases could be accomplished with only minor inconvenience, the Fort Martin site seriously conflicts with commercial expansion. Environmental stress might also result from the demonstration phase and, now that the exact location of the fort is known to the local public, amateur archaeologists and souvenir hunters could do considerable damage.

3. Van Voorhis Farm Archaeological Site

These small features are incompatible with the planned location of the coal pile. Excavation for data recovery should also be scheduled during the 1981 season and should be a rather modest effort compared with the Belldina site effort.

4. Gingrich House Architectural Landmark

The Gingrich House and surrounding buildings will be maintained by DOE for the life of the demonstration project. It is proposed that Gingrich House be used as a public information center for the SRC-II project. Such a center would provide data and media-type presentations regarding the project and would also serve as a visitor's center for the plant. Some of the functions of such a center would be to:

- provide information kits about the project,
- house displays on the history, process, and project development of SRC-II,
- house artifacts or historical articles of the Fort Martin area,
- provide orientations for tours of the plant facility, and
- provide space for meetings related to the project and its future.

In addition to these public functions, Gingrich House may be used for gatherings of research scientists, engineers, or foreign visitors. This productive use should prevent alteration of the structures and/or grounds of Gingrich House.

In the event of successful demonstration, the SRC-II demonstration plant may be expanded to a commercial plant, which would be owned and operated by a private company. As a condition of transfer of title to the property, DOE will require that the new owner continue mitigation as described above.

5. Fort Martin School

The Fort Martin School is currently used as a community center by the residents of Fort Martin. It is proposed that this function continue and also that the building be used for project-related meetings. To assist project layout and to reduce maintenance expenses, the Fort Martin School would be moved from its current location onto the Gingrich property.

A parking lot would be provided for visitors to the plant and the community.

4.6.4 Geology and soils

During the detailed design stage, a Project Environmental Management Plan will be prepared. This plan will specify construction practices and procedures as well as facilities that will be used

to minimize soil erosion and to prevent sedimentation. Particular emphasis will be given to the following (see Sect. 4.2.1.2):

- scheduling of site preparation activities to minimize the area disturbed at any time,
- early construction of drainage collection and permanent sediment control facilities,
- use of construction practices and grading techniques designed to minimize erosion,
- use of temporary sediment control facilities,
- removal and proper storage of topsoil for use in revegetation of disturbed areas,
- protection or removal and proper disposal of pyritic or other soils that should not remain exposed,
- prompt revegetation of disturbed areas and use of mulch or other temporary protection on areas that cannot be revegetated immediately, and
- use of dust-suppression techniques to prevent wind erosion and fugitive dust.

4.6.5 Water

Potential impacts resulting from site preparation activities, including shoreline construction, will be mitigated by the following measures:

- Temporary berms, ditch checks, check dams, or slope drains will be used to reduce erosion and decrease sediment discharge.
- Sedimentation basins will be designed to retain runoff from a 10-year, 24-h precipitation event. Discharge from the basins into natural drainages will meet criteria designated in an NPDES permit. Construction sedimentation basins are typically required to discharge effluents with an average suspended solids concentration of less than 50 mg/liter and a maximum of less than 100 mg/liter.
- Construction activities will be scheduled to limit the area extent and duration of newly exposed areas.
- Vegetative cover will be replaced rapidly and the other soil stabilization practices will be employed.
- Construction sanitary wastes will be collected and treated before discharge.
- Fill, on which the storage facilities will be built, will avoid the once in 500-year flood-plain to the maximum extent possible (Sect. 4.8 and Appendixes C and D).

During operation, the following design features and operating strategies will be used to minimize impacts:

- In the final plant design, water conserving features will be thoroughly evaluated and selected where economics permit. Onsite water storage will also be assessed.
- Wastewater discharge will be eliminated during low-flow periods when discharge would cause the most adverse impacts on Monongahela River water quality.
- Portions of the process area and the product storage area will be lined with impervious material to prevent infiltration of potentially contaminated runoff.
- All runoff up to that resulting from a 24-h storm with a frequency of occurrence of 10 years will be collected and diverted to a treatment facility that recycles the water for process use.
- During precipitation events exceeding the 10-year, 24-h storm, the least contaminated excess runoff stream will be discharged to minimize aquatic impacts. Based on preliminary data, leachate from the slag disposal area would be discharged first, followed by pH-neutralized coal pile drainage and process area runoff (Sect. 4.2.2.3).

- Runoff and any spilled materials in the product storage area will be pumped to oil/water separators to recover products. Water will be routed to the wastewater treatment system.
- Major process units and storage vessels will be provided with secondary containment to retain accidental releases (Sects. 2.2.1.2 and 4.2.2.2).
- Prevention of possible contamination will require careful preparation of the process area, appropriate spill containment facilities, and prompt cleanup of spills that do occur (Sects. 4.2.2.2 and 4.1).
- The risk of groundwater and surface water contamination will be reduced by collection and treatment of coal pile leachates and runoff and by soil compaction or lining of the storage area (see Sect. 2.2.1.2 and Appendix C).
- Although the apparent risks of contaminant movement through the ground are low, springs near the coal storage area will be monitored on a quarterly basis to determine if the shallow groundwater system is being contaminated. If contaminants are detected in the springs, DOE will evaluate the significance of the impact of these contaminants and design appropriate mitigation measures as needed. A detailed analysis of the storage area soils and groundwater flow beneath the area will be conducted to optimize the design of the storage area and select appropriate monitoring locations to provide early detection of infiltration (Sect. 4.2.2.2).
- Current plant design calls for construction of a compacted clay liner below the solid waste disposal area and drains to collect the leachate for analysis and treatment (see Sect. 2.2.1.2 and Appendix C for cross-sectional diagrams).
- Clay liner compatibility studies will be carried out to ensure that the leachate generated does not adversely affect the stability of the liner material (Sect. 4.2.2.2).
- A detailed investigation of the engineering properties of soils in the landfill area will be conducted prior to construction of the landfill. Design of the landfill and specific engineering measures for handling the strip mine soils will be based on the results of these tests (Sects. 4.2.2.2 and 4.2.1.2).
- Procedures that decrease the probability of coal spillage in the river will be implemented (Sect. 4.2.2.3).

4.6.6 Aquatic ecology

- To compensate for destruction of shoreline habitat for construction of the barge dock, barge slip, raw water intake, and wastewater discharge structure, improvements in the remaining undisturbed shoreline are being considered. Public access will be provided to the undisturbed shoreline areas. In addition, measures will be taken to protect and improve the undisturbed shoreline habitat to the north and south of the areas to be developed. These measures will be developed in cooperation with the U.S. Fish and Wildlife Service and the West Virginia Department of Natural Resources.
- Losses of aquatic biota due to impingement will be mitigated by an intake structure that keeps the intake velocity at less than 10 cm/s. Most fish can exceed this speed and escape impingement.
- Losses of planktonic organisms (especially ichthyoplankton) in the raw water intake could probably be reduced by siting the intake structure offshore, if this is compatible with navigation. Additional monitoring (Sect. 4.5.3.3) and consultation with the Corps of Engineers as part of the Sect. 404 permitting process are needed to resolve the uncertainties connected with this issue.

4.6.7 Terrestrial ecology

Many of the mitigation measures listed in Sects. 4.6.1, 4.6.4, 4.6.5, and 4.6.7 will also serve to minimize impacts on terrestrial biota. However, commitment of land to industrial facilities such as the SRC-II facility represents a one-way loss of wildlife habitat that cannot be completely mitigated or compensated for. Compensation is best accomplished by preservation of other habitat for wildlife and, if desired, for public use. Mitigation was discussed with the U.S.

Fish and Wildlife Service and representatives of the State of West Virginia. DOE is considering public access to the river at Belldina's Bottom, creating a pond and wetland area in the sedge-rush meadow near the truck storage area, and improving wildlife habitat in part of the western portion of the site. These plans will be developed in conjunction with the U.S. Fish and Wildlife Service and the State.

4.6.8 Air quality

- Scheduling land clearing, grading, excavation, and other site preparation activities to minimize the area disturbed at any time (Sects. 4.2.1.2, 4.2.2.3, and 4.2.3.1).
- Using dust-suppression measures such as water sprays and polymer coatings to reduce fugitive dust from disturbed areas and stored materials such as topsoil and clay (Sect. 2.2.1.2 and Appendix C).
- Revegetating temporarily disturbed area promptly (Sects. 4.2.1.2 and 4.2.2.3).
- Using mobile equipment that meets applicable emission standards and maintenance, as required to ensure continued compliance (Sect. 4.2.3.1).
- Using alternatives to open burning for disposal of debris from land clearing (Sect. 4.2.3.1), where feasible.
- Performing necessary open burning in accordance with applicable regulations and at times when meteorological conditions favor rapid dispersion of emissions (Sect. 4.2.3.1).
- Incorporating particulate control measures such as the use of gaseous and liquid fuels in fired heaters, enclosures of coal handling equipment and use of fabric filters to control emissions from such equipment, and the use of dust-suppression techniques to control fugitive emissions from coal storage and handling and slag disposal areas (Sect. 2.2.1.2 and Appendix C).
- Controlling sulfur oxides primarily through recovery of elemental sulfur and use of hydro-desulfurized liquid and gaseous fuels (Sect. 2.2.1 and Appendix C).
- Controlling emissions of nitrogen oxides through the use of low-NO_x burner designs (Sect. 2.2.1.2 and Appendix C).
- Hydrocarbon emissions are expected to result primarily from leaks in process equipment and piping and from maintenance of equipment involving release of process materials. Storage tanks will be equipped with vapor recovery systems, and emissions from process upsets will be routed to a controlled-combustion system (Sects. 2.2.1.2 and 4.1 and Appendix C).
- Examples of fugitive hydrocarbon controls that will be employed include the use of leak-resistant valves and fittings, use of double block valves, use of high-quality double mechanical seals, enclosure of selected equipment in ventilated buildings or shelters, and use of unventilated enclosures around critical valves, fittings, and equipment (Sects. 2.2.1.2 and 4.1 and Appendix C).
- Controlling reduced sulfur compound emissions (hydrogen sulfide, carbon disulfide) through recovery as elemental sulfur (Sect. 2.2.1.2 and Appendix C).
- Residual materials in the effluent from the sulfur recovery unit will be converted to sulfur dioxide by incineration before to emission (Sect. 2.2.1.2 and Appendix C).

4.6.9 Industrial hygiene program

A thorough industrial hygiene program will be instituted to ensure the adequacy of engineering controls designed to minimize worker exposure to biologically active materials and to institute additional controls if necessary. This program will be based on the program at the Fort Lewis SRC pilot plant, modified as required on the basis of additional studies for the SRC-II demonstration plant (Appendix Y).

Engineering controls are expected to (1) prevent exposures to materials having acute chemical toxicity and (2) reduce concentrations of all regulated substances to within limits specified

by OSHA, except during emergency conditions (fires, explosions). Additionally, the industrial hygiene program will minimize the impact of exposure to biologically active materials that are currently unregulated.

To provide the greatest amount of protection, it will be assumed that all process streams having the potential to contain toxic materials, carcinogenic or otherwise, are toxic. Until or unless toxicological and process stream characterization studies have identified a process stream as being noncarcinogenic, it will be treated as a potential hazard to workers, and all applicable elements of the occupational health program will be followed in dealing with it.

The primary mechanisms for worker exposure to these biologically active materials will be through skin contact and inhalation. The industrial hygiene program will be designed to control both these mechanisms of exposure. Worker education and training is the first element of the program. The core of any successful occupational health program is worker acceptance and participation, and this is a stated goal of the program. The means of attaining this goal is threefold: initial training of new employees and visitors, annual retraining, and periodic health and safety meetings. The latter will allow airing of individual concerns and permit review of emergency procedures. The workers will be familiar with the potentially hazardous nature of process materials and with mechanisms of exposure.

The proper use of protective equipment and clothing helps to minimize any adverse health effects of worker exposure to coal liquefaction materials that may pose health hazards. For normal operations, employees in areas where contact can occur will be issued and required to use overalls, underwear, socks, and leather boots with oil-resistant soles; gloves, rainsuits, and parkas will be used when needed. In the event of a spill of toxic materials or work assignment that might lead to personal contamination, the employee may be asked to wear special protective equipment such as synthetic rubber boots, special gloves, an impervious rainsuit, face shield, goggles, and/or respirator. Hearing protection will be provided in areas with high noise levels. Visitors entering the plant will be provided with protective clothing to prevent contamination of their street clothing.

To protect the worker and to prevent transport of coal liquefaction contaminants off the plant site, special procedures and facilities have been developed for employees working in areas where contamination may occur. The key elements in the design and use of the change facility are the segregated "clean" and "dirty" areas and a mandatory daily shower and shampoo for workers. All employees and visitors must pass through a change facility when entering or leaving plant areas where contamination can occur. Monitoring of personal hygiene effectiveness by low-level ultra-violet light scanning will be assessed as a technique for improving worker hygiene. If this is concluded to be a safe and effective practice, it will be made available to workers as they pass through the change facility.

The second element of the worker protection program is a carefully designed set of specific work practices. The demonstration plant will follow comprehensive and specifically defined work practices in the following areas: personal contamination, washing practices following accidental contamination, eating, drinking, smoking, material transferrals, material storage, material disposal, maintenance procedures, and emergency plans and procedures. These work practices will be in accordance with accepted principals of industrial hygiene followed in other industries that have handled hazardous materials in the past.

Medical monitoring is an important third element in the program. A medical monitoring program will be made available to all employees who may be occupationally exposed to coal liquefaction products, and participation in the monitoring program will be encouraged. Examinations designed to detect potential coal-liquefaction-related symptoms will be made before employment and annually thereafter unless a different frequency is indicated on the basis of professional medical judgment. This medical monitoring will help detect medical problems early (should any occur) when prognosis for successful treatment is generally very high.

It is of utmost importance to retain employee records for a sufficient time. Due to the occupational health uncertainties inherent in a new industry and the long latency period of potential cancers, employee records will be kept for a period consistent with or longer than those stipulated in Federal regulations. These records shall include demographic information as well as comprehensive work histories, exposure monitoring data, and medical surveillance results.

The fourth element of the program, a thorough system of industrial hygiene monitoring, will assess worker exposures to potentially harmful substances and help formulate work practices and engineering controls to prevent exposure. Potential indicator compounds will be evaluated by methods equivalent to or more current than those specified by the National Institute for Occupational Safety and Health (NIOSH). Frequency of monitoring will depend on an assessment of the potency of

toxicants and the initial concentrations measured. Protocols will be developed by a certified industrial hygienist. Initial area and personnel monitoring will be conducted for, but will not be limited to, the following agents: coal dust, CTPVs, PAHs, aromatic amines, phenols, creosols, hexane, carbon monoxide, nickel carbonyl, carbonyl sulfide, hydrogen sulfide, sulfur dioxide, hydrogen cyanide, welding fumes, silica, trace metals, noise, lighting, and radiation. Materials will be identified (indicator compounds) that may be monitored routinely and continuously to ensure health protection.

4.7 THE CARBON DIOXIDE ISSUE

The climatic impact of high carbon dioxide (CO₂) emissions from fossil fuel use is projected to cause an increase in global temperatures of several degrees during the next century.⁶²⁻⁶⁵ Although many scientists agree that increasing levels of atmospheric CO₂ will cause climatic change,^{66,67} the amount of global warming and the extent of climatic change is still a matter of conjecture.^{68,69} Because of anticipated climatic changes that may occur as a result of increasing levels of atmospheric CO₂, the proposed synthetic fuels program has come under close scrutiny.⁷⁰ A concern about synthetic fuel use is the additional CO₂ emitted during combustion and production compared with the CO₂ emissions from conventional use of fossil fuels.⁷¹ Research concerning the relationship between various aspects of the carbon cycle and global climatic patterns is currently being pursued.⁷² Until the results of this research are in, the effect of atmospheric CO₂ will remain uncertain.

From current predictions based on several development scenarios,⁷³ the additional CO₂ emissions from a commercial synthetic fuels program will not significantly alter the projected output of CO₂ from fossil fuel use by the middle of the next century.⁷⁴ The proposed number and size of DOE's synthetic fuel demonstration program represent a small portion of the projected commercial synfuels industry. Assuming a reasonable degree of accuracy in the anticipated CO₂ impact of the synfuels program, the CO₂ impact of the demonstration plants will be insignificant. Additional information about the CO₂ issue is found in Appendix P.

4.8 FLOODPLAIN/WETLANDS ASSESSMENT

The development of the proposed SRC-II demonstration plant at Fort Martin, West Virginia, will necessitate the use of the west bank floodplain of the Monongahela River between river miles 93.2 and 94.5. The facilities to be located in the floodplain below the 100-year flood elevation include a barge unloading slip, process water intake facility, sections of a haul road and access road, and coal barge unloading and fleeting facilities. A limited amount of fill will be needed to support the product storage area and its associated spill containment facilities. An analysis of available mitigating measures indicates that there are no reasonable alternatives to locating these facilities within the Monongahela River floodplain (Appendix D).

Development in the floodplain and in upland areas will necessitate the elimination of several small areas of wetland habitat. The elimination of these wetland habitat values is not considered a major project impact. No feasible alternatives are available to further reduce these impacts. Mitigation measures, including facility design modifications, have been incorporated into the overall site development plan, and the resultant floodplain/wetland impacts for the proposed SRC-II demonstration plant are considered to be minimal.

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B.A.	1973	Geography	Clark University, Worcester, Massachusetts
M.A.	1974	Geography	University of Colorado, Boulder
Ph.D.	1977	Geography	University of Colorado, Boulder

Years of Experience — 1

Total Publications — 12

Jeffrey M. Young, Environmental Geoscientist, HDR Sciences, Santa Barbara, California

Technical Specialty — Physical Resources Impact Assessment

Education:

B.S.	1976	Geography/Geology	Lockhaven State College, Lockham, Pennsylvania
M.A.	1978	Geography	Arizona State University, Tempe

Years of Experience — 3

Total Publications — 4

Michael William Mayfield, Geographer, HDR Sciences, Knoxville, Tennessee

Technical Specialty — Geomorphology and Hydrology

Education:

B.S.	1977	Geography	West Carolina University, Cullowhee
M.S.	1980	Geography	University of Tennessee, Knoxville

Years of Experience — 3

Total Publications — 6

5.5 WATER QUALITY AND AQUATIC ECOLOGY

R. D. Roop, Research Associate, Environmental Impact Section, Energy Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee

Technical Specialty — Impact Assessment for Aquatic Environments

Education:

B.A.	1971	Biology	Hiram College, Hiram, Ohio
M.A.	1975	Ecology	State University of New York, Stony Brook

Years of Experience — 7

Total Publications — 13

R. M. Cushman, Research Associate, Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee

Technical Specialty — Aquatic Ecology and Toxicology, Aquatic Invertebrates

Education:

B.S.	1971	Zoology	Swarthmore College, Swarthmore, Pennsylvania
M.S.	1975	Ecology	University of Tennessee, Knoxville

Years of Experience — 8

Total Publications — 14

Michael J. Sale, Research Associate, Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee

Technical Specialty — Aquatic Ecology

Education:

B.A.	1972	Zoology	University of Michigan, Ann Arbor
M.S.	1976	Biology	University of Illinois, Urbana
Ph.D.	1980	Environmental Sciences	University of Illinois, Urbana

Years of Experience — 6

Total Publication — 6

Susan C. Turbak, Staff Scientist, Science Applications, Inc., Oak Ridge, Tennessee

Technical Specialty — Impact Assessment for Aquatic Environments

Education:

B.A.	1970	Biology	University of California, Santa Cruz
M.S.	1975	Microbiology	Cornell University, Ithaca, New York

Years of Experience — 6

Total Publications — 7

5.6 TERRESTRIAL ECOLOGY

Roger L. Kroodsmas, Research Staff Member, Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee

Technical Specialty — Terrestrial Ecology

Education:

B.A.	1966	Biology	Hope College, Holland, Michigan
M.S.	1968	Zoology	North Dakota State University, Fargo
Ph.D.	1970	Zoology	North Dakota State University, Fargo

Years of Experience — 10

Total Publications — 14

G. W. Suter, Research Associate, Environmental Sciences Division, Oak Ridge National Laboratory

Technical Specialty — Animal and Soil Ecology, Environmental Effects Monitoring

Education:

B.S.	1970	Biology	Virginia Polytechnic Institute, Blacksburg
Ph.D.	1976	Ecology	University of California, Davis

Years of Experience — 5

Total Publications — 7

W. W. Tolbert, Project Manager, Science Applications, Inc., Oak Ridge, Tennessee

Technical Specialty — Environmental Impact Assessment in Terrestrial Ecology

Education:

A.A.	1968	Biology	Wingate College, Wingate, North Carolina
B.S.	1970	Biology	Wake Forest University, Winston-Salem, North Carolina
M.S.	1972	Ecology	University of Tennessee, Knoxville
Ph.D.	1976	Ecology	University of Tennessee, Knoxville

5.7 PLANT DESIGN

Steven G. DeCicco (see Sect. 5.1).

John S. Gordon, TRW Energy Systems, McLean, Virginia

Technical Specialty — Coal Combustion Systems, Chemical Process Engineering

Education:

B.C.E.	1953	Chemical Engineering	Cornell University, Ithaca, New York
M.S.	1956	Chemical Engineering	Ohio State University, Columbus

Years of Experience — 27

Total Publications — 50

J. A. Klein, Chemical Technology Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee

Technical Specialty — Environmental Control Technology, Chemical Process Engineering

Education:

B.S.	1967	Chemical Engineering	University of Wisconsin, Madison
Ph.D.	1972	Chemical Engineering	Princeton University, Princeton, New Jersey

Years of Experience — 9

Total Publications — 13

Suman P. N. Singh, Development Staff, Chemical Technology Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee

Technical Specialty — Chemical Process Engineering, Environmental Technology

Education:

B.S.	1964	Chemical Engineering	Indian Institute of Technology, Bombay, India
M.S.	1967	Chemical Engineering	Oklahoma State University, Stillwater
Ph.D.	1973	Chemical Engineering	Oklahoma State University, Stillwater

Years of Experience — 10

Total Publications — 14

5.8 OCCUPATIONAL AND PUBLIC HEALTH EFFECTS

P. J. Walsh, Group Leader, Health Effects and Epidemiology, Health and Safety Research Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee

Technical Specialty — Environmental Scientist

Education:

B.S.	1964	Nuclear Physics	North Carolina State University, Raleigh
M.S.	1965	Health Physics	University of North Carolina, Chapel Hill
Ph.D.	1968	Environmental Sciences Engineering	University of North Carolina School of Public Health, Chapel Hill

Years of Experience — 12 (8 years National Institute of Environmental Sciences, 4 years ORNL)

Total Publications — 40

Experience:

Walsh's professional experience and publications have involved exposure, dosimetry, and potential health effects of long-term, low-level exposure to environmental pollutants. Work has included assessments of (1) exposure, dosimetry, and health effects of pollutants associated with fossil, solar, and nuclear technologies and (2) methods for energy conservation. Current activities include risk assessments for (1) direct and indirect coal liquefaction technologies and (2) oil from shale. These activities are funded by EPA, DOE, and NIOSH.

Walsh is Health and Safety Research Division Coordinator for the ORNL Life Sciences in Synfuels Program. His group is the focal point for overall health risk assessments in this program. He recently cochaired the third ORNL Life Sciences Symposium on Health Risk Analysis, which included national and international leaders in the field.

He has participated by invitation in workshops and task forces on such subjects as exposure assessment, health risk analysis, indoor air pollution, and research needs in environmental health sciences. As a member of ORNL's Speakers' Bureau and as a former ORAU lecturer, he speaks to various public groups on health effects of energy technologies.

5.9 HAZARDS IDENTIFICATION

Harold A. Mitchell, Engineering Division, Union Carbide Corporation, Oak Ridge, Tennessee

Technical Specialty — Mechanical Engineering and Systems Engineering

Education:

B.S.	1963	Mechanical Engineering	Louisiana State University, Baton Rouge
M.S.	1965	Mechanical Engineering	Louisiana State University, Baton Rouge

Years of Experience — 6

Bronson R. Everman, Engineering Division, Union Carbide Corporation, Oak Ridge, Tennessee

Technical Specialty — Mechanical Engineering and Systems Engineering

Education:

B.S.	1963	Mechanical Engineering	University of Kentucky, Lexington

Years of Experience — 19

Appendix A

COMMENTS RECEIVED ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT
AND DOE RESPONSES

INTRODUCTION

The Draft Environmental Impact Statement (DOE/EIS-0069-D) was filed with the Environmental Protection Agency on May 23, 1980, and a notice of availability was published in the *Federal Register* on June 2, 1980. Copies of the draft statement were sent to Federal, State, and local agencies with a request to comment on the document. Copies of the statement were also provided to interested groups and individuals for their comments. Additionally, the opportunity to comment on the draft statement was provided at public hearings conducted in Morgantown, West Virginia, on June 30 and July 1, 1980.

The official comment period, originally scheduled for May 30, 1980, to July 16, 1980, was later extended to July 30, 1980. All comments received pertaining to the draft statement were considered and addressed, to the extent possible, in the preparation of the Final Environmental Impact Statement. This includes comments on the draft statement made at the public hearings.

A detailed review of comments received on the draft statement revealed that many of the commenters focused on similar issues. The primary issues raised were related to (in alphabetical order): (1) Air Quality, (2) Health and Safety, (3) Monitoring and Mitigating Measures, (4) Plant Design, (5) Socioeconomics, and (6) Water Availability and Quality. Resolution of these issues as well as other concerns that were raised is presented in this Appendix and by revisions throughout the text.

This Appendix is divided into 4 subsections as follows:

- A.1 provides listings of commenters. The listing includes two separate lists. The first list of commenters includes those Federal, State, and local agencies, groups, or individuals who submitted written comments on the draft statement. This list is numbered and the numbers serve as identification keys for comments and responses in Sect. A.3. The second list includes those individuals who participated in the public hearings in Morgantown, West Virginia, and the numbers serve as identification keys for the summarized comments in Sect. A.4. Complete transcripts of those hearings are available for public inspection at the locations noted in Sect. 5 of the Summary. Appendix A.4 contains a summary of the issues and their resolution.
- A.2 provides reproductions of the letters received on the draft statement.
- A.3 contains comments on the draft statement and DOE responses. Letters received (Appendix A.2) were reviewed to identify specific comments. Because of the similarity of issues raised in many of the letters, comments were grouped in subject areas (e.g., Water, Air, Plant Design, Socioeconomic) and synthesized according to issues. Where a number of secondary issues are associated with a primary issue, they may be included with a primary comment. Some relevant issues were raised by only one commenter and are included within the appropriate subject area. With all comments, the governmental agency, group, or individual raising the issue is identified by number corresponding to the numbered list in Sect. A.1. Each number is followed by a page number (e.g., A-7) in Appendix A.2 where the full comment appears in the appropriate letter.
- A.4 contains a summary of the relevant issues raised on the draft statement during the public hearings. Most of these issues were similar to the issues raised by the written comments. Therefore, reference is made by number to the appropriate comment in Sect. A.3 where that issue is addressed. Each comment is also identified by a number that corresponds to the list of speakers in Sect. A.1. The number is followed by a page number from the transcript of the public hearing where the issue is raised.

The procedure used in this Appendix will not necessarily reflect the uniqueness of specific issues raised by each commenter. Comments received by letter and during the public hearings were voluminous and included a number of issues that were not of an environmental nature. Additionally, the determination of what constitutes a comment requires a subjective decision. However, DOE has attempted to consider and accommodate all substantive concerns, both written and at the public hearings, identified by each commenter.

A.1

COMMENTERS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT

AGENCIES, ORGANIZATIONS, AND INDIVIDUALS SUBMITTING LETTERS
REGARDING THE SRC-II DRAFT ENVIRONMENTAL IMPACT STATEMENT

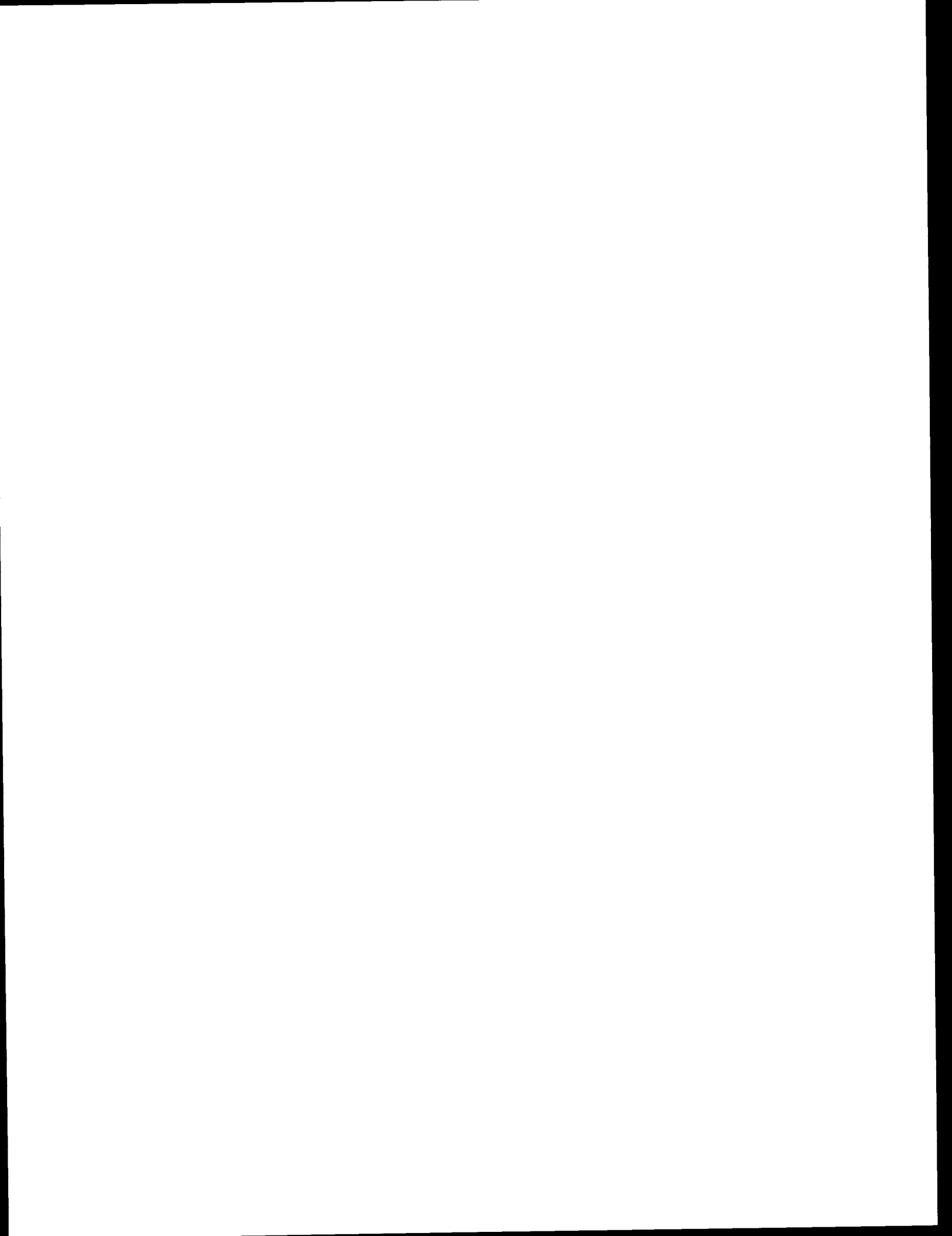
1. Association for Rural Conservation
2. Bakers Ridge Manor Homeowners Association
3. Barnes & Brass Company
4. Paul Becker — Monongahela Alliance for Community Protection
5. Fred Dimmick
6. Rose Mary Eavenson
7. Fort Martin Church Administration Board
8. Robert N. Hoerle
9. Robert A. Jones
10. Allan N. Karin
11. Carol Katonik
12. Kentucky Department of Natural Resources
13. League of Women Voters — Morgantown, West Virginia
14. Sharon Mihnovets (2 letters)
15. Monongahela Alliance for Community Protection
16. National Audubon Society
17. National Science Foundation
18. Natural Resources Defense Council
National Wildlife Federation
Sierra Club
19. North Central West Virginia Legal Aid Society
20. Jack Pavone
21. Pennsylvania Department of Environmental Resources
22. Pennsylvania Fish Commission
23. H. Shaffer, M.D.
24. Sierra Club of West Virginia
25. U.S. Department of the Air Force
26. U.S. Department of the Army, Corps of Engineers
27. U.S. Department of Commerce, National Oceanic and Atmospheric Administration
28. U.S. Environmental Protection Agency
29. U.S. Department of Health and Human Services (Washington, D.C.)
30. U.S. Department of Health and Human Services, Center for Disease Control (Atlanta, Ga.)
31. U.S. House of Representatives, Committee on Science and Technology
32. U.S. Department of Housing and Urban Development (Pittsburgh Office)
33. U.S. Department of the Interior
34. U.S. Department of Transportation, Region III
35. Upper West Fork River Watershed Association
36. Betty Wiley
37. Herbert and Carol Wilcox
38. Douglas Welker
39. West Virginia Department of Culture and History
40. West Virginia Office of Economic and Community Development
41. West Virginia Surface Mining and Reclamation Association

SPEAKERS AT PUBLIC HEARINGS ON THE SOLVENT REFINED COAL-II DEMONSTRATION PROJECT
MONDAY, JUNE 30 AND TUESDAY, JULY 1, 1980
MORGANTOWN, WEST VIRGINIA

1. PAUL BECKER, Monongahela Alliance for Community Protection
2. JOHN BECKMAN, President of the West Virginia Student Public Interest Research Group
3. MARTIN BERG, Mountain Community Union and Monongahela Alliance for Community Protection
4. WILLIAM F. BYRNE, Esq., North Central West Virginia Legal Aid Society, and South Hills Community Association
5. SHERYL CALVERT, Resident of Morgantown, West Virginia
6. MARGIE CARSON, Graduate Student, West Virginia University
7. PHILIP Y. COLEMAN, Pennsylvania Chapter, Sierra Club
8. WILLIAM DELARDAS, Resident of the Morgantown Area
9. RICHARD DIEHL, Monongalia County Resident
10. LINDA COOPER ELKINTON, National Audubon Society, Mid-Atlantic Region, West Virginia Office
11. MARY LOU FULHARTY, Member of Fort Martin Methodist Church, and Resident of Fort Martin and Monongalia County
12. KAREN GRIBBEN, South Hills Community Organization
13. MICHAEL HALL, Fort Martin, West Virginia
14. LINDA HALL, Resident, Fort Martin, West Virginia
15. EUGENE HARNER
16. DOLLY HOERLE
17. CHARLES T. HOLLAND, Winona, West Virginia
18. BETTY JUSTICE, Resident of Point Marion, Pennsylvania
19. DANNY KABLACK, President, Warrior Trail Community Union
20. ALLAN N. KARLIN, Morganton, West Virginia
21. BURKY LILLY, Resident of Morgantown, West Virginia
22. PROFESSOR BENJAMIN LINSKY
23. LOWELL MASON, City Manager, Grafton, West Virginia
24. KEVIN MAGUIRE, Monongahela Association for Community Protection
25. MEL MANN, Resident, Morgantown, West Virginia
26. TOM MORIARTY, Socialist Workers Party Candidate for Governor of West Virginia
27. RUSSELL NEWMAN, Miner, Monongalia County Development Authority, President, Farmers and Merchants Bank
28. ERICA PERLOW
29. DAVID SAVILLE, Graduate Student, West Virginia University
30. FRANCINE SNYDER, Upper West Fork River Watershed Association
31. EILEEN STORY, Physician from Monongalia County
32. DOUGLAS TANNER, Resident, Morgantown, West Virginia
33. BETTY WILEY
34. GEORGE C. WHITE, Ohio River Basin Commission

A.2

LETTERS RECEIVED ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT



00007

Dr. Larry M. Joseph
 Director, SRC Division
 Assistant Secretary for Fossil Energy
 Mail Station E-333
 Washington, DC 20545

July 14, 1980

Dear Dr. Joseph:

Before commenting on the Draft Environmental Impact Statement for the proposed SRC-II Demonstration Project at Port Martin, W.V., I would like to briefly introduce myself to you. I am a professional social scientist engaged in teaching, studying, and doing research in the inter-related fields of socioeconomic development, energy related impact assessment and growth management, and the specific effects the coal industry has had on, continues to have on the place where I live, Greene County, Pa. Consequently, I am concerned about the quality of this draft EIS, particularly the socioeconomic dimensions of it, because I am a social scientist, because I am an impacted resident of this area, and because I am an American consumer, taxpayer, and citizen.

Now I assume as axiomatic that energy resource development must be matched by human resource development. Furthermore, I assume that energy growth management, based on effective impact assessment and operational plans for mitigating the anticipated adverse effects of growth, is our best hope for enhancing rather than degrading our quality of life. Where rigorous, systematic, and comprehensive assessments are lacking or carefully worked out mitigating strategies are non-existent, then growth management is impossible and negative outcomes are predictable.

To get an idea of what will happen when the massive industrialization processes slated for this area take place without effective growth management, consider the following: would you want to live in, raise your children, or send them to a College or University in a place where industrial fumes, smells, pollution, and disruption are a part of your everyday life? Where congested traffic, crime, divorce, juvenile delinquency, alcoholism and drug abuse, family violence, and just about all the other indices of social disintegration are skyrocketing? Where private and public services become increasingly inadequate and expensive? Where productivity declines with the deteriorating quality of life? A place that may be declared "a national sacrifice area" in the near future and "a national disaster area" in the not very distant future?

Anticipating these trends and working now to mitigate them is what an EIS is supposed to do. Unfortunately, the "Socioeconomic Impact Analysis" drafted by CONSAD Research Corporation does not do what it is supposed to do. It does not meet the legal requirements for preparing such a document, it does a very poor job of anticipating the multiple impacts of the proposed project, and it provides no plan for mitigating its adverse consequences.

The law of the land and reason compels the inclusion of mechanisms for ameliorating the predictable negative effects of large scale projects. The courts have held that NEPA Guidelines require the consideration and amelioration of socioeconomic and human impacts in the Trinity Episcopal School Corp. v. Romney, 387 F. Supp. 1044 (S.D.N.Y. 1974) case and elsewhere. There is no dearth of literature on the subject. For example you might want to send CONSAD a copy of a study prepared for your office of Intergovernmental Relations entitled "Mitigating Adverse Socioeconomic Impacts of Energy Development" which was prepared by the growth management experts from the University of Denver Research Institute and Bickert, Browne, Coddington and Associates (January 19, 1978). It will be a useful resource for redrafting the EIS.

The omission of any worthwhile analysis of the public sector finance impacts explains why the draft EIS fails to provide mitigating strategies. Although public sector financing is considered to be a major component of this EIS's conceptual design, the less than two pages devoted to the topic hardly constitutes "the best state of the arts" effort. There is no analysis of the adequacy of previous budgets, no attempt at cost-revenue forecasting with particular reference to the net project related impacts, and no discussion of the widely known, predictable problems of front-end financing, temporal and spatial mismatches between increased costs and increased revenues. There is no analysis of the fiscal impacts on specific aspects of public facilities and services. There is no discussion of mitigating strategies based on existing and needed Federal, state and local governmental, and industrial programs alleviating the financial burden on energy impacted communities. Again there is extensive coverage of this topic in the growth management-impact assessment literature, including four different integrated economic assessment models for computer analysis and a number of elaborate approaches developed at the Oak Ridge National Lab, the Denver Research Institute, and elsewhere.

Lacking mitigating strategies and growth finance management (for the private and public sectors), our community is virtually guaranteed the fate of paying the externalized development costs that should under any principle of equity, including President Carter's energy development guidelines, be internalized by the corporate and national sponsors-beneficiaries of the proposed project. These externalized costs represent a multiple victimization of us in which we get poorer, more costly services, higher taxes, and a degraded environment. A properly designed EIS, can do a lot to avoid such an eventuality.

Some of the other major flaws in the draft EIS that must be corrected in the final draft, include:

1. a comparative socioeconomic cost-benefit analysis of alternative sites; according to NEPA Guidelines, such an analysis is the heart of the environmental assessment process;

2. the community profile, needs assessment, and carrying capacity, as well as the baseline projections should be integrated into the final report, not simply referred to in some inaccessible, probably wholly inadequate, prior report;

3. assess, as required under NEPA Guidelines, the impacts on specific population groups such as the elderly, low income, etc;

4. make use of the known and available methodologies from the fields of technology assessment, impact analysis, and the environmental design arts; the consultants obviously did not approach the "best state of the arts" mandate when they fail to even make full use of the impact model selected for their analysis or when they do not even refer to such obviously relevant materials as the Murphy/Williams Urban Planning and Housing Consultants' "Socioeconomic Impact Assessment: A Methodology Applied to Synthetic Fuels." (Washington, D.C.: Government Printing Office, April, 1978);

5. assess the synergistic, additive effects of other major projects slated for development in the immediately impacted area and its region wide context; it makes no sense to do forecasting in a vacuum, ignoring everything else ~~going on~~ in the environment;

6. assess the effects of the commercial phase of the project, if the goal is to expand the demonstration plant into a five-fold commercial operation, the EIS must include an impact assessment of both the commercial and the close down options;

7. develop a diversification strategy; although the preparers are confused and contradictory about the nature and extent of the existing system's degree of specialization-diversity (see page 3-30), we need a diversification plan that assures that we experience growth with development.

Finally, may I suggest that a quality control reviewer closely monitor the process of redrafting this section of the EIS so that further delays and expenses can be avoided. Why not do it the right way the next time around?

Thank you for your consideration of my comments. I hope that what I have said will facilitate an assessment of the real costs of synthetic fuels national energy policy options.

Kevin Maguire
Kevin Maguire, Ph.D.
Steering Committee Member
Association for Rural Conservation
and
The Monongahela Alliance for
Community Protection

P.S. If you are willing to accept this draft of the EIS, you might also be willing to hire me as your typist.

BAKERS RIDGE MANOR HOMEOWNERS ASSOCIATION
124 Diamond Court
Morgantown, WV 26505

00012

July 14, 1980

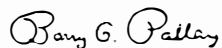
Dr. Larry M. Joseph
Director, SRC Division
Office of Project Management
Department of Energy
Mail Station E-333
Washington, D.C. 20545

Dear Dr. Joseph:

Our community is in close proximity to the proposed site of the SRC facility in Morgantown, WV. As a part of the DOE work on the environmental impact (e.g. EIS) of the proposed facility, the Bakers Ridge Manor homeowners' request a written description of the impact of the facility on our community be included in the EIS and a separate, if necessary, written statement of impact on our community be prepared for distribution to our homeowners. We request this statement, based on engineering/scientific analyses, include comments on the concentration and identity of chemical and physical agents (e.g. concentrations of gaseous and particulate species, noise levels, appearance) we might be exposed to under both best and worst case conditions.

If there are questions regarding our request or if there are problems in providing the information request, feel free to contact me at -- (304) 599-2077.

Sincerely yours,



Barry G. Pallay, President
Bakers Ridge Manor Homeowners
Association

BGP:cs



N. FOURTH & FORD STREETS • P.O. DRAWER 1678 • CLARKSBURG, W.VA. 26301
304/624-7551

July 3, 1980

00009

Hearing Board on the SRC II
Draft Environmental Statement
Ms. Ann Rick, League of Women's Voters
Dr. Charles C. Nathan, Director of New Mexico Energy Institute
Dr. Charles Hill, Envirotech Professor,
Dept. of Chemical Engineering,
University of Utah
Dr. William Miernick, Director Regional Research Institute
West Virginia University

Subject: Response to statement regarding the SRC II

Ms. Rick and Gentlemen:

It is a responsibility and privilege to actively support the attainment of energy independence. This can best be achieved by the full utilization of coal and all domestic sources including synthetic fuels. The regulatory process of which this review is a part, may be essential to insure public input, but the delay caused by it and accompanying legal attack does a disservice to the economic survival of the country.

As a registered professional engineer, a business man with thirty-six years experience in diversified construction activities, I feel qualified to speak out on this issue.

For four years our firm has been active in Public Relations related to energy. Contacts include government, the Deans of Engineering Colleges of West Virginia and neighboring states, the energy industry and scientific community. We feel that the security of the nation depends on the skill with which the energy crisis is handled. We find that:

1. Statements of environmental problems are emotionally motivated and often lack factual basis. The purpose is to regulate business.

2. The medical problems resulting from the application of coal and nuclear energy are over-emphasized to create fear and influence the public. Although, a small minority will testify otherwise, the great majority actively support nuclear and coal. Nuclear, according to a five year report of the National Academy of Sciences entitled "Energy in Transition 1985-2010", is the cheapest, safest and most reliable source.

3. The medical problems from SRC II are so little known that the local medical profession has no knowledge of them. Although,

there has yet to be anyone killed or even made sick in the operation of a nuclear plant the industry is exposed to all manner of negative publicity by the media.

4. Please accept these statements as an expression of personal support for a strong viable nation. It is not intended to reflect on the actions or character of the board members.

Yours very truly,

J. T. Van Voorhis
J. T. Van Voorhis

436 Clark Street
Morgantown, W.V. 26505
July 13, 1980

Dr. Larry M. Joseph
Director, SRC Division
Mail Station E-333
Washington, D.C. 20545

00011

Dear Dr. Joseph,

Please find my written comments on the SRC-II Ft. Martin demonstration plant Environmental Impact Statement. I testified at the E.I.S. hearing, June 30, in Morgantown. This written version is an amplified and referenced version of the remarks I made at that session.

Looking forward to a timely reply to these comments,

Paul Becker
Paul Becker

COMMENTS ON SRC-II DRAFT ENVIRONMENTAL IMPACT STATEMENT

OCCUPATIONAL HAZARDS

The Environmental Impact Statement (E.I.S.) is insufficient, inaccurate, or misleading in seven areas of its treatment of the occupational impacts of the SRC-II planned for Ft. Martin, West Virginia. The document underestimates and misleads the public as to the degree of hazard associated with the SRC-II. It misinterprets the health experience of the Fort Lewis, Washington pilot plant. It is clearly lacking in its exposition of a worker protection program that will not address plant design, but come into play after the plant is built. It does not address the major impacts of unexpected events such as explosions or prolonged release of toxic gases. It underestimates the hazard and does not deal with the public health hazards posed by the use of the fuels the SRC-II will produce. In all, because of its own contradictions, its misinterpretations, and its omissions, the E.I.S. is not a credible document. Finally, the E.I.S. makes clear the intent that SRC-II become a health experiment, and the residents and workers of this region are subjects for that experiment.

HEALTH HAZARDS

According to the E.I.S., "the hydrogenation reaction produces complex organic materials which have the potential for serious adverse health effects (4-3)." Although not proven by direct experiments, "the statement continues, "it is suspected that these materials are carcinogenic or toxic to man"(4-1). Because of these suspicions, we are assured that "DOE is actively engaged in a multi-million-dollar-per-year comprehensive program for characterizing, assessing, and controlling the health effects of SRC materials. Major long-term chemical and biological testing studies are under way..."(4-1).

The implication here is that little is known of the health effects of the materials produced in the SRC process; that what is known is not proven; and that much research is needed before anyone can say whether the SRC process is safe or dangerous. None of these implications is true. It is already known that SRC process materials, emissions inside and outside the plant, and the end product itself will all contain compounds capable of producing genetic mutations, birth defects, and cancer.

To document the effects, we can look to four sources of information: 1) laboratory screening tests; 2) animal studies; 3) the health experience of workers at a previous coal liquefaction pilot plant; and 4) the health experience of workers in industries with similar exposures.

1) Under DOE sponsorship, the Pacific Northwest Laboratory, operated by Battelle Memorial Institute, recently conducted an extensive series of tests on the oil produced in the SRC process at Fort Lewis. These tests were designed to predict the risk of causing mutations. In tests with microbial organisms and in mammalian cell cultures, this oil produced significant numbers of mutations. In fact, when compared against other fuel oils, it was found to be forty to eighty times more mutagenic than shale oil.

(2)

2) When pregnant animals were exposed to high doses of the heavy oil at the same laboratory, an increased incidence of fetal malformations was found.

In skin painting experiments at the same facility, SRC material was absorbed through the skin of animals, and produced a high incidence of malignant tumors. This finding is particularly disturbing in light of the statement in the E.I.S. that the primary source of occupational exposures within the plant will be through direct skin contact with materials in the process. (4-3)

Occupational exposures within the plant will not, however, be limited to skin contact. On page 4-3, the E.I.S. identifies aerosols of the heavy process materials as the likely source of inhalation exposures and ingestions. But it immediately dispenses with these hazards by stating that the materials are of low volatility (irrelevant to aerosol exposure) and that the exposures "would be insignificant in relation to dermal exposures." No justification for this is given. Industrial data from a similar facility¹³ has shown very high concentrations of carcinogenic material within 200 feet of major process fugitive aerosol generators.

The E.I.S. also ignores the fact that once SRC-II process material contaminates a worker's skin, "its complete and immediate removal is impossible".¹⁹ Although it would be difficult to demonstrate in humans, such binding to tissues may occur in the lungs as well, converting a high level acute exposure to a long-term contact with the toxic materials. In laboratory experiments with animals¹⁴, coal tar materials were administered into the lungs. The tumors produced were found to be closely associated with and contain brown or black coal tar spots, suggesting that the materials were bound to lung tissue, and caused the tumors by their direct, local chemical action.

The importance of animal experiments is emphasized by a National Cancer Institute report to the Surgeon General of the U.S. (1970) which stated, "Any substance which is shown conclusively to cause tumors in animals should be considered carcinogenic, and a potential cancer hazard in man."⁸

3) In 1952 an experimental coal liquefaction pilot plant began operation at Institute, W.V. Before closing in 1963, the plant employed 359 workers. The incidence of skin cancer among these workers has been reported as between 16 and 37 times greater than would be expected in a similar non-exposed group.^{15,20} Since not enough time has passed for researchers to analyze cancers of other organs (lung, brain, stomach, scrotum) in these workers, or the overall death rate, the ultimate result of this human experiment is still unknown.

4) It has long been recognized that combustion and distillation products of coal cause cancer in humans. The carcinogenic potential of these products has been recognized since 1775 with the observation of high rates of scrotal cancer in chimney sweeps.¹⁷ As industrial processes have developed which heat coal at high temperature, producing gases, tars, and oils, the cancer incidence continues to be documented. Epidemiological evidence throughout the world, and for various occupational groups, shows conclusively that workers exposed to the products of combustion or distillation of coal have an increase in cancer of the lungs, skin, urinary organs, larynx, stomach, and intestines.²³

(3)

The industrial operations which most closely resemble coal liquefaction in production of hazardous chemical exposures are the coke oven and coal tar processes.^{3,5} Similar exposures also occur in such coal carbonization facilities as gas retorts and producer gas plants. Many polynuclear aromatic hydrocarbons, widely recognized as cancer agents, are present in these processes, as well as in coal liquefaction. Workers exposed to such process materials have clearly been shown to have an increased rate of several types of cancer.

In 1946, a British study of coal tar exposures reported that the rate of cancer of the scrotum was over five times higher in coke oven workers than in the general population.¹¹ In 1952, an 81% excess in deaths due to lung cancer was found in British gas retort workers as compared to the general population.⁶ A 1966 study of the gas retort industry also found a high rate of bladder cancer in these workers.¹ In 1967, workers in a Japanese producer gas plant were studied. These workers had a lung cancer rate 33 times higher than other Japanese steel workers.¹²

More recent studies continue to document high cancer rates related to coal distillation and combustion materials. An American study of roofers working with coal tar pitch found a significantly increased mortality rate of deaths from lung cancer.⁹ In 1972, a report was published of a long term study of British gas industry workers.⁷ In this study, over 11,000 gasworkers were followed for eight years, and over 3,000 of them followed for a further six years. In a 12 year period, lung cancer deaths were higher by 140% and bladder cancer deaths by 208% in men heavily exposed to the products of coal carbonization as compared with those exposed only to by-products. A recent American study of 57,000 steelworkers in Allegheny County, Pennsylvania, found excess lung cancer mortality for coke oven workers up to ten times the rate in other steelworkers, with significant increases in cancers of the kidney and prostate.¹⁸

In summary, the implication of the E.I.S. that the hazards of the SRC-II are unknown and unproven is inaccurate, misleading, and just not true. SRC-II is an extremely hazardous and dangerous process - one that should be approached with far more caution than does the DOE.

IMPLICATIONS OF FORT LEWIS EXPERIENCE

The DOE's contention that the SRC-II plant will be a safe place to work is based primarily on the experience reported from the Fort Lewis pilot plant in Washington State.

The evaluation of this experience is inadequate, unscientific, and misleading. A scientific evaluation of the health and safety of a working population requires that a statistical analysis of the illnesses and complaints of the workers be done, and compared to a control group of healthy but unexposed workers. The draft E.I.S. only offers the subjective impression that no "chemically traceable incidents" occurred (a statement which the Energy Department knew was untrue). In their own literature on the medical program at Fort Lewis,¹⁹ they reported "transient dermatitis from skin contact with the coal-derived material", photo sensitization of the skin, and folliculitis.

The E.I.S. states (4-1) that five years of operation at Fort Lewis "is well beyond the latency period of about 100 days for the appearance of skin tumors in experiments with laboratory animals." This statement

(4)

is simply a lie, based on the DOE's own research from the Batelle Memorial Institute.² The cancer latency periods in all mice except those exposed to nearly lethal doses was considerably longer than 100 days; the researchers are still following many animals after 456 days. But even more dishonest, and scientifically invalid, is the attempt to relate the cancer latency period in experiments with laboratory mice to that in humans. It is widely recognized that most cancers of internal organs will not show up for ten to 20 years after initial exposure.⁴ Five years of monitoring of the Fort Lewis workers is simply not enough time to say anything reassuring about the effects of these chemicals.

The draft E.I.S. also notes (4-2) that the fuel tested (and found hazardous) from the Fort Lewis plant contained "significantly less" of the most toxic and cancer-causing chemicals (in the heavy distillates) than the fuel to be produced in Monongalia County. The Fort Martin fuel is likely to be even more hazardous to this community and the work-force.

In the area of worker safety, the draft E.I.S. is virtually silent. Serious explosions have taken place at several SRC facilities.⁵ Spills are known to have occurred at Fort Lewis.⁶ None are mentioned here. An evaluation of previous accidents, spills, and explosions with plans for design modifications and community and worker contingency and evacuation programs are essential.

The DOE's claim that the results of the health program at Fort Lewis are "encouraging" (4-2) is based on a superficial analysis, inadequate information, and misleading statements. It is far from reassuring for the future workers of the proposed Fort Martin plant.

PLANT DESIGN FOR HEALTH AND SAFETY

The prevention of the exposure of workers to hazards is the first principle of Industrial Hygiene.¹⁶ This is best accomplished by the use of engineering design and controls built into a plant at the earliest stages of design. This approach is far superior to the wearing of personal protective clothing, respirators, taking showers, etc. Health and safety measures built into a plant are far more effective and less costly than adding these controls after a plant is built. To fail to take occupational exposure into account in plant design, when the materials involved are as hazardous as in SRC-II is to predict failure in building a safe and healthy demonstration plant.

The E.I.S. does not reflect this design approach to the SRC-II. The E.I.S. evaluates eleven major process areas and control options. (2-23) The evaluation of these alternatives, however, is based on threats to the external environment, and in no way shows any consideration of alternatives desirable from an occupational exposure point of view. The only references to design for safety are references to high-integrity pump seals and packing and "where possible" enclosures around processing equipment that typically requires frequent maintenance. Considering the difficulties in designing a safely enclosed system under the expected conditions of heat, pressure, and abrasion from the slurry material, the E.I.S. is clearly insufficient.

The SRC-II process presents some unique problems for maintaining the integrity of a closed system and preventing fires, explosions, and exposures

(5)

to hazardous chemicals. The E.I.S. does not address the problems that stem from the combination of high temperature, high pressure, transport of abrasive and corrosive material, and three phase (solid, liquid, and gas) system found in the SRC-II process. These conditions are unique to the process, and design meant for typical petro-chemical industry application will be insufficient. In particular, the operating conditions accelerate erosion/corrosion effects and increase the likelihood of leaks and equipment failure.

NIOSH states¹⁰ that coal liquefaction pilot plant technology has shown the need for improvement in materials of construction, piping and pressure vessels, rotating equipment, seals, valves, instrumentation, solid/liquid and design techniques. With the exception of seals, none of these design questions are addressed in the E.I.S.

The bulk of attention in the E.I.S. to worker health and safety is directed to what is referred to as Industrial Hygiene - that is measuring exposure (after the fact) and the development of epidemiology (again the measuring of disease after it is too late to do something about it.)

The E.I.S. treats the SRC-II as just another petro-chemical plant. It is not just another chemical plant. The level of risk involved to workers will be far more serious than those associated with the petro-chemical industry. As such, special attention to worker health and safety must be given at the early stages of design - before the demonstration plant is built. NIOSH recommends that the special risks in the coal conversion industry demand that systems safety or fault tree analysis be applied in the design of these facilities.⁴ Impact of a plant can not be assessed until possibilities and probabilities of various kinds of failures are presented. The fault tree analysis systems were developed in the aerospace industry where a small margin of error was absolutely necessary. This method looks at each step of a process and attempts to predict its chances of failure, and the effect this failure will have on the safety or integrity of the whole system. Its greatest asset is its ability to identify many accident and leak situations which would be missed if less detailed methods are used. A systems safety analysis must be done before the safety of this plant can be evaluated.

UNEXPECTED FAILURES

In several areas, the draft E.I.S. either does not recognize or fails to address major potential impacts. For example, the possibility of major explosions, as has occurred at other similar plants;¹⁵ or a prolonged release of toxic gases, are not mentioned, nor are their potential impacts on the community addressed.

The discussion of transportation accidents involving the product fuel (4-6) never actually addresses the problem. Most of the discussion is devoted to a superficial estimate of the frequency of railroad spills, using accident rates it admits are not likely to be typical in the congested eastern rail beds involved. It is then concluded that the impact of these spills "is not believed to be greater than that from a major accidental release of hazardous chemicals, pesticides, or similar materials". Considering

the pollution of the entire James River basin by Kepone, and the disease and birth defects from chemical pollution of soils at Love Canal, this assessment is little comfort.

PRODUCT USE

The hazards of exposure to the heavy fuel oil to be produced at the SRC plant have been discussed. It is clear that the product cannot be treated like a conventional fuel oil, but must be regarded as a hazardous chemical. Because of its mutagenic and carcinogenic properties, Battelle Memorial Institute "suggests the need for effective means for SRC materials management", including:

- 1) Raw product refining for upgrading (that is catalytic and non-catalytic hydro-treating)
- 2) Protocols for special marketing and handling of identified toxic products.
- 3) Optimization of process operations to minimize the production of toxic materials.²

Although the E.I.S. acknowledges that hydro-treating "might significantly reduce the mutagenic activity of transported products," (4-2) a hydro-treating facility is not included in the proposed plan.

The handling and marketing of this product are clearly issues of great public health concern. On these questions, the document is not reassuring. In the discussion of transportation we are told that "it is likely that transportation of the products will result in accidental releases which result in direct and indirect exposure of the public to process material." (4-6) The logistics of transporting this highly toxic fuel around the country are ignored. No special procedures have been developed for the safe transfer and handling of the product.

We are also concerned about the uses planned for this toxic fuel. According to the E.I.S., risks may be reduced by "the imposition of appropriate limitations on the distribution of the product during the initial operation of the demonstration plant" (4-10). These limitations are not defined; we are not informed of the plans for the distribution of the product either during the initial operation of the plant, or during later phases of operation. Is this fuel to be used only at select public utilities? Or is it to be available on the open market as a private transportation fuel (diesel)? We are given no information about the expected end-uses of this fuel; its indiscriminate use could result in major public health hazards throughout the country.

E.I.S. CREDIBILITY

The credibility of the E.I.S. with regard to occupational hazards is in serious doubt because of glaring omissions and inconsistencies in the document.

The E.I.S. reassures us by pointing to experience at the Ft. Lewis pilot plant. We have demonstrated how misleading this assurance is.

The E.I.S. is misleading in its assertion that the materials in SRC-II are only "suspected...carcinogenic or toxic to man". (4-1) Further doubt is cast on the E.I.S.'s credibility by their underestimate of the toxic potential of the process.

The E.I.S. shows a lack of attention to the hazards of exposures to workers at the plant. This lack of attention is underlined by the fact that no one with occupational health or industrial hygiene credentials appears among the preparers of the E.I.S.

The E.I.S. states (4-4) that "some skin contact will be inevitable for some members of the maintenance crew." This is followed by the statement that, "Effects of such exposure can be minimized by proper washing techniques." However, Gulf's operator of the Ft. Lewis Plant reports that some of the polynuclear aromatic materials can not be washed off the skin.²¹

The E.I.S. implies that worker exposure to hazardous materials will be minimal (4-4) "Exposure mechanisms for the plant work force will vary significantly, depending on job assignment; maintenance and operating personnel will receive the highest exposure during maintenance operations. Exposure mechanisms for the work force not directly involved in maintenance will be similar to those for the general population, except that exposures will be greater." Enviro Control, in its study of the Ft. Lewis operation gives a different picture of exposure. "Of the 134 workers at the Fort Lewis plant, 133 were identified by job assignment as having potential exposure to process contaminants."¹⁹

While the E.I.S. refers several times to a plan for some future "safety analysis report" (4-5), we assert that impacts of the SRC can not be determined until this report is completed.

The E.I.S. is contradictory in its analysis of plans for toxic material control. The introduction (XIX) states that existing regulations will not assure elimination of risks associated with the materials found in SRC-II. But what is the goal of the DOE control plan? The E.I.S. states (T-4) that they will apply "pollution controls and mitigation procedures for compliance with existing regulations for the demonstration plant." While admitting the inadequacy of current environmental and occupational health standards for SRC-II materials, the E.I.S. makes clear that compliance with the inadequate standards is Gulf and DOE's goal.

SRC-II AS HEALTH EXPERIMENT

The most shocking part of the E.I.S. is its clear implication that the demonstration plant is intended as a health experiment in which the workers and residents of the region are to be the guinea pigs. "one purpose of the SRC-II demonstration is to identify any serious health and environmental risks associated with the demonstration plant and a future commercial SRC industry." (4-59) According to the E.I.S., DOE will develop a program to monitor plant emissions, monitor the region's environment, monitor the workers' environment, conduct medical examinations of the work force "to monitor the response of individuals to occupational exposures", and conduct research to discover how workers and the environment respond to chemicals in the SRC. (4-59-62) This is exactly how experiments on guinea pigs are carried out.

(8)

The substance of the entire document approaches occupational health problems by measuring the chemicals that the plant puts out, and the effects these chemicals have on human beings. Despite the certainty that these chemicals are extremely dangerous, the E.I.S. states that the toxic and cancer producing nature of these chemicals is "not proven by direct experiments." (4-1) "Direct experiment" is a euphemism for experiment on human beings. SRC-II, Ft. Martin, is the direct experiment, and all of us here in this room are the guinea pigs.

Submitted by the Monongahela
Alliance for Community
Protection

Prepared by Paul Becker
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304-291-3600

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000022

July 16, 1980
2017 Eastwood Drive
Durham, N.C. 27704

Dr. Larry M. Joseph, Director
SRC Division
Office of Project Management
Mail Station E-833
Washington, D.C. 20545

Dear Dr. Joseph:

This letter is a comment on the draft environmental impact statement (DOE/EIS-0069-0) concerning the Solvent Refined Coal-11 Demonstration Project planned for Fort Monry West Virginia. I commented on the preparation of the impact statement on November 7, 1979. I would appreciate receiving a copy of the final environmental impact statement.

My particular area of specialty is air pollution control engineering and therefore I will limit my comments to that area. First, I want to support some aspects of the Solvent Refined Coal-11 Demonstration Project (SRC-11) to the extent of suggesting that they are essential to the SRC-11. Vapor recovery systems on all hydrocarbon (organic chemical) storage tanks and loading racks is essential. Usually heavy (low vapor pressure) hydrocarbons are excluded from control by vapor recovery systems; however, in this case the heavy hydrocarbons are apollutely the more toxic chemicals produced by a SRC-11. The use of

a controlled combustion/flame system is essential. Startup, upset and shutdown operations will most likely be frequent experiences in the SRC-11. These operations must be controlled and the use of typical refinery flares does not provide adequate control.

Second, I want to suggest that additional controls should be used in some cases. Where double or tandem mechanical seals with a flushing liquid can not be used a siphon seal with a flushing liquid should be used. Welded connections should be used as often as possible. Sealed bellows and diaphragm valves should be used as often as possible. Control of SO_2 and NO_x should be pursued from a goal of reducing these emissions to a minimum. Control of particulate matter should start with a level representative of the current state of art and then develop to provide information for possible future expansions.

I want to suggest three additional controls and control strategies because one demonstration that SRC-11 must exhibit is its ability to be an acceptable neighbor. For example, fugitive emissions of hydrocarbons, including H_2S , could cause an odor nuisance. Such a problem would demand closer review of the remaining hydrocarbons, including benzene

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matter, SO_2 , NO_x and hydrocarbons. The use of the Radian estimates for fugitive emissions of hydrocarbons is appropriate for uncontrolled emissions. Emissions of hydrocarbons from in-line valves are 82 lb/hr. (Table C.6 of the draft EIS). Emissions of other pollutants require comparative evaluations. I have attached "Standards of Practice Manual for the Solvent Refined Coal Liquefaction Process" (EPA-600/7-78-091). This manual should provide the basis for a reasonable comparison to the estimates in the EIS. I have also enclosed draft premises and regulations for fugitive emission levels of volatile organic chemicals and benzene and a background document on control of fugitive emission sources. These drafts were presented to the National Air Pollution Control Techniques Advisory Committee in April 1980. I plan to answer the application for construction of SEC-11

Sincerely,
Fred Dimmick

cc: Vernon Butler

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and other carcinogenic substances. Just because the emissions from the sulfur recovery plant might achieve the standard of performance for new stationary sources (40 CFR 60.104) does not mean that about 800 tons per year of SO_2 should be considered the best available limit. Fuel burning devices would be covered by 40 CFR 60.104 also. The use of low NO_x burners is recommended. The use of wind barriers in addition to water suppression is recommended for active coal piles. Polymeric crusting agents for passive coal piles; baghouses to control particulate matter from the many point sources in the coal preparation plant (40 CFR 60.250); and fine small process venters when operators adjust an intake; periodic calibration of the combustion system for low NO_x emissions for allowed operators to attempt to maintain low NO_x conditions are recommended. The environmental impact of the SEC-11 which is only the first phase of an overall program is significant by reducing emissions beyond a level which is just acceptable. SEC-11 will demonstrate that these types of plants can be acceptable, clean neighbors.

Finally, I believe that review of the actual construction is necessary to ensure that the best available control technologies are used. SEC-11 would be a major stationary source for particulate

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July 22, 1980

Dear Sir,

This is simply a request for information because now that the plant is in the final stages before construction, we need some answers. Some of us choose to stay on in Ft. Martin because months ago we were lead to believe we'd be safe. Now that time is running out we find out the truth. Gulf Oil people are finally "telling it like it is." As a resident of Ft. Martin, I would like to request that someone arrange a small private informative meeting with local residents (in Ft. Martin Area only) so we can have some TRUE IMPACT STATEMENTS. There's been enough ~~batting~~ around the bush. We need answers now. The Ft. Martin United Methodist Church would be a good place since most of those concerned attend that Church. Please help us.

Sincerely,
Mrs. R. May Everson
Rt 1 Box 190
Madenville, W. Va.
36541
Phone 599-6916

James K. Alexander
U. S. Department of Energy
SRC-II Public Hearing
Post Office Box E
Oak Ridge, Tennessee 37830

July 28, 1980

Dr. Lerry M. Joseph, Director
 SFC Division
 Mail Station E-333
 Washington, D.C. 20545

00029

Dear Sir:

This is in regards to the possible destruction of something that has, for the past two hundred years, touched the lives of several generations of the people of Ft. Martin. The Ft. Martin Methodist Church is now in danger of being abandoned because of the impact of the proposed Solvent Refined Coal-II (SRC-II) project for Ft. Martin in Monongalia County, West Virginia.

If the SRC-II project is approved for construction we stand to lose more than our history, but our future as well. We have been told that the church building will be preserved but for us this isn't enough. What is a church with no people? Slowly the Ft. Martin Community is being dissolved with grim statements of what the SRC-II project will do to their environment and that of the surrounding area.

We feel that too many questions are left unanswered by the Draft Environmental Impact Statement and we simply wish to request that final approval of such an experimental project be held off until the answers are found. Surely there are ways to find the answers without affecting so many individuals.

We, the members of the Ft. Martin Methodist Church congregation, wish to request that those who represent us consider the long range impact of SRC-II before the final decision is made. Ask questions! Get answers! We ask your concern for the people whose future you are deciding.

With prayers of concern and hope for our future, we solicit your assistance in regard to this matter.

Respectfully,

Janita Coyle
Rosemary Cavensow
Mary Lou Fickhardt
Georgia M. Parker

Representatives
 Fort Martin Church
 Administrative Board

Rt. 5 Box 120 DH
Morgantown, W. Va. 26505
July 10, 1980

July 10, 1980
Page 2

Robert N. Hoerle

Mr. James Alexander
P. O. Box 3
Oak Ridge, Tennessee 37830

Dear Mr. Alexander:

The following are my comments on the Draft Environmental Impact Statement prepared by the Department of Energy on the proposed Gulf Oil SRC II project for Fort Martin, West Virginia:

1. It should be made clear that this project alone will not significantly decrease our nations dependency on foreign oil supplies. Figures showing the amount of fuel (boiler fuel) this plant will produce in its different stages, and how much fuel (boiler fuel) is consumed yearly in the United States should be supplied. This will allow the people to better compare the advantages to the disadvantages related to this project.
2. In order to effectively assess impact, the part this plant will play in the local tax structure needs to be addressed. What projected taxes will this plant pay locally. More emphasis should be put on the inevitable increased cost of living to surrounding communities, also increased taxes. All of which will result from the increased demands that will be put on all commodities including public services. In short, spell out in dollars and cents what the monetary cost will be to surrounding communities.
3. Present condition of public services was not addressed. In most areas of the surrounding communities, public services are below standard. In most cases, water and sewage is not in the fore-seeable future. How will an influx of people effect these conditions.
4. Alternative solutions to the "energy crisis" were not adequately addressed, i.e., conservation, solar and wind.
5. A complete re-writing of the Draft Environmental Impact Statement should be considered. Adequate information to allow proper assessment, was not available in most cases throughout the EIS. The possibility of a third agency such as, Council on Environmental Quality, preparing the EIS or overseeing the EIS should be considered. The Department of Energy is obviously very involved in this project. Conflict of interest could prove to be a real threat to the validity of the EIS.
6. Since people should be the main concern of any environmental impact statement, the feelings of the people in

surrounding communities should be addressed. The significant opposition to this plant which was apparent at many public meetings is an adverse impact that is relevant to this project. Lists of all public meetings, attendance, and statements should be made available in this EIS. Information should be supplied as to the names of property owners from whom land was acquired. The amount paid for the purchase and whether the land was acquired through condemnation proceeding or not.

In order that people can make a fair and educated evaluation of any project, particularly one of this magnitude, all facts that can possibly be supplied from the inception of this project to future projections should be supplied to the public.

Sincerely yours,

Robert N. Hoerle
Robert N. Hoerle

Robert A. Jones

00095

1205 Macomb Street
Morgantown, West Virginia 26505

July 16, 1980

Dr. Larry M. Joseph
Director SRC Division
Office of Project Management
under the Assistant Secretary for Fossil Energy
Mail Station E-333
Washington, D.C. 20545

Dear Dr. Joseph:

Re: Comments on DEIS
DOE/EIS-0069-D

I am providing herein my written comments on the Draft Environmental Impact Statement, Solvent Refined Coal II Demonstration Project at Fort Martin, West Virginia. My comments are directed toward the socio-environmental aspects of the DEIS.

I am currently an Assistant Professor in the School of Social Work at West Virginia University, having been employed here for the past seven years. Previously, I have professional employment experience in Mental Health and Public Welfare, all in the State of West Virginia. I have a Masters in Social Work degree from West Virginia University. My professional interests are in the area of rural community work. I am currently participating with several other Social Work faculty in studying the effects on rural community development of industrial development related to energy production. My comments are based upon my professional knowledge and experience, not related to my affiliation with West Virginia University.

My general reaction to the Draft Environment Impact Statement is that it does not satisfactorily assess the short-term or long-term and cumulative impacts of SRC-II. My recommendation is that the DEIS be re-drafted, hopefully with the assistance of people with more expertise in subjects of this nature. My specific concerns are the following:

1. The statement does not utilize a "systematic, inter-disciplinary approach" as called for in the National Environmental Policy Act of 1969. The background of those who prepared the socio-economic section and the DEIS material itself do not reflect knowledgeable use of current sociological, psychological, economic and political science concepts. Clearly absent is socio-psychological analysis of costs and benefits of SRC-II. There is existing professional literature on this general topic which does not appear to be reflected in the report.

2. The DEIS does not, as indicated by the 1969 NEPA, indicate "any irreversible and irretrievable commitments of resources which should be involved in the proposed action should it be implemented".
3. The DEIS does not assess the long-range and cumulative impacts of possible future expansion of SRC-II to commercial scale. Since large amounts of resources will be devoted to the demonstration phase, the long-range effects should be given equally careful analysis in the initial assessment to prevent development of a project which is acceptable at demonstration scale but not at commercial scale. Since the commercial scale project is some five times larger than demonstration, this long-range assessment is critical. Important, too, is assessment of cumulative effects of SRC-II with other planned or potential industrial developments in this region. For example local and state industrial development authorities should be consulted to determine their long-range plans for this area so their potential socio-economic effects could be added to those of SRC-II. Noticeably absent from the EIS was reference to the planned Coking Facility at Round-bottom in Monongalia County.
4. The DEIS does not address the potential adverse impacts which may be experienced by communities faced with rapid growth due to energy development which are described in DOE's Report to the President on Energy Impact Assistance, published in March 1978 (DOE/T-R-009, UC-13). This report states that uncertainty on the part of those affected by industrial development aggravates socio-economic problems related to it. In the words of the report, "This uncertainty may stem from lack of information from industry or government, regulatory, or litigative conflict, lack of clarity regarding the duration of the activity, or the threat of 'boom and bust'." One does not have to travel far in Monongalia County from the site of SRC-II (e.g. to communities of Osage, Jere, Pursglove, Everettville, and others) to observe what is meant by the threat of "boom and bust" and why local residents can have concerns in this regard. The Appalachian regions economic development has been typified by such "boom and bust" cycles and the human suffering which has resulted from the "bust" end of the cycle. That SRC-II is a demonstration project with federal government involvement because of the "risks" involved clearly identifies this project as one which is more uncertain in terms of long-range development. That this DEIS does not address potential long-range consequences of SRC-II adds to the uncertainty which the Report to the President warns against.

In addition the DEIS does not reflect consideration of all the categories around which adverse socio-environmental impacts could occur. For example the Report recommends study of the following:

1. Public facilities and services shortfalls.

2. Commercial facilities and professional services shortfalls.
3. Housing shortages and housing price inflation.
4. Social disruption.
5. Transportation impacts.

While there are inadequacies in the breadth and depth of the discussion in the DEIS of all these categories, #4, Social disruption, is totally neglected. Stressful conditions which can arise from the influx of new residents to communities are "increases in rates of crime, depression, alcoholism, divorce, and child abuse. These in turn may further erode the quality of community life....These factors tend to increase the costs of local government....Preventive and remedial social service programs are crucial". It is obvious that analysis of these considerations as well as provisions for amelioration are not assessed in the DEIS. If the project is to be successful, uncertainty regarding the nature of those impacts should be reduced through a careful and scholarly analysis of existing knowledge about the effects of social change of this nature. The results of this analysis should, then, be shared through a series of public meetings with residents of the region for their reactions and involvement in development of ways to reduce the negative aspects and strengthen the positive contributions of SRC-II to local social and economic life.

5. The economic aspects of the DEIS are very incomplete. Information should be included to specify the projected amounts of money which should accrue to the local private economy and description of the primary and secondary effects of this infusion of income locally. For example, will housing and other prices increase, thereby having negative effects on those with limited incomes? Will affordable and decent housing be even less available to them than is presently the case? What are the long-term effects on development of jobs in the area? Will those who are currently unemployed or underemployed benefit from SRC-II jobs directly or indirectly? Will these jobs end if the demonstration is unsuccessful? What related industries can result (e.g. more fast food franchises, more bars or taverns, more department stores, etc.)? What happens to the capital investment for these industries if SRC-II fails?
6. The analysis of impacts on schools is very incomplete. The specific schools within each county which can and cannot accommodate increased numbers of students should be identified based upon building size and desirable pupil/teacher ratios. The location of these schools should, then, be matched against areas where population growth in the region is most likely to occur. A similar micro-assessment should be made regarding other public services such as fire protection, police, water, sewerage, recreation, social services, etc.
7. The relationship of SRC-II to local planning efforts (or lack of them in Monongalia County) is not dealt with adequately in the DEIS, Research

as indicated, for example, that growth is managed most smoothly when it is planned for. That there is no comprehensive plan in Monongalia County regarding land use and public facilities (e.g. water, sewage, housing, etc.) could be of concern in this regard. There is no local mechanism to bring about local development in an orderly and cost efficient manner.

8. The baseline data does not take into account aspects of community life which are commonly included in community analyses. I would recommend that the paradigm used by Roland Warren, one of the foremost experts in the field of Community Research. Briefly, he includes community background and geographic setting; economic life; government, politics and law enforcement; community planning; housing; education; recreation; religious activities; social insurance and public assistance; social welfare services; health services; provisions for special groups (e.g. aging, handicapped, displaced persons, etc.); public communications media, inter-group relations; and community associations; as categories for study. The categories covered in the baseline assessment should, then, be those dealt with in the section on impacts associated with demonstration phase (both construction and operation) and long range commercial phase. The present DEIS is inconsistent in the ways in which categories are described for each stage of development.
9. The DEIS is not well documented. Most of the information does not rely on scientifically-obtained evidence. References are lacking which describe studies which are related to SRC-II development and on which conclusions are based. For example what is the experience of similar communities in accommodating industrial developments of this kind?
10. The kinds of mitigating measures which are indicated is totally lacking in the DEIS. The studies currently underway or to be undertaken to determine the nature and magnitude of potential socio-environmental problem areas should be described in detail.
11. Public financing of services for SRC-II and in-coming population is not described adequately in the DEIS. Except to say that local property taxes are low and could go higher to provide necessary expansion of public services, the DEIS does not indicate how these services could be obtained. What level of public investment will be necessary in each tax and expenditure to support needed services category? The nature of increased tax payments locally is not specified. The \$11. million payment in Business and Occupation Tax to be paid by SRC-II is to the State of West Virginia and does not necessarily result in increased services locally.

12. One final comment.....The most critical variable in determining the socio-economic acceptability of a project such as this is whether the people of the region to be affected understand the costs and benefits and want the project. Except in experiments on rats, guinea pigs, and other lower species, opinions on the desires, concerns, and wishes of those to be affected is common practice in determining the feasibility of a specific change. The lack of this information in the DEIS is the most serious indictment which can be made of its effectiveness in addressing potential impacts of SRC-II. Democratic values and principles of experimentation on human subjects indicates that "informed consent" must be obtained. In addition, unless the residents of this region are ready, willing, and able to accept new residents to the community, suspicion of "outsiders" and newcomers which is a primary feature of the traditional culture of this region will result in their rejection and ineffectiveness of the project. My 36 years of experience as a resident of West Virginia, my academic study of rural and Appalachian cultural patterns and 15 years of professional experience provide evidence that these cultural considerations are paramount. While I have no empirical evidence to indicate that SRC-II is not understood nor favored by the local community now, I suspect that it is not. I would strongly recommend that some form of public opinion surveys be conducted throughout each stage of development to provide awareness of this critical aspect of development of the project. Certainly no EIS is complete without evidence of this nature.

All is not negative with the DEIS. The material concerning demographics-numbers of people anticipated to be employed directly or indirectly by SRC-II is very useful in providing population projections. This is a good beginning, one which I hope can be continued in a revised DEIS.

Sincerely yours,


Robert A. Jones

00032

2 Braddock Street
Morgantown, WV 26505
July 29, 1980

Dr. Larry M. Joseph
SRC Division
Office of Project Management under the
Assistant Secretary for Fossil Energy
Mail Station E-333
Washington, DC 20545

RE: Environmental Impact Statement
Proposed SRC-II Facility, Monongalia County,
West Virginia

Dear Dr. Joseph:

This comment is written to clarify and supplement my remarks at the hearings which occurred in Morgantown on July 1, 1980. To summarize, I am concerned that the Department of Energy has totally ignored the serious detriment to housing and other matters that will result from construction of SRC-II according to the present schedule.

First, the Environmental Impact Statement suggests a vacancy rate of 7% for rental apartment units in the Morgantown area. (§4.2.4.1). Yet, nothing in the Statement identifies the source for this statistic. In fact, the purported vacancy rate is both unsubstantiated and contrary to the experience of Morgantown residents. Recently Robert & Eichler Associates, Inc., issued a "Housing Analysis for the Monongalia County Area of West Virginia". The document is the first "working paper" in a study prepared for the Region VI Planning and Development Council. That document suggests a vacancy rate of between 1 and 2 percent during the past academic year. A slightly increased vacancy rate of 2 to 3 percent is projected for the next academic year.¹ See pp. 13-14.

1]Footnote on following page

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July 29, 1980

Moreover, the Eichler study confirms the one percent vacancy rate in single family rental units and the absence of any vacancies in mobile home rentals. Given this situation, it is apparent that there is no significant rental market in Monongalia County to absorb the expected influx of construction workers or others who will be attracted to employment opportunities in the county.

Second, the Environmental Impact Statement projects an increase of only 1,620 persons in the county. (§4.2.4.1). This figure is highly suspect and appears to be a low estimate. However, even if it is correct in relation to the SRC-II work force, it fails to consider the substantial workforce which will also be necessary to construct the proposed coke plant to be located in Monongalia County or the expansion and addition of other businesses which will result from the "boom economy" that the SRC-II and coke plant will create.²

Third, the problem that will result will have its most disastrous impact on senior citizen, the disabled, low-wage earners, and welfare recipients in the county. Almost none of these individuals will benefit from the high wage jobs created by the construction of SRC-II. The maximum welfare grant in this state is \$254/month. SSI grants are not supplemented in West Virginia. Outside of coal mining and construction, wages are low. Rents, however, are already high.³

¹An earlier study, which I have not been able to obtain, was conducted for the Monongalia County Hospital Board. I understand that the study indicated a vacancy rate of 1%. I am confident you can obtain that study if you wish.

²The Environmental Impact Statement optimistically projected a decline in enrollment at West Virginia University of 2000 students between 1980 and 1988. (§4.2.4.1). However, Eichler Associates indicated, in a personal communication, that the decline results from a projected decrease in the number of West Virginia high school graduates. Since the University currently denies admission to a substantial number of applicants from other states, the decline will occur only if out of state admissions are frozen at current levels.

3] Footnote on following page

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July 29, 1980

The rental market cannot absorb the population growth anticipated in this county. The result will be severe escalation in rents. The construction workers, who will receive relatively high wages, may be inconvenienced, but they will be able to afford those rents. Local residents, however, will be priced out of the rental market or relegated to overcrowding in existing substandard rental units which the better paid workers do not desire. The impact of rent escalations will fall most severely on those least able to adjust--individuals living on fixed income, unskilled workers, and students.

Fourth, the speed with which SRC-II will be constructed probably renders any significant local adjustment in the housing market impossible. The housing study proposed by Region VI will not be completed until September of this year. Any action will occur much later. Yet, construction will begin next year. By December, 1981, the Environmental Impact Statement projects a workforce of 1,175. By December, 1982, the workforce will increase to 3,154. (Table 4.4). Again, this presupposes no workforce will be involved in the coke plant and no additional demand on the rental market will result from other sources. Even so, when the workers arrive, the housing will not yet have been built.

Fifth, neither the County nor the State have shown much interest in resolving this problem. None of the recent round of 601 Energy Grants will address the imminent housing crisis. The comment which you have already received from the Pittsburgh HUD office, dated July 21, 1980, emphasizes the problem--lack of available sewer and water facilities for mobile home development, absence of land use controls, etc.

In conclusion, the projected development of SRC-II is moving this county toward a serious housing emergency without sufficient lead time for planning and efforts to avoid the resulting problems--if they can be avoided. Monongalia County is already in a housing crisis. The future is gloomy and will not be made to disappear by the apparent effort of DOE to ignore or dismiss the problem.

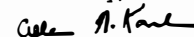
³ Rents may not be high compared to some large cities, but they are high in relation to surrounding counties and to the incomes of individuals in the area. A study done for the Monongalia County Hospital Board indicates that the rate for a one bedroom unit was \$245 in 1980. Individuals on SSI and welfare do not receive income, in general, equal to that rate. See the Housing Study by Roberts & Eichler Associates, Inc., page 14.

Dr. Larry M. Joseph
Page Four
July 29, 1980

Similar problems exist with roads, sewers, water, etc. There is insufficient lead time to address the anticipated problems. Road congestion is already a problem when the University is in session. While the Department of Highways may be studying road construction possibilities, it appears that the roads will be constructed after SRC-II is already underway. Moreover, as with housing, the discussion of roads and services in the Environmental Impact Statement ignores the intersection of SRC-II and the coke plant.

Finally, I am extremely concerned with the potential of a disastrous boom, followed by an incredible bust. By the time the local economy begins to adjust, DOE and Gulf will be considering the decision as to whether to build a commercial phase. That commercial phase may prove impossible without severe deviation from acceptable air, water or other environmental standards. At that point, the choices will be acceptance of a commercial phase that destroys our air and water or acceptance of a severe economic downturn with unemployment, etc. Before a final decision on the demonstration plant is made, the DOE should have a better idea as to whether the commercial phase is realistic.

Sincerely,



Allan N. Karin

ANK/dm^c

11

471 Cobun Avenue
Morgantown, West Virginia 26505

July 15, 1980

Mr. James Alexander
PO Box E
Oak Ridge, Tenn. 37830

Dear Mr. Alexander:

I write as a citizen and taxpayer of Morgantown concerned about the environmental and social ramifications of the SRC II plant "planned" for this area. I wasn't able to attend the recent hearings, even though I did receive and read the draft EIS. I feel the project will go through regardless of public outcry; however, I want to make my opinions heard since you are going through this formality.

First, I fear for the impact of this plant, combined with the impact of currently-operating plants and the planned coking facility, on the environment. Needless to say, Morgantown's location in a "bowl" surrounded by mountains guarantees that our air, if not unhealthful, will be unpleasant. Living here will no longer be a source of pleasure. Our one true asset, our pleasant surroundings, will be marred.

Second, I feel that the existence of the university in a polluted earcindgenic environment will be threatened. The university is perhaps the largest employer in Monongalia County. Since I work for WVU, my job will cease to exist along with the university.

Having been born and raised in the steel-producing town of Homestead, Pennsylvania, near Pittsburgh, I distinctly remember the days when, waiting for my school bus to take me home in the afternoon, a mist of silver dust particles would fall and form a layer on the school books cradled in my arms. I would write my name in this glittering layer, as an innocent child not realizing that I was playing with disease-causing materials that threatened my health.

I am not so innocent now. I am angered by threats to my health and my livelihood. I say "no" to SRC II.

Sincerely,

Carol A. Katonik
Carol A. Katonik

*Logged on
CIST*

A-31

JACKIE SWIGART
Secretary



JOHN Y. BROWN, JR.
Governor

COMMONWEALTH OF KENTUCKY
DEPARTMENT FOR NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION
BUREAU OF ENVIRONMENTAL PROTECTION
DIVISION OF AIR POLLUTION CONTROL
WEST FRANKFORT OFFICE COMPLEX
1050 U.S. 127 BYPASS SOUTH
FRANKFORT, KENTUCKY 40601

00043

August 7, 1980

Dr. Larry M. Joseph, Director
SRC Division
Mail Station E-333
Washington, D.C. 20545

RE: SRC-II Draft Environmental Impact Statement (EIS)

Dear Mr. Joseph:

We have reviewed the May 1980 Draft Environmental Impact Statement (EIS) for the Solvent Refined Coal Project, SRC-II. We have listed below some additional points that should be addressed in the final Environmental Impact Statement, and in the construction permit application to the Kentucky Division of Air Pollution Control if the alternate site at Equality, Ohio County, Kentucky is selected.

I. Odors: The Federal Register Vol. 44, No. 196, Tuesday, October 9, 1979 which announced the preparation of the EIS, stated on page 57960 that the problem of odors from SRC-II would be addressed. (Column 2, Item (2)). To our knowledge the Draft Environmental Impact Statement of May 1980 does not discuss odors from the plant. Potential sources of odors include fugitive H₂S emissions and nonmethane hydrocarbon emissions (NMHC) from reactors, pumps, valves, flanges, fuel gas handling, sulfur removal and recovery, waste water treatment, heat rejection system leaks, maintenance, upsets, and incomplete combustion in the flare. The H₂S emissions should be calculated and modeled to assure that they do not exceed odor threshold levels, Kentucky's ambient H₂S standard of 14 ug/m³ -1 hour average, and the odor standard of 7 dilutions.

II. Flare emissions: Since combustion in an elevated flare is incomplete, what will be the emissions of particulate, NMHC, CO, H₂S and other sulfur compounds, SO₂, and NO_x. Preconstruction modeling and post-construction monitoring should be done to assure that the flare emissions (in combination with the other plant emissions) will not violate the ambient standards, the PSD increments, or the odor standards. Page C-8 indicates that major flaring can be expected several times per year.

III. Control device efficiency for sulfur: Although the proposed Claus/Superscot control device meets the requirements of the federal New Source Performance Standard (NSPS), will it meet the requirements for Best Available Control Technology (BACT) under the PSD regulation?

IV. Coal dryer: Do the coal dryer emissions listed on page C-9 include the NMHC and sulfur compounds volatilized from the coal during drying? What are the amounts and types of these emissions?

V. Modeling: (Appendix Q). The time conversion factor

$$X_s = X_k (t_k/t_s)^{.17}$$

is not considered to be accurate. Other modeling techniques using 5 years of actual meteorological data should be used to determine the 1 hr, 3 hr, 24 hr, and annual averages.

The modeling should include estimates of the amounts of pollutants, (especially those that are hazardous) that will be deposited on the ground.

VI. Cooling towers: (pages 2-24 and 4-35) A determination should be made of the substances that would be emitted from the cooling towers, including the techniques to minimize such emissions. The ambient impact of the cooling towers should be included in the modeling. Since there will be no waste water discharge and the purified waste water will be evaporated, it is important that the emissions from the cooling towers are included in the determination of the over all impact of the source.

VII. A safety analysis report is mentioned on p 4-5 in the last paragraph, line 3b, but is not included in Section 1.3.3 as indicated. This report should be included in the Environmental Impact Statement.

VIII. There was no discussion regarding possible ammonia emissions. This should be confirmed.

Your consideration of the above eight concerns will be appreciated. If you have any questions please call Mr. George Day at (502) 564-6844.

Sincerely,

Norman E. Schell
Norman E. Schell, Director

NES:GHD:cm

cc: Jack Wilson

A-32

July 24, 1980

Dr. Larry M. Joseph
Director SRC Division
Mail Station E-333
Washington, D.C. 20545

00025

Dear Dr. Joseph:

Building the SRCII plant in Monongalia County will have many social and environmental consequences. Stresses on existing schools, roads, and housing will have far-reaching effects on the county and its people.

The absence of county planning and zoning, the low property tax (constitutionally limited), and the limited infra-governmental structure in the county will contribute to the difficulty of adjusting to the expected population increase. Present Federal programs such as the Farmers Home Administration 601 program, meant to help energy impacted communities, do not appear to be designed to meet our needs in providing needed services. At present the way these programs are being administered, communities which are in no way energy impacted may receive the bulk of the funds. Regulations have been written in such a way as to specifically forbid funding of projects most needed such as the extension of existing sewer and water lines.

While it appears that emissions monitored by existing EPA regulations will be within reasonable limits, there will be other emissions which may be potentially dangerous. We hope that this will not be a case of learning 20 years from now that some emission has caused severe medical problems or an environmental disaster. All emission information should be made available to regulatory agencies and the potential effects evaluated.

Sincerely yours,



League of Women Voters
Morgantown-Monongalia Co.

League of Women Voters
306 Lebanon Avenue
Morgantown, W. Va 26505

14

Dr. Larry Joseph
SRC Environmental
S.O.E. Hazard Energy
Forrestal Bldg.
Washington, D.C. 20585

J.K. May 29, 1980
Alexander

Rec 7/21 Comment #1

Dear Dr. Joseph

Attached are my comments on the River Basin Assessment of May 9, 1980. The comments are preliminary in nature and call attention to a glaring lack of objectivity, intentional misrepresentation of facts, and unsupported conclusions. In the appendix the S.O.E. draft EIS on SRC II reflects erroneous parts of the River Basin assessment, it suffers the same shortcomings.

Although I have not had the time to read the draft EIS in its entirety, its summary reflects a connection between the proposed Stensville Jackson Dam and SRC II. For example, it states that availability of water may be a "potential limitation for later demonstration and commercial operations," and later suggests that the SFD, with a potential 80 cfs, could solve the problem. The available data, however, indicates that there should not be any water shortage during the demonstration phase. Further, even assuming the SFD will be built — and that is not yet certain — the flow augmentation it might provide would not solve water quality problems or significantly reduce the flow deficits in PA during the Commercial phase (1990-2020).

Based on our discussion today, it is clear that the S.O.E. realises there are no factual basis for claiming SRC II dependence on SFD and that

problems associated with SRC II will exist with or without SFD.

With this in mind, as well as the fact that Pennsylvania is objecting to inclusion of SFD as a potential water source, I recommend that any reference to SFD be omitted from the final edition of the EIS. While such a recommendation may appear extreme at first glance, the careful scrutiny of available data will bear out the wisdom of the omission.

As I've indicated to you, I will provide further comments on the draft EIS once I have read it. In the interim, I trust my input is received in the same spirit it is offered, and I look forward to meeting with you at some later point in time.

Very sincerely,
Thomas Mikomoto

COMMENTS ON ORBC ASSESSMENT
WITH RESPECT TO WATER AVAILABILITY
FOR SRC II
NEAR MORGANTOWN, W. VA.

Dated May 9, 1980

By

SHARON MIHNOVETS

OBJECTIVE: Stated in subject assessment.

- develop
 - analyze
- >
- relevant data and information on
water availability and requirements

TO

assess availability of adequate water resources for SRC

GENERAL COMMENTS:

- Pennsylvania's methodology and approach appears neutral and in keeping with charter and objective.
- analysis by PA appears adequate and based on accepted professional methodology and practice.
- West Virginia's input
 - lacks analytical approach and does not provide technical data required to make unbiased assessment.
 - the lack of analysis is further obfuscated by categorical assertions that the proposed Stonewall Jackson (Dam) Lake Project (SJD) solves all of W.VA.'s problems (unknowns from analysis) plus those identified by PA --clearly contrary to facts contained in study or available from deductive comparison.
 - As the proposed SJD is in litigation in U.S. District Court, (The counts of the case involve major water quality and quantity problems,) it is unwise and unusual to treat it as a future given in an assessment of water resource availability.

- Given the impetus and emphasis on the synfuel plant, it is inadvisable to link any justification for SRC to the controversial proposed Stonewall where in fact SRC will not be SJD dependent.
- Does not address alternatives -- does not speak to conservation and water management options to reduce deficit in flow for DO., i.e., point source treatment of pollution. (BAT/BPT)
- Does not speak to reserves inherent in Tygart Lake (augmented flow capacity), Stonecoal Lake, or groundwater feasibility. (See p. 12)
- Assessment draws conclusions/makes assertions which cannot be supported by given and other available facts.
- Assessment presents data out of context in a misleading manner. For example, what is the quality of the 80 cfs -- under what conditions?, etc. The application of 80 cfs to all locks and dams is theoretically and in practice an impossibility based on Justin's or Vermuelle's formulas.
- Throughout assessment, it is claimed SJD will provide necessary water flow during drought when no such assurances can be made. Many factors would impinge, such as allotments to other claimants on water supply of SJD, etc. Due to size and number of tributaries of Monongahela river as compared to the West Fork (of the Monongahela) river, it is likely that the West Fork river would dry up before the Monongahela. What was measurement of West Fork river during, preceding and following drought of record as compared with measurements of Monongahela covering same period?
- Incorrect water storage figures assigned to SJD (45,050 af, see p.9) whereas conditions call for 13,300 af. (See FWPCA document.)

- W. VA. appears to use this assessment as a vehicle to tie efficacy of SRC to the building of the threatened SJD. No factual bases exist for tying the two projects.
- It is noted that David Callaghan, listed as Vice-Chairman on the May 9, 1980 ORBC committee report, is a long-time active proponent of the SJD. As director of the W. VA. Dept. of Natural Resources, he currently is being legally challenged to promulgate water management regulations long overdue according to W. VA. and federal statutes.

Note: Additions and deletions in "Specific Comments" which follow are provided as Contributions & efforts to objectify presentation of data.

SPECIFIC COMMENTS:

Page 1, Para A. Fails to mention that demands will exceed technical capacity of Maxwell Lock and Dam plus three other locks by 1988. Thus, flow requirements become academic.

Para C. Add, "using BAT and/or BPT levels of treatment," to end of sentence.

Para D. W. VA. ignores BAT/BPT levels of treatment, water quality management policy, conservation and other available options for meeting DO requirements from 1990 to 2020.

Page 2, Para 2B. Sentences 2 and 3 conflict with Pennsylvania (PA.) findings (see pp. 20, 22, 37 and 38). Data does not support claims.

Para 2C. Low flow of 315 is without augmentation (see p. 10.) Add to 4th sentence after "...plant is 3.8%", leaving a surplus flow of 221 cfs.

Para 3A. Add to end of sentence, "an insignificant impact on availability of surplus water flow in W. VA. except for DO needs in 2020 using current standards."

Page 3, Para 3D. Same as above. Total deficit at L&D 4 is 1259, (see P. 38 table). If accounting is to be retained, add after "3%", (from 1218 to 1259). As written, it appears that SJD's 4% flow solves problem, obfuscating the fact that a 65% deficit is reduced by only 4% to a 61% deficit with SJD (see other comments - re: p. 31 para 2).

Page 3, Para 3E. Omit since SJD case is in court and PA objects to its inclusion in assessment.

Further, flow provided by SJD will not significantly alter result of A, B or C or SRC impact on entire system in general.

Page 3, Para 3F. Include water resource management and BAT and BPT options for DO and TDS flow deficit resolution and new exploration of ground water availability at or near SRC; also redesign of SRC to lower consumption.

Page 4, Para 3D. Add, "develop W. VA. plan to ensure common water resource management practice employed by PA. W. VA. needs to develop and apply water conservation standards and policy. New structures should be considered as a last resort only".

Page 6, last sentence. (Also see p. 32, para 1). By claiming synfuel plant dependence upon construction of proposed SJD, the environmental impacts of SJD (and its downstream impacts) need to be included in the EIS for SRC.

Page 7. Omit reference to SJD.

Page 9. Omit SJD altogether. If not possible, add: "SJD will not alter systemic impact resulting from SRC or SRC's economics. SJD contributions to the resolution of current problems/deficits as well as those associated with SRC in 1990 and 2020 is insignificant. Current state of technological art, modern water resource management techniques as well as conservation measures can make greater difference and at a much lesser cost than the SJD.

Page 9A. Omit references to SJD based on PA. objection and insignificant or no capacity to resolve systemic deficits. Need to break down specific cfs requirements for each category of benefits.

Page 10 Table. Omit "with Stonewall" table columns. An example of the faulty logic used throughout this table is found in the "exceedence" columns. If a requirement is exceeded, which it is, to exceed it additionally with Stonewall is unnecessary and irrelevant to the question at hand.

Page 11. Omit ^{attempts to illustrate SJD contribution} graph which ~~exaggerates~~ and has no ^{statistical} significance.

Page 12. Add here (and/or Pg. 4 para D): Para A: "New exploration of ground water availability at or near SRC should be initiated to determine how much of SRC water needs can be met by groundwater at or near plant site."
Para B: "W. VA. should also provide comparable analysis to include BAT and BPT measures for treatment at source and not depend on pollution dilution methods."

Page 21, Para C2. Omit SJD from text since by 1988, maximum lock capacity will be reached at Maxwell and 3 other locks. "Satisfactory level of service" is a subjective determination which can be adjusted to circumstance and existing physical conditions. ^{report's subsequent} As the ~~following~~ sentence stated, Maxwell cannot handle the traffic for reasons not related to flow, and therefore, its problems cannot be alleviated by SJD. Additionally, PA. objects to using SJD in assessment.

Page 22 Table. Add asterisk to Maxwell by 327, 341, 403 and 325. (See pg. 21 and pg. 25, Para E middle of para).

Page 28, Para 3. Add, after "consume water": (8.7 cfs and 23 cfs respectively).

Page 28, Para A2. While 23 cfs is considered significant when addressing consumptive use, 10-30 cfs is treated as insignificant in addressing leakage problems (see p. 22).

Page 29, Para 2. If this data is correct, then there would be a surplus of 305 cfs as opposed to a deficit, in meeting W. VA. DO standard (based on current requirement of 345 cfs).

Page 29, Para 3. Omit last sentence. BAT/BPT point source treatment are more than adequate to correct and reverse deficit of 17 cfs to meet W. VA. DO standards. Arguing in favor of building a quarter of a billion dollar highrise dam to meet a low flow deficit of 17 cfs is to blatantly ignore congressional mandate against pollution dilution as a method of pollution treatment. As such it represents an abrogation of responsibility to establish sound water quality management policy and practice. Tygart Lake may have reserve capacity to increase flow, but lack of W. VA. analysis of problem and available alternatives to solve it (see PA. analysis) misleads the reader into believing that SJD is the only alternative. By so doing, it belies accepted professional principles, methodology and practice.

A-38

Page 29, last para. Omit reference to SJD. The 80 cfs water supply availability projected for SJD in the assessment is contingent upon available flow downstream of SJD. This flow represents 88% of water available in the West Fork river basin. (Stream flow data for this segment of the river is not provided in the assessment). Concomittantly, only 12% of the basin would be controlled by SJD. It would therefore appear that SJD would have a limited capacity to augment Monongahela river flow during drought of record. Conversely, Tygart Lake, controlling 87% of its much larger river basin is the most feasible candidate to provide flow augmentation in drought of record.

Page 31, Para 2. Omit reference to SJD. Also last sentence in para 2 is wrong. 80 cfs of 1860 required flow is 4%. SJD would increase low flow by only 4%. To present it in a different light: in 2020, 650 cfs available at L&D 4 vis-a-vis 1860 cfs requirements is 35% of needed flow or a deficit of 65%. Assuming SJD can provide 80 cfs of clean water, which it cannot, based on Army's own conclusions, down to L&D 4 it represents only a 4% reduction in the deficit, bringing that deficit of 65% to 61% - an insignificant factor reduction.

Page 32, Para 1. Conclusion not based on facts. Contrary to this paragraph, the data throughout the report shows that in 1990, water is available without qualification in W, VA, and PA, except for TDS flow needs in PA, which cannot be solved or significantly reduced by SJD.

Page 32, Para 1 (continued).

Omit reference to SJD. Such conclusion is not supported by facts however well manipulated and obfuscated they may be in this analysis. An absence of adequate analysis of W, VA problems is obvious. Assertions in lieu of analysis serve to point out efforts to tie the efficacy of SRC to SJD where in fact, no such connection exists. The 17 cfs deficit in 2020 (see p. 38) to maintain W, VA, DO standards (currently based on 345 cfs) is minimal when compared to PA, deficits in both DO and TDS requirements. Yet, PA, will solve all of its DO problems by 1990 and 2020 using BAT/BPT measures to treat pollution at its source, thus reducing dilution requirement. Current state of technology, plus what may be improved technology by 1990-2020, is more than adequate to resolve the 17 cfs deficit and is much more economical than SJD. Available alternatives are: Among others, redesign SRC to reduce water consumption; better management of available resources; effective policies to encourage conservation; ground water use to reduce consumption (1968 report states adequate water available for moderate industrial use. See p. 12); greater augmentation from Tygart Lake is feasible from built-in reserves; and a host of other administrative and technical measures can be taken to correct water quality problem.

In short, alternatives to SJD are much more economical and, from water quality point of view, more desirable in the long run. Even if administrative and management alternatives should, in the future, prove inadequate, it would be more economical to increase Tygart Lake and Stonecoal Lake as opposed to building SJD.

Page 36.

Omit SJD. Graph is misleading, convoluted and incomplete. If SJD is to be mentioned at all, graph should be shown "without SJD" as well as "with SJD" to illustrate clearly that SJD contribution would be statistically insignificant. (For example, 2% for the first item in chart on page 10). Additionally, combining TDS with DO standards in the same graph is confusing and serves to mislead the reader by appearing overly complex.

Page 37 & 38.

Omit SJD from footnote. PA. objects, and facts do not support assertions stated or implied.

Page 38.

L&D nos. 8, 4, and Maxwell should be analyzed for all conditions.

J. K. Alexander

Rec. 7/21

Comment #3

July 11, 1980

Dr. Larry Joseph
SRC Division Director
D.O.E. Fossil Energy
Furnace Blldg.
Washington, D.C., 20585

Dear Larry,

Regarding my letter of May 29, 1980, and our phone conversations, I continue to urge that references to the proposed Stromboli Jackson (Strom) Lake Project (S.J.P.) as related to potential water availability for the regional plan be omitted from the D.O.E. Final E.I.S. on SRC II.

Shot of complete omission of all data and references to S.G.B., in substance, explicit, summary statement is required to the effect that S.G.B. was assessed for water availability (flow and quality), impact on SRC II and found to have none. That whether or not S.G.B. is built will make no significant difference to the operation, efficiency, or outcome of SRC II (demon or Commerce).

As my calls to you in recent weeks were not returned, I had only to assume you read and incorporated my comments of May 29, which, in general terms, still apply. More specifically, subsequent comments, attached herewith, address misrepresentations in the Draft E.I.S., misrepresentations which I feel certain the D.O.E. will not want to endorse in future reports - drafts and final.

It is important that no tie be made between the 2 proposed projects for several reasons, the most important being (1) there is no connection, and (2) the possible consequences to the outcome of both projects.

2

As it stands, the draft EIS contains gratuitous references to S.G.B. connecting the projects without bases in fact and contrary to available data. Sprinkled throughout the draft, these references to S.G.B. as a possible solution to this or that problem with no factual justification and the use of insignificant and irrelevant data to support assertions make the D.O.E. and SRC II look worse and worse as one reads on. As one observer on the Hill said, "Maybe we'll better reconsider our definition of it requires building-a-rise dome!"

Once implied in various official reports and in the Federal Register, any claim that the one project might depend on the other would, as you know, be magnified, multiplied, and used as grapple by those who are using SGNP as the latest bail-out to keep S.G.B. afloat.

Efficiency being resorted to by certain D.O.E. public officials regarding the S.G.B. adds to the urgency to ensure that material forthcoming from the D.O.E. does not aid and abet such action.

It is only people in positions such as your own who can see to it that the D.O.E. puts forth sound, accurate, unbiased information upon which the rest of us can decide whether or not to support administrative policies.

Many of us will not be able to support the SRC II undertaking with the EIS as it stands because while it strenuously tries to give credence to a need for the S.G.B., it may more subtly be erroneous as well in other areas less familiar to us.

My communications come with the very sincere intent to help in the objectification of data relating to a very serious matter, and, as I wrote earlier, I look forward to the inputs being received in the same spirit as that with which it is offered. I also look forward to the meeting with you and the Assistant Secretary next week.

Very sincerely,
Sharon A. Mihnovets

COMMENTS
ON
DOE DRAFT EIS
SRCII DEMONSTRATION PROJECT
FORT MARTIN, W.VA
May 1980

by
Sharon A. Mihnovets
June 25, 1980

General Comments

The following additional comments are directed at those sections of the DOE Draft EIS which explicitly or implicitly suggest SRC II dependence on the Stonewall Jackson Lake Project. (SJD). Based on hydrological data contained in the Draft EIS water availability impact associated with the SRC II and its mitigation are derived primarily from a clearly subjective and biased Ohio River Basin Commission (ORBC) Report of 9 May 1980. To the extent this draft EIS reflects unsubstantiated claims, unsupported conclusions, and misrepresentation of facts contained in the ORBC report, it suffers the same shortcomings.

While the EIS acknowledges "... significant economic and environmental risks ..." associated with the first liquifaction plant (p. XVII), it, nonetheless, suggests implicitly, that such risks could, perhaps, be mitigated if the SJD is built. Neither the data developed in the EIS, nor presented in the ORBC report and used in compiling the EIS, nor more importantly, available facts support such inductive reasoning (See comments at attachment 2). Yet, the summary--which is most likely to be widely read--and CHS 2 and 4 of the EIS mislead the reader into believing that the SJD may, indeed, solve some of SRC II's problems.

The approach adopted in the EIS misrepresents facts associated with water availability issue and in the process perverts the spirit and the

letter of the law embodied in NEPA legislation. The flow augmentation which SJD may be able to provide--even if built--would not solve water quality problems or significantly reduce flow deficits currently experienced by Pennsylvania--with or without SRC II. Concomitantly, W. Va. will have no water quality or flow problems during the demonstration phase of the project. Lasting mitigation of water quality (D.O.) problem during record drought associated with commercial phase of SRC II in W. Va. (17CFS deficit) can be accomplished better and more economically both, in terms of short- and long-range perspectives, by point source treatment and other technical and administrative measures addressed on pp. XXII, 2-19 and 4-21 of the EIS.

Thus, logic tying SRC II to SJD begs the issue. There are and will be persistent water quality (TDS) problems in Pa. with or without the SJD and with or without SRC II. The insignificant and easily correctible water quality problem between 1990-2020 in W. Va., added to the economic uncertainty associated with commercialization of SRC II hardly warrant building a \$250M dam which lacks all other justification. This is particularly relevant in view of the fact that the DOE has a broad authority to "... direct modification to the project ..." (p. XIX EIS). This vested authority was given presumably to mitigate undesirable economic and/or environmental consequences system-wide. This authority, added to administrative, technological, and operational options available, (p. 4-21 EIS) facilitate responsible and economically viable integration of SRC II

system-wide, without, SJD. Conversely, the proposed SJD will lack the capacity to resolve or significantly reduce systemic deficits with or without SRC II.

While it is recognized that the EIS attempts to minimize SJD/SRC II connection by such caveats as "somewhat" it, nonetheless, repeatedly refers to SJD and thus fails, to clearly disconnect the two projects. By this failure the EIS aids and abets efforts to misrepresent facts associated with the issue to decisionmakers and the public alike. This failure, if allowed to be reflected in the final EIS, may also encumber the SRC II with liabilities associated with the SJD. In that regard, the DOE may be required to include impacts associated with the SJD in its SRC II EIS.

I, therefore, urge that since there is no evidence, factual bases or necessity to connect the two projects, any and all references suggesting SRC dependence on the Stonewall be purged from the EIS. Short of that, an explicit statement disconnecting the two projects should be included in each case SJD is mentioned. This qualifier should state, to the effect, that the additional flow to be provided by the SJD is redundant to SRC II needs and as such will not affect efficacy or viability of the SRC II if the dam is not built. (See Item 4 attach 1) Specific comments follow at attachment 1L.

SPECIFIC COMMENTS

1. P. XVI, para 5, p. 2-14, sect 2.2.2, para 4

Add sentence to paras. Ward and Wilmoth study of ground water availability in 1968 reported that Allegheny aquifer yields are sufficient for moderate industrial and public water use at proposed plant site.

REASON:

Inadequate statement on ground water availability vis-a-vis plant water needs.

1968 report suggests that adequate ground water is available for moderate industrial use (p. 12 ORBC report 9 May 1980).

2. P. XX

Penultimate para. Sentence 3:

P. 2-16, para 6, sent 3

Delete "... both demonstration and ..."

REASON:

Objectivity and accuracy. Water supply at plant site and its quality is adequate for demonstration phase of project under all flow conditions. Pa. will experience flow deficits for meeting its water quality standards (TDS), with or without SRC II and with or without the SJD (pp 37-39 ORBC report, p. XVI EIS).

3. Pp XXI, 2-18, "Water Supply", para 1

Delete all references to SJD.

P. 4-20, "Impacts Related ..." para 1

REASON:

Accuracy and objectivity. Water supply to accommodate consumptive

water use by commercial SRC II at plant site as well as L&D 8 will be more than adequate (Q710, 360 CFS), leaving a surplus of 220 CFS after all claimants, including SRC II, have been satisfied (pp 34, 38 ORBC). Even during drought of record (340 CFS), adequate water supply will be available for all purposes, including SRC II, except for meeting DO standards at L&D 8, where a 17 CFS deficit would occur within an overall surplus of 200 CFS (pp 36-39 ORBC, p M-2 EIS), after all claimants have been satisfied. BAT/BPT and other measures addressed on pp 2-19, 4-21 EIS, would be more than adequate to resolve this DO deficit more economically, on a lasting basis and without undesirable environmental impacts associated with SJD. SRC II has more than adequate supply of water without the SJD. Additional 80 CFS flow is redundant to the 220 CFS surplus and has no bearing on viability of SRC II (p 38 ORBC, pp M-2, N-3, 4 EIS).

4. Alternative to 3 above:

If unable to omit reference to SJD suggested above, add the following sentence to end of paragraph:

The additional flow associated with the proposed SJD is redundant to SRC II needs and as such will not effect efficacy of SRC II if the dam is not built.

REASON:

Accuracy and objectivity.

5. P XXII, "Water . . ." para 2, p 2-18 "Water . . .", para 3,

Delete parenthetical reference to SJD.

p 4-20, "Impacts . . ." para 3

REASON:

Accuracy and logic. Same as 2 and 3 above. There are gratuitous references having little or no bearing on viability of commercial SRC II (p XVII). This is particularly so based on the fact that design alternatives (p XXVII) and other administrative measures (pp XXII, 2-19, 4-21) would reduce consumptive water use currently estimated at 6.7 percent of minimum flow and/or increase water availability and quality (p 4-21 EIS).

The 1.3 percent reduction in consumptive use of water (from 6.7 percent to 5.4 percent of minimum flow) if the SJD is built, is insignificant. The quality and quantity of available water for SRC II is adequate without the SJD. Gratuitous mention of SJD without qualification suggests SRC dependency on SJD. This is contrary to available facts and nonsequitur (p N-3, see also Items 2, 3, and 4 above).

6. Pp 2-18, 4-20, "Water Supply", para 2

REASON:

Delete parenthetical reference to SJD.

Accuracy and objectivity. Same as 2, 3, 4, 5 above. Gratuitous reference having no bearing on viability of demonstration SRC II. A 0.4percent increase in desired minimum flow of 340 CFS at drought of record is insignificant. More than adequate water supply is available for demonstration phase of SRC II at all flow conditions. Further, data (pp N-3, 4) indicates

that at no time since 1938 did the flow fall below 617 m3m (Jul 66). The minimum desired flow is 578 m3m (340 CFS). Additionally, the flow since 1967 has been high--well above data presented for "worstcase conditions."

* * * * *

7. a. P 4-29, "Impacts Associated . . .", para 1

Delete reference to SJD.

REASON:

Accuracy and objectivity. (See 3, 5 above) Gratuitous inclusion of SJD having no bearing on viability or efficacy of SRC II. The SJD contribution to resolution of current water quality problems/deficits in Pa. (none exist in W. Va) as well as those associated with Pa. TDS problems in 1990-2020 timeframe is insignificant. Pa. DO standards would be overcome using BAT/BPT measures by 1990, with or without the SJD (p 1 ORBC report) TDS problems in Pa. will remain. Without the SJD, Pa. will experience a 65 percent deficit of the needed 1860 CFS flow vis-avis 650 CFS of available flow. The SJD, if built, will reduce this deficit by 4 percent to 61 percent, an insignificant factor reduction. W. Va. will have adequate water supply in 1990-2020 timeframe to meet all of its needs (SRC included) except maintenance of DO standards. The current projected estimate of 17 CFS deficit during drought of record assumes continuing the current level of pollution control measures, with no improvement or additional point source treatment facilities or advances in BAT/BPT technology. This is unlikely if W. Va. is to meet clean water requirements mandated by law.

This deficit of 17 CFS is small and well within means of alternative solutions which would be more economical and lasting than would the \$250 mil DAM (see item 3 above). Additionally, Tygart Lake, controlling 87 percent of the basin, has reserve capacity to provide additional flow which, when combined with correcting 10-30 CFS leaks in locks and dams would prove to be more than adequate to make up the deficit. It is also noteworthy that Pa. objects to including SJD as water supply source (p 4F ORBC report).

* * * * *

7. b. P 4-32, "Mitigation . . ." para 1.

Delete reference to SJD.

REASON:

Accuracy and objectivity. Gratuitous inclusion of SJD having no bearing on viability or efficacy of SRC II. Also, 714 m3m is incorrect. The flow with SJD would be 680 m3m (p 4-29). Caveat "somewhat" does not rectify gratuitous reference to SJD or justify inclusion of SJD in discussion. Impact of reduction to 1.6 percent facilitated by SJD is unclear, and baseless. To 1.6 percent from what? Is the reduction significant enough that without SJD the SRC II would not be built? Are not the alternatives to SJD suggested in this paragraph more economical and sufficient to bring aquatic losses to acceptable level? What is an acceptable level? Mention of SJD in this context is meaningless and serves only to promote SJD without bases in fact. (see also item 4 above.)

* * * * *

7. c. P 4-32, "Impacts . . ." para 1.

Delete all reference to SJD.

REASON:

Accuracy and objectivity. Reference to SJD gratuitous having no bearing on viability or efficacy of SRC II. Are losses of such magnitude as to be unacceptable without SJD? are not alternative designs available to modify intake structure to minimize losses without the SJD? It is clear that mention of SJD serves no other purpose than SJD advocacy, having no bases in fact connecting SRC II viability with SJD. (Also see 3, 4, and 5 above.)

* * * * *

8. P 4-70, Sect 4.6.6.

Delete reference to SJD.

REASON:

Accuracy and objectivity. A gratuitous mention of SJD having no bearing or connection with SRC II. Further, aquatic loss may be reduced by alternative design of intake structure without SJD. A reduction to 2.1 percent is from what—2.2 percent? 714 m³m does not agree with data on p 4-29. And 2.1 percent does not agree with 1.6 percent on p 4-32. 680 m³m appears correct, but due to lack of data it is impossible to comment correctly on reduction factor. (Also see items 3, 4, and 5 above).

The EIS professes "no connection" between SRC II and the SJD, clearly stated. As such inclusion of SJD is indeed gratuitous suggesting advocacy for construction of the SJD. An improper use of the EIS.

* * * * *

9. Conclusion. In summary, it must be noted that Pa. objects to the inclusion of projected water supply from SJD as available for consumptive

use (p 4 F ORBC). Indeed, the construction of the SJD is not yet certain. Yet, while the SJD, which would control 12 percent of West Fork River basin, is referenced freely as a given water quality and water supply source, the Tygart Dam and Lake controlling 87 percent of the Tygart River basin, already built, is basically ignored. In fact, the Tygart Lake has the reserve capacity to mitigate W. Va. DO standard flow needs through the projected life of SRC II (2020). Stonecoal Lake, too, offers some reserve capacity if water management practice is modified and conservation practices implemented. Both are already built and available. Indeed, on balance, it would be more economical to purchase or otherwise acquire Lake Lyn on the Cheat River for public use, as additional water resource, than it would to build the SJD. As pages XXII, 2-19 and 4-21 suggest, administrative alternatives coupled with technological and operational management options already discussed offer more economical and lasting alternative to the SJD. Finally, the inclusion of Stonewall in the final EIS should not be permitted as a matter of principle. If permitted, it would constitute using the EIS as a vehicle to advocate construction of SJD. Since there is no connection, in fact, between SRC II and SJD, gratuitous inclusion of the dam in the final EIS would be tantamount to aiding and abetting efforts to misrepresent facts to the decisionmakers and the public. We urge, therefore, that the DOE not encumber itself with liabilities associated with SJD. The DOE should refuse to acquiesce to efforts designed to use the EIS as a vehicle to promote the SJD.

Monongahela Alliance for Community Protection 7/17
Address last Page

GENERAL COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT, SRC-II, FORT MARTIN, W.VA.

Along with promises of jobs and a "solution to the energy crisis", the SRC-II promises to have some potentially devastating effects for the people of Monongalia, Marion, Preston, Fayette, and Greene Counties.

The Draft Environmental Impact Statement identifies at least ten problems for which it promises no solutions. These problems include:

- 1) the creation of poisonous chemicals which are not regulated by the government,
- 2) the anticipation of spills, explosions, and other catastrophes,
- 3) the expectation of transportation accidents,
- 4) product spills from storage areas adjacent to the river,
- 5) the using up of the PSD increment for particulates and probably exceeding the limit for ozone pollution, especially if traffic on and off plant property is considered,
- 6) the building of part of the plant -- the part where the most highly carcinogenic and toxic products are stored -- on the floodplain, and the building of part of the plant on areas prone to landslides,
- 7) the inadequacy of local roads to handle even workforce commuting traffic,
- 8) the lack of housing,
- 9) the frequency -- 41% of the time -- of temperature inversions which will trap pollutants in the area, and
- 10) the inability of the Monongahela River to accomodate navigation demands and water consumption needs downriver in Pennsylvania.

Despite these acknowledged problems, the Department of Energy concludes that construction of the SRC-II should proceed. This is typical of the DOE attitude to proceed with the project at any cost to the taxpayers throughout the country and the residents of this area, despite the results of their own studies or the wishes of our community. This presumptuous attitude is further confirmed by the intention of signing final contracts before a final environmental impact statement is even issued.

(7)

Although the EIS should address all potentially negative effects of the proposed SRC-II, and methods to minimize adverse impacts, many problems are not addressed at all. The absence of these issues represents a serious omission. Such an inadequacy warrants a total re-writing of the EIS and another round of public hearings -- that second, but not final, draft.

Following is a partial list of omissions:

Evacuation. Throughout the EIS, it is recognized that emergencies are not only possible, but expected. In the event of major explosions, fires, and emissions, it may be in our best interest for all of us to leave -- and possibly, in a hurry.

However, there is no mention of an evacuation plan for our area. How will we know when to leave and where to go? Who decides if there is an "emergency"?

The EIS anticipates that transportation accidents, for instance WILL happen, but they won't be worse than any "normal" transportation accident involving chemicals. Need we be reminded of the accidents in the Kanawha Valley or the train wreck in Florida last year (at the same time as the Three Mile Island accident) when thousands of people were forced to leave their homes because of chlorine? What will we do when that is repeated here?

Lack of Baseline Data. (or, are guinea pigs eligible for compensation?) The SRC-II Demonstration Plant according to DOE is an experiment -- an economic, technological, environmental experiment. DOE and Gulf plan to monitor the health of plant workers and pollution levels in the environment.

There is no mention of the health of community residents in the five county area surrounding the SRC-II. Because there are no comprehensive health statistics for our area now, there will be no way to evaluate the relationship between changing health patterns as a result of the SRC-II. Without baseline health data, it would be nearly impossible to ever determine whether the SRC-II "experiment" was successful.

If anyone gets sick because of the SRC-II, it will be difficult to prove. And if someone could prove such a connection, the EIS makes no mention of whether they could be compensated for their loss of health, medical bills, loss of income, etc. Nor does it consider compensation for any property damage or decreased property values as a result of the acknowledged "experiment".

Taxes, Planning, Social Services. The EIS recognizes that there will be a strain on our social services -- sewers, roads, schools -- both during the demonstration and commercial phases of the SRC-II. Relieving this increased burden will require planning and funds for expanding social services. Yet, the EIS does not take into account Monongalia County's peculiar attitude toward planning. The only county planning professional quit recently because he said the planning commission did not have sufficient funds to do effective work. Evidently, the county places a low priority on the long-range planning DOE and Gulf are calling for.

The EIS does mention, in passing, that property taxes could be "substantially" increased by raising property assessments and rates. The EIS does not address why our local communities should subsidize Gulf Oil.

Water. The EIS admits there might be a problem with water availability from the Monongahela River. It does not mention the possibility of serious water shortages downriver in Pennsylvania where construction of additional municipal water systems is already limited and where people remember the Borg-Warner chemical spill of several weeks ago which made their water barely drinkable.

Another item left out is that Pennsylvania has more stringent water quality standards than either West Virginia or the federal government. Since the SRC-II is in West Virginia, will it be permitted to violate Pennsylvania's laws -- even though it is right on the state line?

Cumulative Effects. Although the proposed Round Bottom coke plant is noted as another pollution source, the EIS mistakenly describes it as a "permitted" facility.

Neither the coke plant nor the SRC-II have received any pollution permits. The preliminary application to EPA for the coke plant says it will consume 91% of available particulates. The SRC-II claims it will need 94% (not counting what happens if it goes commercial). Obviously, 91% plus 94% exceeds the allowable amount of pollution, yet this is not mentioned. Nor is the pollution potential of whatever industry is planning to locate at the Mason-Dixon Industrial Park at Core, or the pollution that will come our way if Sharon Steel reopens its Fairmont coke plant, or the pollution that could come from the proposed H-coal synfuels plant across the state line in Greene County.

In addition to neglecting potential water and air pollution from other proposed industrial developments and their possible cumulative or "synergistic" effects, the EIS also ignores whatever social impacts will result from expanded development.

Inflation. Especially during construction of the demonstration plant, there will be a large influx of relatively highly paid skilled workers and their families. As a result, demand for goods and services will increase -- gasoline, food, housing, recreation, etc. It can be reasonably expected if the market system works, prices will go up.

The EIS does not address the likelihood or impact of increased inflation due to the SRC-II, which will hit hardest at those on fixed incomes and working people. And once prices go up, it is unlikely they will go down after construction is completed.

Future Government Policy Changes. A potential policy change which could affect the SRC-II is a re-evaluation of the national priority on synfuels. Since many of the northeastern power plants for which SRC fuel is intended are expected to convert to coal or simply outlive their usefulness, the demand for the SRC product could be significantly reduced. The need for boiler fuel could easily be met without the SRC-II by using residual oil, while most power plants burn coal directly. The government might then want to only emphasize the development of synfuels for transportation -- some-

thing the SRC-II is not currently designed to produce. How could such a policy change affect the future of the SRC-II in Fort Martin?

Increased Coal Mining. While the demonstration plant will use coal primarily from southeastern Ohio, the developers hope the commercial plant could use local coal. Consumption of 30,000 tons of coal per day will require increasing coal production.

The EIS does not consider the effects to miners or the community of increased coal mining, referring to a couple of national studies on the environmental impact of strip mining. Will the additional coal come from strip or deep mines? And what will be the specific impacts here?

Community Participation. The EIS process provides a limited forum for public comment in the development phase of the SRC-II. But it does not provide any mechanism for continued public participation. The community will not merely go away with the construction and operation of the SRC-II. How will the project developers remain in communication with the public once their legal EIS requirements are satisfied? How can we, as a community, influence our own future?

What If It Doesn't Work? The EIS considers the possibility of the demonstration plant never making it to commercial operation. It considers the effect of "mothballing" on eliminating pollution. But it does not consider what would happen to the local economy and the unemployment rate (currently the lowest in WV) once all the workers who have come here to work at the SRC-II are laid-off-- the "bust" part of the boom/bust syndrome.

Once the demonstration plant is built and the economy becomes dependent on it, there will be tremendous political and economic pressure to go commercial even if it could become an environmental or economic disaster. If the decision is made to abandon the SRC-II after demonstration, however, what provisions will be made for the unemployed workers and for the community?

Who Will Gain and Who Will Lose? There are no dollar figures in the EIS. Throughout the public hearings and the discussion in the community, a blatant contradiction seems to have emerged. Some people in this area believe they will get rich off of the SRC-II. Other people maintain that taxes will go up, services will go down, property values will go down, medical bills will go up, and so forth. Although the EIS claims it has addressed the economic impact of the plant, it does not mention who in the community will prosper and who will suffer. Will the rich get richer? Will the poor get poorer?

Economic Viability. This is one of the three principal criteria by which the SRC-II will be judged -- along with technical operability and environmental acceptability. Economic viability will not be determined by the price of the final product of the SRC plant compared with imported oil, but rather by the prices of the final products produced in privately-financed facilities compared with the prices of those products produced by existing means.

By having the capital investment costs split four ways, the product costs are being subsidized and will ultimately be artificially lower. This method demonstrates only the economic viability of heavily subsidized demonstration plants rather than the viability of commercial plants as they would actually exist in the marketplace. This is not addressed in the EIS.

Risk Assessment. The EIS claims the plant will not cause an "undue risk" to either the workforce, the public or the environment. There is no scientific basis for this statement. "Undue" means inappropriate or unsuitable. How does DOE define appropriate and suitable risk for substances whose danger is acknowledged by government, industry, and independent experts?

For the record, I will simply list a number of other issues not addressed in the EIS:

- *** It ignores the economic implications of limiting future industrial development and jobs by using up the available pollution margin,
- *** Final design plans are missing,
- *** The chemical composition of the slag, the precise methods and locations for disposal, and plans for indefinitely monitoring the disposal sites if/when the SRC-II is closed down are all left out of the EIS,
- *** If there is a fire at the SRC-II, will Gulf Oil depend on the volunteer fire department?
- *** Many social services are not discussed or are inadequately addressed, including medical services, fire protection, garbage collection, nursing homes, and utilities. Thus, as with health status, there is inadequate base-line data on social services.
- *** The EIS does not mention the fact that there is significant and widespread local opposition to the SRC-II,
- *** The EIS does not mention the specific impact on particular populations -- such as the elderly,
- *** The EIS does not adequately address the impact of the commercial plant -- claiming those problems will be solved later--hopefully,
- *** While the EIS lists the history of the SRC-II process, it does not list the legacy of hazards associated with related technologies,
- *** When the EIS described the additional strain on social services, it incorrectly assumes the current level of services is adequate,
- *** The EIS claims, on the one hand, there is less than one percent housing vacancy rate. Yet it goes on to say there is adequate housing,
- *** The EIS mentions there are vacancies in the public schools, but it never matches up where those vacancies may be with where there may be housing vacancies.

In conclusion, as we evaluate whether we want the SRC-II in our community, we need

to look around our region, country, and world. The goals of sound development -- a better living environment for everyone -- include public health and the security of future resources. When these concerns are overridden or ignored, we may achieve growth but not development.

Increasingly, throughout the world, the poorest of the poor are, with the help of U.S. corporate policies, literally cutting the ground from under their feet in a desperate assault upon their environment as their only hope of immediate survival. We often pity those people in developing countries who are forced to compromise their lives just to live until tomorrow. We must consider whether we in this country have reached that stage of despair where there are no other alternatives available to us. There are those who would like to force us into believing we have, so they can profit from our sacrifices.

Submitted on behalf of the Monongahela
Alliance for Community Protection.

Prepared by Joyce Goldstein
321 Richwood Ave.
Morgantown, West Virginia
26505



National Audubon Society

MID-ATLANTIC REGION
WEST VIRGINIA OFFICE
RT. 5, BOX 228-A, MORGANTOWN, W. VA. 26505 (304) 296-0565

July 30, 1980

Dr. Larry M. Joseph, Director
SRC Division
Mail Station E-333
Washington, D. C. 20545

00038

Dear Dr. Joseph:

The following are additional comments we would like to submit for your consideration on the DEIS for SRC-II proposed for Fort Martin, WV:

- p.xiii. Sterns-Roger, Inc, a subcontractor to P&M (Gulf), are cited as having prepared an environmental report which was used by DOE in preparation of the EIS. We believe strongly that DOE should rely on their own data, not the industrial partner's nor its contractor for such important information. Such reliance calls the entire DEIS into question.
- xvi. The Water Resources Council's 13(b) Water Assessment has yet to be published for public comment, let alone adopted. Therefore the public cannot possibly factor this crucial data into its comments on the EIS. Separate provisions must be made for explanation, circulation and solicitation of comments on this important report when it is issued.
- 4-38 If demonstration plant is expected to consume "essentially the entire particulate increment," how can a commercial plant be even remotely contemplated?
- 4-38/39 References to the proposed Roundbottom coke plant should be both consistent and correct, not Fairmont Energy Corporation Coke Plant (4-38) or Akla Ohio Coke Plant (4-39). In addition, since both this plant and SRC-II would consume so many important resources in the area, the combine physical and social and other environmental effects of the presense of both these developments in Monongalia County must be analyzed here in detail.
- 4-43 No reference is made to an increase in alcoholism and crime which a large influx of construction workers would cause, based on the experience of similar projects elsewhere. These and other important social factors need to be analyzed.

AMERICANS COMMITTED TO CONSERVATION

Dr. Joseph

Pg. 2

- 4-47 Proposed pipeline routes must be identified and their impacts reviewed in this EIS.

Despite our efforts to address a number of significant factors relevant to the development of this plant in our oral testimony that are not included or even mentioned in this DEIS, upon further review of this statement it appears only the surface has been scratched in this regard. It is imperative that this entire project be reviewed in greater depth, breadth and with much greater certainty. The delay this would necessitate in construction will be minor compared to the technical and legal delays it will prompt if left undone.

Thank you for your attention to these matters.

Sincerely,

Linda Cooper Elkinton
Assistant Representative

cc:Dunstan

A-52

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

July 17, 1980

00019



OFFICE OF THE
ASSISTANT DIRECTOR
FOR ASTRONOMICAL,
ATMOSPHERIC, EARTH,
AND OCEAN SCIENCES

Dr. Larry M. Joseph
Director, SRC Division
Office of Project Management
under the Assistant Secretary
for Fossil Energy
Mail Station E-333
Washington, DC 20545

Dear Dr. Joseph:

The enclosed comments are submitted in response to your agency's request for review of the DEIS for a Solvent Refined Coal II Demonstration Project (DOE/EIS-0069-0). I hope that these remarks, which focus on those sections of the DEIS related to meteorology and air quality, are useful to you in your review process.

Sincerely,

Adair F. Montgomery

Adair F. Montgomery
Chairman
Committee on Environmental Matters

Enclosure

NSF COMMENTS ON DOE DEIS

Solvent Refined Coal II Demonstration Project

1. Section 3 describes the existing environments. A very brief description of the climatology at the primary site (Fort Martin, WV) is given. It is noteworthy that a site that has "stable" atmospheric conditions 41% of the days for an average of 10 h/d could pose an air quality problem. It is noted (page 3-26) that, although air quality is presently being affected by operating sources, pollutant concentration is well below standards except for ozone which could pose a hazard. At both alternative sites (Equality, KY and Ravenswood, WV) only superficial meteorological descriptions are offered. Some air quality problems exist presently at both sites. At Ravenswood there are 204 days of fog per year indicating potentially significant air quality problems.
2. The evaluations of environmental consequences and monitoring programs are presented in Section 4. At the primary site, ozone is projected as the principal air quality concern. At Equality, KY, less air quality problems than Fort Martin are projected. At Ravenswood, WV, greater impact is projected as could be anticipated by the climatology. The proposed monitoring of air quality appears adequate.
3. The "models" used to project air quality impact are very briefly discussed in Appendix Q. Extremely simple methods have been applied, e.g., using statistically defined, line source solutions. For certain pollutants they indicate "conservative" results are determined with admittedly unknown errors. For ground-level concentrations, the DEIS specifies that "the magnitude of the errors and whether actual concentrations are over- or under-predicted is unknown at this time." It is stated that a carefully planned monitoring program is essential to validate the air quality conclusions.
4. In conclusion, it seems that there are potential air quality problems at the three sites. It also appears that the least air quality problem potential exists at the alternate site at Equality, KY. The depth of analysis applied to the air quality evaluations appears minimal. It should be noted that the information used to prepare the EIS came from a one-year baseline monitoring program conducted by a sub-contractor to the Pittsburgh and Midway Coal Mining Company proposed to operate the demonstration plant. There is reason to be concerned, therefore, about a conflict-of-interest situation.

Natural Resources Defense Council, Inc.

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SUITE 600
WASHINGTON, D.C. 20006
202 223-8210

00033

New York Office
122 EAST 42ND STREET
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212 949-0049

July 30, 1980

Western Office
25 KEARNY STREET
SAN FRANCISCO, CALIF. 94108
415 321-6561

Dr. Larry M. Joseph
Director
SRC Division
Mail Station E-333
U.S. Department of Energy
Washington, D.C. 20545

Dear Dr. Joseph:

Enclosed please find the comments of the National Wildlife Federation and the Natural Resources Defense Council on the Draft EIS for the proposed SRC-II demonstration plant.

Sincerely,

Jonathan Lash /DD
Jonathan Lash
Senior Staff Attorney
Natural Resources
Defense Council

N. L. Dean
Norman L. Dean
Counsel
National Wildlife
Federation

enclosure

COMMENTS ON THE DRAFT ENVIRONMENTAL
IMPACT STATEMENT FOR THE PROPOSED
SRC-II DEMONSTRATION PLANT (DOE/EIS-0069-D)
submitted on behalf of
NATIONAL WILDLIFE FEDERATION
NATURAL RESOURCES DEFENSE COUNCIL

and joined by

SIERRA CLUB

July 30, 1980

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COMMENTS OF THE NATIONAL WILDLIFE FEDERATION
AND THE NATURAL RESOURCES DEFENSE COUNCIL¹
ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT
FOR THE PROPOSED SRC-II DEMONSTRATION PLANT²

I.

DOE's Environmental Management of Its Synthetic Fuels
Program Has Been Inadequate

There is today no commercial synthetic fuels industry in the United States. With the passage of the Energy Security Act, however, the Nation is committed to the development within a dozen years of an industry capable of producing two million barrels of oil equivalent per day. That commitment represents an opportunity to develop domestic supplies of liquid and gaseous fuels, to reduce our dependence upon foreign oil, and to help to smooth the transition to an energy supply system based upon renewable resources, as well as, an opportunity to manage development of the industry in an environmentally responsible manner. But the commitment also represents a significant danger that the urgency of the development of synfuels will result in hasty and ill-considered decisions made without adequate data or consideration of potential consequences, and that the scale

1/ The National Wildlife Federation is a private, non-profit Conservation organization with 4.6 million members and supporters. The Natural Resources Defense Council is a private, non-profit organization with 45,000 members. Both organizations are committed to the protection and enhancement of the human environment and the conservation and sensible use of the Earth's natural resources. The magnitude of the potential impact of synthetic fuels development on the environment leads us to focus with particular urgency upon the Government's early efforts to promote synfuels and the quality and scope of the environmental analyses accompanying those efforts.

2/ These comments are joined by the Sierra Club. All three Organizations have members living in the vicinity of the proposed SRC-II plant.

of Federal participation will lead to inefficient and ad hoc development distorted by the absence of market pressures and confused by the proximity of regulator to regulatee.³

3/ The historical precedents are troubling. The synthetic rubber program -- often referred to as a model for the synthetic fuels effort -- was very nearly a catastrophic failure as a consequence of bureaucratic incompetence. See "The Saga of Synthetic Rubber," Robert A. Solo, The Bulletin of the Atomic Scientists, April 1980.

Many of the difficulties of the nuclear industry have been traced to the overly close relationship of the Federal Government with the industry. As NRC Commissioner Bradford stated:

Much of the problem lies with the commitments, pressures, and expectations spawned by the grave overestimates of nuclear needs and possibilities that once emanated from the AEC and from ERDA. As bureaucratic and institutional prestige became committed, one almost rational step at a time, to stated and perceived national goals that had very little to do with real national interests, truth and other people's money were the first casualties. The truth took a beating in silenced concerns and rigged or suppressed studies. Conclusions were expressed in assurances of safety so absolute that the industry and the Commission can now be embarrassed into shutdowns by occasional showings that assertedly impossible accident sequences are merely very highly improbable. Massive financial commitments were made by utility ratepayers and by taxpayers to a nuclear future clearly in excess of anything that the nation really needed within the time it was to be provided. Alternatives, including some nuclear alternatives, were given short shrift. As criticism grew, those who participated in the initial misjudgements behaved as though open-minded reevaluations would be admissions of previous errors. Instead they blamed nuclear power's troubles on delays and losses of confidence caused by its critics, whose patriotism and integrity and allegiance to the American dream were subtly or non-so-subtly called into question.

Testimony of Commissioner Peter Bradford of the Nuclear Regulatory Commission before the House Committee on Interior and Insular Affairs, May 22, 1978.

[footnote continued on next page]

Whether the opportunities are seized and the dangers avoided will depend primarily upon a series of forthcoming Federal decisions. The Nation has little experience with the operation of even demonstration synthetic fuels plants, and many of the decisions that will determine the shape of the synfuels industry will be made during the next year. While the responsibility for developing an overall synthetic fuels strategy will ultimately lie with the Synthetic Fuels Corporation

[footnote continued from previous page]

Commissioner Gilinsky reached similar conclusions:

Instead of developing sensible practical solutions to protecting the growing investments in nuclear power, the industry and the government dismissed current problems and chased the visions of even grander reactors -- plutonium fueled breeders that would free the world altogether from energy resource constraints. In my view, this romance with future reactors distracted attention away from mastering the commercial reactors we have been building and operating.

Remarks of Commissioner Victor Gilinsky of the Nuclear Regulatory Commission before the American Newspaper Publishers' Association, September 19, 1979.

There are already indications that DOE has lost sight of the distinction between program management and uncritical promotion of a technology. A series of serious spills occurred during 1979 at the DOE-funded SRC-II pilot facility in Fort Lewis, Washington. The contractor failed to report the spills to the State environmental authorities, and then refused to cooperate with these officials when they learned of the spills and became concerned about contamination of drinking water supplies and a fish hatchery. DOE wanted to

avoid litigation because (1) the spill, which up to now has had little press attention, will, we believe, become highly visible in the media; (2) it may become an issue in the Gubernatorial, Senatorial, and Congressional campaigns; and (3) litigation may unduly restrict the resolution options available to DOE.

Memorandum dated 5/21/80 from Jack B. Robertson, Regional Representative of the Secretary, Region X, entitled "Urgent Warning on Washington State Environmental Enforcement Action Against DOE Contractor, to George Fumich, Assistant Secretary for Fossil Energy.

(SFC), pursuant to Section 126 of the Energy Security Act, what the Department of Energy (DOE) does during the coming months will have an enormous impact on the industry and the options available to the SFC. It is essential that the early phases of the Federal synfuels program be structured to identify opportunities and resolve critical issues.

Unfortunately, as these comments will detail, DOE has failed to develop a sound environmental management plan for dealing with the impacts of its synthetic fuels program. No programmatic analysis of environmental issues has been prepared as required by the National Environmental Policy Act, 42 U.S.C. §§ 4321-4347 (NEPA).⁴ The Department of Energy has made irrevocable commitments of resources before completing relevant environmental studies and statements. The Department has made informed public comment on proposals impossible by withholding or delaying the release of relevant information.

4/ The Impact Statement issued by the Energy Research and Development Administration in September 1977 on the Alternative Fuels Demonstration program, while it correctly asserts the importance of generic assessment of potential impacts, utterly fails to accomplish such an assessment. What purports to be environmental analysis is cursory and speculative. Other than vague statements about future research and consultation, there is no indication of how the demonstration program will resolve environmental, safety, and health questions. No specific strategy is developed for the management of the program to deal with environmental, safety, and health hazards. Nothing in the document would assist a decisionmaker in determining which proposal involving which technology to support, when to support it, and under what conditions.

DOE tacitly admits this through its conduct, relying on the ERDA document neither in its programmatic decisions, nor in the DEIS.

Not surprisingly, this Draft Environmental Impact Statement on the Proposed SRC-II Demonstration Plant (DEIS) reflects the lack of a strong environmental management program. Although it is the first DEIS prepared by DOE for any synfuels plant, it is a directionless and mechanical document, a pro forma recitation of limited data, unsupported assumptions, and bland assurances. Far from demonstrating, as required by NEPA, that DOE has considered the potential impacts of the proposed action, and has fully assessed the alternatives and available mitigation measures, the DEIS demonstrates that DOE has failed to do so.

A. A Programmatic Impact Statement is Necessary

Already DOE has made extensive commitments to fund synfuels development. These include the construction of a variety of pilot-scale liquefaction plants and plans for numerous liquefaction and gasification demonstration plants. Pursuant to the Defense Production Act, the Energy Security Act, P.L. 96-126, and programmatic authority, DOE may provide in excess of six billion dollars in financial incentives for synthetic fuels development during the next year. While there is evidence that DOE has sought to manage the incentives program to achieve the most rapid technological progress possible (see, e.g., Fossil Energy, Program Summary Document for Fiscal Year 1981, February 1980 (Draft)), there is nothing to indicate that program decisions are being made in consonance with a systematic environmental plan. It is not sufficient simply to ask questions about environmental, safety, and health impacts if the program is not structured to require the answers while it is still practical to respond to them.

The decisions DOE must make in administering the synthetic fuels program require hundreds of determinations whether, when, in what form, and under what conditions to assist in the design and construction of specific plants. Those determinations require selections among technologies, among sites, and among sponsors, reflecting a ~~complex~~ web of interrelated factors that will determine environmental consequences. Some of the obvious questions in each of these areas are:

Technologies

- What type of fuel is produced? How can it be used? For utilities? Transportation? Petrochemical feedstocks? Industrial boiler fuel? Where is the demand for the fuel? At what price? Does the fuel meet environmental requirements for the regions where it might be used?
- Is the technology restricted to certain geographical regions by resource availability (e.g., water, specific types of coal, clean air increments, or, for specific technologies, shale, waste, or grain)?
- How close is the technology to commercial readiness from a purely technological viewpoint?
- What are the known environmental, safety, and health problems associated with the technology? What are the available control technologies and their relative merits? What are the known residual impacts after application of control technology?
- What are the unanswered environmental, safety, and health questions? What are the alternative means to provide the data necessary to answer the questions? How long will it take? How significant are the risks associated with the questions and what is the affected area or population? Are the questions uniquely associated with production or use of the fuel? Are certain uses more problematic than others? Are the questions unique to the technology? How much previous research has been done and by whom?

Site Selection

- Which geographic regions are suitable for which technologies? Which are uniquely suitable? What are the controlling factors?
- What is the likely timetable for development of different technologies in each region absent DOE restraints?
- What is the capacity of the region to absorb the cumulative impacts of multiple synfuels development, in terms of infrastructure, environment, and socio-economic dislocations? Which competing uses -- other industries, agriculture, recreation, etc. -- will be adversely affected and to what degree by multiple plant development?
- What are the applicable regulatory requirements in each region? Which requirements are likely to change or develop?

Sponsors

- What types of sponsors have expressed interest in synthetic fuels development?
- Are there significant differences among sponsors relative to their ability and willingness to resolve environmental, safety, health, and socio-economic issues? Is it significant if a sponsor already owns a site? A resource supply? A specific process?
- Are there important differences in approach among sponsors that are energy primarily producers and those that seek feedstock or a captive fuel supply?
- What factors can be used to determine a sponsor's capacity and willingness to promptly identify and resolve environmental, safety, health, and socio-economic problems? Commitment of resources in project preparation? Regulatory record? Commitment of resources to environmental, safety, health, and socio-economic problems in other activities? Early consultation with the public?

The interaction of these factors cannot be assessed or managed proposal-by-proposal. It requires generic programmatic analysis and planning. That is precisely the function of a programmatic EIS.⁵ In the absence of such an analysis, DOE

5/ The Council on Environmental Quality's Regulations for Implementing the Procedural Requirements of NEPA (CEQ NEPA Regulations) state:

(b) Environmental impact statements may be prepared, and are sometimes required for broad Federal actions such as the adoption of new agency programs or regulations (§ 1508.18). Agencies shall prepare statements on broad actions so that they are relevant to policy and are timed to coincide with meaningful points in agency planning and decisionmaking.

(c) When preparing statements on broad actions (including proposals by more than one agency), agencies may find it useful to evaluate the proposal(s) in one of the following ways:

(1) Geographically, including actions occurring in the same general location, such as body of water, region, or metropolitan area.

(2) Generically, including actions which have relevant similarities, such as common timing, impacts, alternatives, methods of implementation, media, or subject matter.

[footnote continued on next page]

will inevitably proceed ad hoc and will thereby foreclose both environmental and technological options. Each failure to resolve problems early before going forward to the next step will simply increase the cost of later rectification of previous errors, and may will impose a cost in lives and illness.

While DOE has commendably commissioned a variety of studies on specific aspects of the program,⁶ they remain essentially useless because they have not been integrated into a coherent whole and made a basis for action. Each of the studies is like a sentence out of context. It is impossible to read them and determine what steps will be taken by DOE managers as a result.

[footnote continued from previous page]

(3) By stage of technological development including federal or federally assisted research, development or demonstration programs for new technologies which, if applied, could significantly affect the quality of the human environment. Statements shall be prepared on such programs and shall be available before the program has reached a stage of investment or commitment to implementation likely to determine subsequent development or restrict later alternatives.

§ 1502.4(b) and (c).

6/ See, e.g., Synthetic Fuels And the Environment, A Environmental And Regulatory Impacts Analysis, Prepared by the DOE Assistant Secretary for Environment.

The failure to insist upon effective coordination of research, regulatory, promotional and industrial activities may enable DOE to issue more grants sooner, but it will ultimately injure the synthetic fuels industry. Sites that should have been reserved for site-limited proposals will be used by plants that could have been sited elsewhere. Environmental monitoring and late-concluded health studies will reveal the need for expensive modifications that could have been avoided through early resolution of critical questions. The failure to address cumulative local impacts will lead to levels of degradation and rates of growth unacceptable to the local population, in turn resulting in litigation and legislative action. Haste now will create all the necessary preconditions for debilitating regulatory uncertainty later.

DOE should write a programmatic impact statement and treat it not as an inconvenience, but as a vehicle for developing a comprehensive strategy that establishes standards and criteria for environmentally responsible management of the program. In the absence of such a document, DOE will continue to ooze around NEPA requirements as a series of irrelevant obstacles and will in the end make the kind of shortsighted decisions NEPA was enacted to prevent.

B. A Special Approach Is Necessary For Environmental Review of Demonstration Plants

1. An Adequate Design

The proposed SRC-II plant is a demonstration facility intended to "minimize the technical and economic risks" and to "significantly reduce the environmental risks" associated with the development of a new technology (DEIS, p. xvii). Because the technology is new, both the process components and the operation of available control devices are unfamiliar. Since the DEIS is based upon a conceptual design of the plant, design specifications critical to evaluation of the environmental, safety, and health impacts of the plant and the adequacy of proposed controls and mitigation measures are not available.⁷ Thus neither outside reviewers nor DOE decisionmakers can effectively assess the proposed plant design.

The solution is obvious. The DEIS should be rewritten based upon a substantially more complete plant design. The DEIS can then become the basis for improvements in the design required to minimize environmental hazards and resolve critical issues. Because the plant is a demonstration intended to answer questions, obviously the DEIS cannot provide all the answers. However, it is not sufficient to simply state that the plant is designed as a demonstration and outstanding questions

7/ The missing information is detailed in Section II, *infra*, and summarized in Section II(A), *infra*. The process information is so sketchy it presents less specific information than a recent chemical industry advertisement. Compare DEIS Figure 2.1 with the ad from the *Washington Post*, July 27, 1980, p. D3, reproduced on the next page:

Clearing the Nation's Air

What the chemical industry is doing to help
clean up the air you breathe

The chemical industry was taking steps to prevent pollution long before most of the nation recognized the need for action. Today, almost all of our industry's plants meet or exceed Environmental Protection Agency clean air requirements. But we're not stopping there. Here are some of the actions we're taking to help America breathe easier:

1. Committing billions to clean up

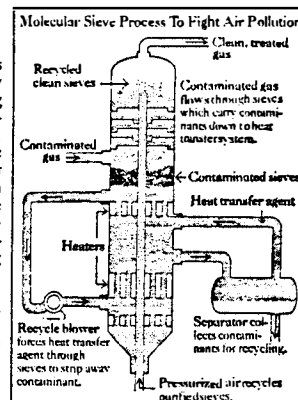
The chemical industry is investing more than any other U.S. manufacturing industry in fighting pollution, according to the U.S. Census Bureau. Since 1976, we've doubled our investment in air pollution control equipment. By the end of 1979, this commitment exceeded \$2.6 billion. We are also investing millions of dollars in environmental research. The expenditures for one research program alone are expected to exceed \$9 million by the end of 1980.

2. Upgrading plants and processes

New plant construction includes sophisticated operating equipment and technology to prevent emissions. Older, existing plants are being refitted with additional equipment to improve emission control and meet environmental requirements. We're also finding ways to recycle emissions to create useful raw materials.

3. Trapping particulates more effectively

Asenbher at one company helps trap more than 1,300 tons of par-



The chemical industry uses equipment ranging from simple wet scrubbers to highly sophisticated molecular sieves to remove solids, vapors and odors.

ticulate sulfur each year. Other companies use electrostatic precipitators to help reduce fly ash emissions by nearly 100 percent. Still other companies use "baghouses," which operate like household vacuum cleaners, to keep dusts and solid particles from contaminating the air.

4. Capturing vapors with new technology

Research is helping us find new and better ways to control gas-

eous wastes. For example: a highly specialized molecular sieve recovers waste sulfur dioxide from the vent gas of sulfuric acid plants for recycling into the acid-making process. Special incinerators help control odorous gases. We've created compounds which can trap specific kinds of pollutant molecules.

5. Getting more employees involved

The chemical industry already has more than 10,000 employees whose sole job is to operate, maintain and monitor pollution control equipment. And we keep adding to this number each year. At one facility, employee programs encouraged ideas which helped eliminate 75,000 tons of air pollutants each year.

Write for this booklet: Chemical Manufacturers Association, Dept. DY-07, P.O. Box 363, Beltsville, Md. 20705.



America's Chemical Industry

The member companies of the Chemical Manufacturers Association

will be answered during the course of the plant's operation. It is essential that the DEIS describe the specifications of the monitoring system that will be used to gather necessary data.

The DEIS is not useless. We applaud DOE for having prepared an environmental analysis at this early conceptual stage. But it does not satisfy the need for a DEIS. The DEIS for a demonstration synthetic fuels plant should discuss in meaningful detail the major design choices to be made. After consideration of the document and the comments of outside reviewers, the Department's decisionmakers should then make final decisions with respect to the design. The final EIS then should represent the final design and explain why it was selected over its alternatives.

2. There Should be a Clear Decision Point Before Commercialization Proceeds

The summary of the proposed cost-sharing agreement for the SRC-II plant transmitted by DOE to the Chairmen of the House and Senate Appropriations Committees states that the contractor will be entitled to purchase the facility and construct, on the same site, additional commercial facilities increasing the plant's capacity of 500%. The impact of this provision is to nullify the benefits of constructing a demonstration plant, for whatever may be learned through operation of the demonstration plant, DOE would leave itself no authority either to decide not to proceed to commercialization, or to impose new health and environmental conditions for the construction and operation of commercial facilities.

Normal market incentives will stimulate the contractor to respond to business and technological innovations, but there will be no such pressure to elicit constructive response to new environmental data.⁸ Indeed, market pressures will be to the contrary. Thus, DOE appears to have abandoned what the DEIS calls one of the central purposes of the demonstration -- the reduction of environmental risks associated with commercial development.

Such a result is perverse. It is as much in the national interest to determine how effectively environmental health and safety problems associated with the process can be addressed as to determine how efficiently the process can turn coal into liquid fuel. Worse still are the announced plans of DOE to sign the agreement before it has even seen the comments on the DEIS, let alone completed a final EIS. Those plans simply flaunt DOE's scorn of the NEPA process.

8/ The agreement will also apparently remove all incentives for the contractor to avoid environmental, safety, and health damage, by requiring the government to indemnify the contractor for any liability arising "in connection with this contract, including the production, sale, distribution, and use of products pursuant to this contract." Summary, p. 11.

C. Informed Comment Is Impossible

The purpose of public and agency comment on a draft environmental impact statement is to improve the quality of the data and analysis available to agency decisionmakers responsible for the action that is the subject of the impact statement. Comments can only be useful if they are specific and concrete. They can only be specific and concrete if the draft impact statement is clear and the reviewer has access to the materials upon which the draft is based.

The DEIS is not clear. As discussed in later sections of these comments, the DEIS is full of gaps, unsupported assumptions, ambiguities, and references to incomplete work. For example, the DEIS indicates that studies of the "acute hazards to the work force and general population" will not even be available in preliminary form until the completion of the baseline design next spring (DEIS, at 1-18). In addition, DOE failed to disclose information on a series of spills at the Fort Lewis pilot plant. Furthermore, DOE has failed to make important documents available. These include:

- Five volumes of the phase zero deliverables detailing background and preliminary stage studies and describing the SRC-II process and proposed environmental controls. Without these documents, evaluation of the effectiveness of the proposed control technologies, the availability of alternatives, and the potential impacts is impossible.
- The cost-sharing agreement proposed to be signed July 30, 1980, by DOE, Gulf, and the Governments of Germany and

Japan. The summary of this agreement provided by DOE to the House and Senate Appropriations Committees suggests that the agreement commits DOE to construction of the demonstration plant and subsequent commercialization of the process as proposed by Gulf regardless of comments on the DEIS or new data obtained through subsequent research and the operation of the demonstration plant.

Other documents were made available too late to be useful. The Battelle health studies were placed on file in the DOE reading room only on July 10, 1980, after repeated requests. These are the basic documents on potential health impacts. The Water Resources Council study, the basic document on hydrologic effects, was unavailable until June 27, 1980.

These failures are not simply inconveniences; they render effective comment virtually impossible. As one Federal court observed:

To suppress meaningful comment by failure to disclose the basic data relied upon is akin to rejecting comment altogether. . . . The inadequacy of comment in turn leads in the direction of arbitrary decision-making.

United States v. Nova Scotia Food Products Corp., 568 F.2d 240, 252 (2d Cir. 1977).

DOE's actions are inconsistent with its responsibilities under NEPA, and CEQ NEPA Regulations. See, e.g., 40 C.F.R. § 1502.22, and Executive Order 11514, March 5, 1970, as amended by Executive Order 11991, May 24, 1977.

II.

The SRC-II DEIS Is So Totally Inadequate
That A New or Supplemental Draft Must Be Prepared
And Circulated For Public Comment

NEPA has been correctly characterized as "an environmental full disclosure law." Environmental Defense Fund v. Corps of Engineers 325 F.Supp. 749, 759 (E.D.La. 1971). By requiring the preparation of environmental impact statements for major federal actions, Congress was acting to assure that government decisionmakers and the public had sufficient information to weigh the environmental costs and benefits of proposed federal actions. As the Council on Environmental Quality's NEPA Regulations note (40 C.F.R. § 1502.1):

The primary purpose of an environmental impact statement is to serve as an action-forcing device to insure that the policies and goals defined in the [National Environmental Policy] Act are infused into the ongoing programs and actions of the Federal Government. It shall provide full and fair discussion of significant environmental impacts and shall inform decisionmakers and the public of the reasonable alternatives which would avoid or minimize adverse impacts or enhance the quality of the human environment. . . . Statements shall be concise, clear, to the point, and shall be supported by evidence that the agency has made the necessary environmental analyses.

NEPA requires that an environmental impact statement's discussion of impacts and alternatives must be "detailed." As the U.S. District Court for the District of Columbia has stated (Environmental Defense Fund v. Hardin, 325 F.Supp. 1401, 1403-04 (D.D.C. 1971):

[An EIS] must be sufficiently detailed to allow a responsible executive to arrive at a reasonably accurate decisions regarding the environmental benefits and detriments to be expected from program implementation.

For all its length, the draft EIS on the SRC-II plant is not "detailed" and does not contain a "full and fair discussion" of alternatives and impacts as required by NEPA. On the contrary, the impact statement contains so little description of the proposed SRC-II plant, is so shallow in its assessment of impacts, is so riddled with errors and contradictions, and is so devoid of alternatives for mitigating environmental impacts, that no reasonable decisionmaker could possibly arrive at a fair decision on the merits of the proposed project based on the DEIS.

Indeed, the DEIS on the SRC-II plant is so totally inadequate that Hittman Associates, a firm with considerable experience in evaluating the SRC-II process, was led to conclude that the document should not even be termed an environmental impact statement. In comments submitted to EPA, Hittman stated that:

This draft EIS document then, in our opinion, is not an EIS by EPA definition because it does not contain details for public review of the perceived potential environmental impacts of a specific plant to be built. It appears to us that this is an in-house environmental review of a conceptual design with recommendations for environmentally realted process changes, and/or alternate DOE actions which might be taken to improve the basic conceptual design. The document apparently was not intended originally for public review. It is unfortunate that: (1) the document is being used as an EIS in the more common use of the word, i.e.,

for a plant with a specific design; (2) there is insufficient information included in the document for the reviewer to evaluate what is stated; (3) the document is poorly organized with information scattered throughout; and (4) the document developers have exceeded the scope of their task by including a number of vague and questionable statements.

Review of U.S. Department of Energy, Draft Environmental Impact Statement, Solvent Refined Coal-II Demonstration Project;

Submitted to U.S. Environmental Protection Agency Industrial Environmental Research Laboratory by Hittman Associates, Inc., July 1980 (hereafter cited as "Hittman Report"), pp. ix-x.

Under these circumstances, the obligation of DOE is clear: it must either prepare an entirely new EIS or circulate a supplemental EIS. As stated in the CEQ regulations:

The draft statement must fulfill and satisfy to the fullest extent possible the requirements established for final statements in section 102(2)(C) of the Act. If a draft statement is so inadequate as to preclude meaningful analysis, the agency shall prepare and circulate a revised draft of the appropriate portion.

40 C.F.R. 1502.9(a). Unless supplemental EISs are prepared in circumstances such as these, the preparation of environmental impact statements will, in the words of the U.S. Court of Appeals for the District of Columbia Circuit, "become a useless ritual, defeating the purposes of NEPA, and rather making a mockery of it." Natural Resources Defense Council v. Callaway, 524 F.2d 70 (D.C. Cir. 1975).

The circumstances with respect to this project are analogous to those addressed in Environmental Defense Fund v. Armstrong,

352 F.Supp. 50, 56 (D.Cal. 1972), where a Federal District Court noted that:

Under the circumstances presented in this case, we hold that where the ultimate operation of a project is still in doubt at the time the EIS must be filed, a tentative discussion or "best estimate" of the possible uses to which the project may be directed is nonetheless required. As such the EIS should be viewed as an interim statement, the first part of a two-step process whereby the responsible Federal officials would first give their best estimate of the uses to which the project will be put, and then prior to actual use, a revised or supplemental statement should be filed either reaffirming those estimates or describing the newer proposed uses and their environmental impacts.

Here, as in the Armstrong case, DOE must treat this EIS as "an interim statement." When final plant design is complete and the many health and environmental studies finished, the agency must then issue a revised or supplemental draft statement for public comment.

A. The DEIS Contains Virtually No Data on Plant Design, Process Flows, or Emissions

Perhaps the single most pervasive defect in the DEIS is that the document includes almost no data on plant design, process flows, or emissions. In most cases, the DEIS attributes the absence of this data to the "lack of a final plant design." This is one of the fundamental problems with the DEIS and the central reason why it cannot be finalized without preparation of another draft EIS reflecting a substantially more complete design and without a meaningful opportunity to comment on it.

There are literally dozens of examples of this problem which could be cited. In this section we mention just a few.

Occupational and Public Health Effects. On the subject of possible exposure of workers and the public to carcinogenic or toxic materials, the DEIS notes (p. 4-1):

[P]ilot plant studies have shown that the qualitative and quantitative composition of SRC products and wastes vary and are sensitive to changes in coal feedstock and process conditions such as temperature, hydrogen pressure, and residence time. This variability, combined with the fact that only a conceptual SRC plant design exists at this time, reduces the ability to predict the specific compounds and exact concentrations that will be present in products, intermediate streams, wastes, and occupational environments.

Conceptual design, in turn, depends on studies of public health effects. At page 4-2 and 4-3, the DEIS states

Based on the information currently available, inclusion in the demonstration plant of a complete hydrotreating facility solely to reduce biological activity would appear to warrant consideration only if further studies indicate the health hazards of SRC fuel products to be much more serious than now anticipated. If, however, further studies indicate that the materials responsible for

a significant portion of the biological activity may be concentrated in a small fraction of the product, which may be separated by distillation or other means, hydrotreating of this fraction may warrant consideration.

Potential public exposure to these health hazards remains inadequately researched. With regard to product transportation, for example, the DEIS notes (p. 4-6):

Although accidental releases on the plant site are not expected to result in public exposure it is likely that transportation of the products will result in accidental releases which result in direct and indirect exposure of the public to process materials. Direct exposure may result from contact with the material due to involvement in the accident, response and clean up operations, or from inhalation of materials aerosolized as a result of fire. Depending on the distance from the scene of the accident, inhalation exposures may be higher than those resulting from a fire on site.

But a meaningful evaluation of the hazards cannot be assessed because:

A number of possible routes exist from the site to Baltimore, and identification of the specific route to be used has not been made.

Impacts on the Proposed Site. Impacts on the site cannot be quantified as the site boundaries have not yet been secured (p. 2-14):

Due to a revision in the plant layout to avoid commercial slag disposal in areas subject to possible subsidence, the site boundaries may change significantly because acquisition of the western portion of the site may no longer be necessary (but may be acquired as a result of the pattern of land ownership), and additional buffer area may be acquired along Highway 53.

Impacts on geologic characteristics are dependent also on later design. On p. 4-13, the DEIS states:

the environmental impacts related to geotechnical properties will be negligible as a result of avoidance of unsuitable areas in specifying the final plant layout and consideration of these properties in the engineering design. Final analysis and design of such measures will be completed prior to construction. Potential geotechnical problems, . . . will be addressed along with engineering measures in detail in the safety analysis report . . .

Conversely, effects of geotechnical properties on operation are related to later design. At page 4-14, the DEIS states:

Analysis of the probabilities and effects related to slumping, landslides, and subsidence and measures to mitigate the risk will be presented in the safety analysis report . . . The possibility of landslides will be considered in the final design of critical structures, such as the product pipelines from the main process area to the riverside storage tanks.

Impacts on terrestrial ecology cannot be adequately assessed because the final design is not decided (p. 4-14):

The area that may be temporarily disturbed during construction is larger, but difficult to quantify without detailed construction plans. Updated designs for final plant layout, temporary facilities, and acreage estimates for plant communities to be cleared will be given in the FEIS. Temporarily affected acreages will be minimized as much as possible by locating temporary-use activities on areas to be eventually used for permanent facilities. . .

Knowledge of the impacts on forested areas and wetlands is ambiguous. On p. 4-16, the DEIS notes:

The significance of the loss of the forested wetland is unclear, because the abundance of such wetlands near the site is unknown.

Final plans will consider minimizing this clearing of forest and will be discussed to the extent possible in the FEIS.

Water Impacts

Flooding by the Monongahela River could inundate the area surrounding the storage tank area and docking facilities located near the river. The probability of structural failure will be analyzed in the safety analysis report . . . before final design of the storage area.

This statement on p. 4-20 reflects the preliminary stage of knowledge on safety impacts, as well as of final design.

The water needs and water availability are equally dependent on studies that must be conducted on the region. Ultimate design alternatives will follow these studies. On p. 4-21, the DEIS states:

Based on the results of the WRC [Water Resources Council] evaluation, a detailed evaluation of the water resource impacts of commercial operation will be conducted.

Design alternatives include offstream storage either on- or offsite, and increased reliance on nonevaporative cooling. Although a detailed evaluation cannot be made until the WRC study is completed, a combination of the above alternatives should be adequate to prevent unacceptable impacts on water resources.

On p. 4-22, the DEIS describes the need for further study and design to prevent danger of leaching from coal piles --

If contaminants are detected in the springs, DOE will evaluate the significance of the impact of these contaminants and design the appropriate mitigation measures as needed. A detailed analysis of the storage area soils and groundwater flow beneath the area will be conducted to optimize the design of the storage area and select appropriate monitoring locations to provide early detection of infiltration.

and leaching of solid wastes:

The disposal of slag from the gasifier requires the largest commitment of land resources and is discussed below. The disposal plans for the remaining wastes are not finalized as yet. Some of these wastes may be hazardous, though of small volumes. Possible options include disposal in secure offsite landfills, onsite disposal after chemical fixation or encapsulation, or returning spent material to vendors for recycling. Quantification and characterization of these wastes during the detailed design phase and demonstration plant operation will determine the option or combination of options selected and the potential impacts.

On the solid waste disposal system, the DEIS states at p. 4-24:

Differential settlement could can [sic] cause failure of the clay liner and the underdrain system. Therefore, a detailed investigation of the engineering properties of these soils will be conducted before construction of the landfill. Design of the landfill and specific engineering measures for handling the strip mine soils will be based on the results of these tests.

Impacts on Air. Air impacts studies and resultant design phases are not completed, as demonstrated on p. 4-33 and p. 4-34:

Construction of the demonstration plant will generate air emissions as a result of land clearing, grading and excavation, operation of vehicles and mobile equipment, storage and transfer of fuels and other materials, and evaporation of solvents from paints and coatings. These emission sources are common to major construction projects and, except for vehicle and equipment emissions, are primarily are or fugitive emission sources which may be effectively controlled only by implementing good management practices. As part of the detailed design, a Construction Environmental Management Plan will be developed. This plan will permit qualification of potential air quality impacts of construction.

Because design of the demonstration plant is not yet final, the control measures that will be used in each area cannot be specified, nor can the degree of reduction that will be achieved be estimated. This subject, which has been identified as an area of concern, will be addressed in detail when additional information is available.

Cooling tower operation also will affect quantity and quality of air emissions. On this subject the DEIS states at p. 4-34:

[S]election of a cooling system design involves balancing economic and environmental factors and affects the selection of a wastewater treatment system; a final system design has not yet been established.

When the design basis for the cooling system is established, a detailed analysis of the potential for increased fogging and icing will be made, and the results of this analysis will be used to site the cooling towers.

Emergencies. The incomplete final design makes it difficult to evaluate the potential for and effects of an emergency. The DEIS notes at p. 4-36:

Although alternative designs are now being considered . . . emergencies may result in process materials bypassing the controlled combustion system and going to the flare.

And at page 4-38:

Emissions of process materials resulting from such an event cannot be predicted at this time. These streams will contain complex organic compounds and various compounds of sulfur. If flaring is incomplete, materials may be released which present long-term health hazards. Large quantities of SO₂ will be emitted, but the ground-level concentrations are impossible to quantify at this time. Emissions during flaring represent a potential health hazard. In a worst-case scenario (e.g., catastrophic failure of a reactor vessel), public exposures resulting from acute emergency conditions in the plant, though brief,

could be significant. Available data indicate that repeated low-level exposures are of greater concern than single acute exposures from the standpoint of long-term health effects. The safety analysis report . . . will specifically address the likelihood of these events and the impacts that would result from them, should they occur.

Cumulative Impacts

Cumulative effects have not been determined:

Sufficient emissions information is not available at the time of this analysis to accurately quantify all cumulative impacts. However, a brief examination of the impact prediction of a proposed new source located at Round Bottom, West Virginia, approximately 25 km south of the proposed site indicated that cumulative effects with the new sources will not be large. Maximum air quality impacts are anticipated to be within 10 km from the Fairmont Energy Corporation Core Plant. A complete, detailed analysis of all cumulative effects will be conducted by the industrial participant during the review of the proposed SRC-II facility for compliance with PSD regulations. At that time, both the State of West Virginia Air Pollution Control Commission and the USEPA Region III will have sufficient emissions information from all sources to adequately address cumulative impacts resulting from the operation of the proposed facility. Pollutant transport to surrounding states will be addressed for regulatory compliance at that time. [Footnote omitted.]

Socioeconomic Effects. On p. 4-44, the DEIS states:

As soon as the final plant layout is selected, all archaeological sites that may be disturbed by plant construction will be further evaluated to assess their potential significance.

And on page 4-47:

Studies are underway by the West Virginia Department of Transportation to address the highway transportation needs of the demonstration project and the commercial plant. The study related to permanent road improvements will not be available until after December 1980.

Alternate means of shipping coal to the commercial facility should be studied, as current lock capacities along the existing river system might be inadequate to accommodate the volume of coal required for the commercial plant without causing delays to other users of the river system. The capacity of the barge system is being evaluated in the WRC assessment.

It is probable that some product will be shipped by pipeline and by barge. Possible pipeline routes have not been identified at this time.

In sum, an enormous number of questions remain to be answered and future studies remain to be performed before meaningful plant design choices can be made. The lack of meaningful data in this DEIS precludes adopting it as a final EIS, for it does not inform decisionmakers of the health and environmental risks and control options they face. Another draft must be prepared for public comment, with the design taken to a level at which these health and environmental questions can be meaningfully answered, and choices can be made concerning the safest way to proceed in the building and operation of this demonstration plant.

In the following sections, we explain in more detail some of the DEIS's most serious shortcomings.

B. The DEIS Projects Air Quality Violations From Both the Demonstration and Commercial SRC-II Plants, And Yet the DEIS Contains Insufficient Analysis of Means Available To Avoid These Violations.

The Federal Clean Air Act⁹ entitles the Nation's citizens to air quality that does not impair their health or the natural and man-made environment around them. The foundation of the Nation's clean air program is the National Ambient Air Quality Standards for seven major pollutants: sulfur dioxide (SO₂), total suspended particulates (TSP), ozone, nitrogen dioxide (NO₂), hydrocarbons, and lead.¹⁰ For each pollutant there is a Primary Standard, which the law requires to be set at the level necessary to protect the health of even the susceptible individuals in the population, and a Secondary Standard, required to be set at the level necessary to protect the environment.

In addition, Congress has established in the Act rules for preventing degradation of air quality that is currently better than the Primary and Secondary Standards. The Clean Air Act specifies "prevention of significant deterioration" (PSD) increments for additional SO₂ and TSP pollution in such areas, which may not be exceeded. The Act requires EPA to establish similar PSD rules for ozone and other pollutants as well, and EPA is currently developing increments for these pollutants. Congress enacted the PSD rules to guard against potential health and environmental damage at levels below the Primary

⁹/ 42 U.S.C. §§ 7401-7562.

¹⁰/ 40 C.F.R. Part 50.

and Secondary Standards, and to protect long-distance visibility and other priceless aesthetic resources. The prevention of significant deterioration rules represent a national commitment that we shall not pollute unspoiled areas as we have our existing cities and industrial centers.

The DEIS reveals that the demonstration plant probably will cause violations of the ozone standards, and that the commercial plant probably will cause violations of the ozone, SO₂, and TSP standards. Despite these likely violations of major requirements of Federal law, the DEIS contains inadequate discussion of means available to prevent them.

1. Ozone and Other Photochemical Oxidants

The demonstration plant probably will cause violations of the ozone standard. DEIS, p. 4-34, Table 4-2, p. 4-35. Ozone is one of hundreds of photochemical oxidants formed in the presence of sunlight from hydrocarbons and oxides of nitrogen released from pollution sources. Ozone and the accompanying oxidants cause or aggravate chronic obstructive lung diseases such as bronchitis, emphysema, and asthma. They increase susceptibility to serious respiratory infections. These effects may be especially hazardous for older people. In addition, ozone and other oxidants exert adverse effects on the sensitive respiratory systems of growing children.¹¹

¹¹/ See generally, Environmental Protection Agency, Air Quality Criteria for Ozone and Other Photochemical Oxidants (April 1978) (EPA-600/81-78-004).

Ozone levels near the plant, currently measured at 217 ug/m³, are already very close to violating the Primary and Secondary Standards, 235 ug/m³. DEIS Table 4-2, p. 4-35. The DEIS states that hydrocarbon emissions from the demonstration plant and hydrocarbon emissions from motor vehicle traffic induced by the plant may be sufficient to push the ozone levels out of compliance with the standards. *Id.* at 4-34.

The likelihood of breaching this major requirement of Federal law mandates a detailed investigation of the sources and quantities of hydrocarbon emissions to be expected from the demonstration plant, and of the opportunities to reduce those emissions further. Yet the DEIS makes no attempt at such an analysis, either in this discussion or in treatment elsewhere of fugitive and other sources of hydrocarbons, in sections oriented towards the carcinogenic and other especially toxic effects of many of these chemicals.¹²

Moreover, the Department should be aware that EPA's recent weakening of this standard to its current scope and level is under legal challenge. Prior to January 1979, the standards covered not just ozone, but the whole photochemical oxidant mixture, and the standards limited the concentration of this mixture to 160 ug/m³. The narrowing of the standards to ozone alone and the raising of the allowable level to 235 ug/m³ has been challenged by the Natural Resources Defense Council and the American Lung Association.¹³ The case has been argued,

^{12/} See Part II(D) of these Comments, below.

^{13/} The cases are collected under the name American Petroleum Institute v. Costle, Nos. 79-1104 et al., and are pending in the U.S. Court of Appeals for the District of Columbia Circuit.

and a decision is expected shortly that may require EPA to reinstate the prior, more protective standard. In this light, it also cannot be assumed (as in Table 4-2 on page 4-35 of the DEIS) that West Virginia's standards, which still reflect the prior Federal standards, will be changed.

The demonstration plant will need to make even greater hydrocarbon emission reductions to comply with the 160 ug/m³ standard if it is reinstated. Yet this is not discussed.

The commercial plant, five times the size of the demonstration, almost certainly will violate the ozone standards unless hydrocarbons are reduced even further. Yet the DEIS contains no discussion of this point. No commitment to building the commercial plant can be made until this issue is fully treated.

2. Particulates and Sulfur Dioxides

Emissions of particulate matter and sulfur dioxide create dangerous air pollution that increases deaths and serious illnesses and causes serious environmental degradation. The hazards of these emissions were succinctly summarized in the 1977 Report of the President's Committee on Health and Environmental Impacts of Increased Coal Utilization, published at 43 Fed. Reg. 2290-40 (January 16, 1978). The Committee was composed of ten notable experts in the health and environmental impacts of these emissions, and was chaired by Dr. David P. Rall, Director of the National Institute for Environmental Health Sciences. Their Report stated:

These pollutants are irritants of the respiratory system. Both sulfur dioxide and nitrogen dioxide can react in the atmosphere to become even more toxic. Exposure to elevated levels of these pollutants can increase the number and frequency of attacks in persons with existing bronchial disorders, and can contribute to chronic respiratory diseases.

The primary health problems of these air pollutants relate to the lung . . . [W]e can anticipate an increase in the number of asthma attacks in susceptible individuals, and increased incidence or exacerbation of acute and chronic respiratory disorders.

Many areas now enjoy very good air quality with respect to the [NAAQS] pollutants. . . . [D]eterioration in air quality [induced by increased coal use], even if it does not exceed current standards, may affect susceptible individuals, such as the elderly and those with existing pulmonary diseases, under those circumstances. In other areas with poorer quality air, where pollutant levels already are at or near standards, increased use of coal may have to be constrained. Forecasts received by the Committee indicated that many adverse health effects could be avoided by careful siting of new . . . facilities. However, if the standards are significantly violated, there inevitably will be deleterious public health impacts. The Committee is also concerned about those other pollutants, not covered by EPA criteria standards, such as sulfates, POM, etc., for which emission forecasts are not available. We need more information.

43 Fed. Reg. 2231, 2233-34.

Sulfur and particulate emissions from coal combustion and conversion also exacerbate acid rain. The Rall Report stated:

Emission of SO₂, particularly from coal, and NO_x from all fossil fuel combustion have increased the acidity of precipitation in northeastern U.S. This has decreased fish populations in many lakes, and may already be reducing forest and agricultural productivity.

Sulfate and nitrate ions are the predominant cause of the acid fallout that has lowered the pH (increased the acidity) of lakes and soils, and lowered productivity in many areas impacted by emissions from fossil-fired plants.

Ibid., pp. 2231, 2233. EPA is currently preparing an extensive review of the scientific information available on the adverse effects of sulfur and particulate compounds. See "Air Quality Criteria for Particulate Matter and Sulfur Oxides," Vols. I-IV (External Review Draft No. 1, April 1980). As a result of this review, the levels of the Primary and Secondary Standards for these substances may be lowered, perhaps even below the level allowed by the current PSD increments.

In addition, NRDC has petitioned EPA to establish NAAQS for fine particles, the portion of total suspended particulates that is most dangerous to health and plays the biggest role in acid rain. Fine particles are emitted directly from facilities such as this demonstration plant, and they are formed secondarily in the ambient air from sulfur and nitrogen compounds and particulate matter. Such standards would require more effective emission limitations at the SRC-II plant than are currently contemplated. See "Petition of Natural Resources Defense Council, Inc., for Control of Fine Particles" (May 29, 1980).

The DEIS projects that particulate and SO₂ emissions from the demonstration plant will amount to 94 and 41 percent, respectively, of the incremental emissions allowed under the PSD rules of the Clean Air Act. These projections raise three problems:

(a) Inability to assess accuracy of modeling. Inadequate information has been given on the emission factors used to generate the estimate of ambient TSP and SO₂ levels. The DEIS soothingly states that the TSP projection is "believed" to be an overestimate (DEIS, p. 4-38), but no data are given to substantiate this statement. The DEIS identifies coal storage, preparation, and handling, and the process heat generators, as the major sources of particulate emissions, and the sulfur recovery system and the process heat generators as the major sources of sulfur. DEIS, pp. 2-23 to 2-27, 4-39. Without detailed emissions information described for these sources, it is impossible to assess the credibility of the ambient air quality modeling.

(b) Inadequate discussion of control alternatives. Without such data, based on thorough descriptions of the control technology and its operating effectiveness, it is impossible to determine whether the best pollution control measures will be used at these emission points.

With regard to particulates, the DEIS fails to discuss many points in coal storage, preparation, and handling. And at some points where control is discussed, the control measures specified are demonstrably not the best available. See the Hittman Report, Table 1 "Coal Storage, Preparation, and Handling," p. 3. For instance:

- No control methods are specified for conveyor loading, transfer points, and discharge. The Hittman Report indicates that vacuum hoods, scrubbers, and dust

suppression techniques are available measures to control particulate emissions from this stage of the process.

- The DEIS indicates that simple water spraying of the coal piles will be used to control dust. It mentions a more effective technique for inactive piles, coating them with a polymer crust, but there is no indication that this better technique will be used. DEIS, pp. 2-33 to 2-34. The Hittman Report recommends the use of the polymer crust.
- The DEIS gives no attention to the control of particulate emissions due to coal pile fires, which the Hittman Report, at p. 2, states will be increased by use of water spraying on high-sulfur coal, rather than the polymer crust. Coal pile fire handling techniques must be developed.
- The DEIS recommends flash drying of the coal. DEIS, p. 2-34. The Hittman Report agrees that this will reduce particulate emissions, but states that it may increase fire risks. For this reason the best control technology for coal drying consists of using flue gas heat to dry the coal, and collecting particulates with a baghouse. Hittman Report, p. 2, and Table 1, p. 3.

The DEIS's treatment of the sulfur recovery system, which is stated to account for 65 percent of sulfur emissions, has similar deficiencies. First, inadequate data is supplied for the acid gas scrubbing system. The concentration of hydrogen sulfide in the stream to be sent to the primary recovery system, and the variability of the components of this stream, are not given. These are important data for determining what is the best control technology at the primary recovery stage. The Hittman Report points to readily available data missing from the DEIS, on the diethanolamine and Benfield systems. A diethanolamine system is in use at the Fort Lewis pilot plant. Benfield units are in use in several coal conversion plants. Hittman Report, p. 4. This data must be analyzed and discussed.

The DEIS states that under normal circumstances the acid gas scrubbing system will not vent emissions to the atmosphere. DEIS, p. 2-26. But the potential for fugitive emissions of toxic sulfur compounds, such as hydrogen sulfide, carbonyl sulfide, and carbon disulfide, as well as carbon monoxide, is not discussed.

The choice of the Claus system for primary sulfur recovery depends in part on the unavailable data on the acid gas scrubbing system. Other sulfur recovery devices are available which can reduce sulfur emissions to a lower level than the Claus unit, such as Stretford and Giammarco-Ventrococo units. The primary reason given for rejecting these is their asserted higher cost. They are also said to be sensitive to variability in the incoming sulfur stream, and the latter is said to lead to a potential contamination problem. DEIS, p. 2-27. This is insufficient information on which to base any choices. Even the DEIS, at the same page, admits that further study of these alternatives is needed. The Hittman Report contains much more data on these alternatives than the DEIS. Hittman Report, pp. 5, 9-10, and Table 2 "Sulfur Recovery Comparisons," at pp. 6-8. Without data on the composition and variability of the incoming stream, and without far more detailed analysis of the technological and economic aspects of the many alternatives, intelligent choices cannot be made.

Similar questions exist with regard to the method for cleaning the sulfur-bearing tail gas from the Claus (or other) unit. The DEIS states, at p. 2-27, that a Super SCOT unit

will be used to reduce emissions. The Hittman Report, at p. 9, states flatly that this is not the best available control technology, and discusses more effective options. See Table 2 at pp. 6-8. It is even possible to run Super SCOT units at a higher level of sulfur removal than the DEIS suggests. The DEIS itself identifies more effective technology, but simply states that more study of alternatives is needed. DEIS, p. 2-27. This discussion is far too incomplete to illuminate choices with regard to tail gas clean-up.

The DEIS states that particulate and sulfur emissions from process heat generation will be limited by burning gaseous SRC-II product, rather than coal with pollution control technology. DEIS, pp. 2-32 to 2-33. We must express some skepticism that this commitment will be kept, especially if the plant is commercialized, since the SRC-II product so used may have a market value sufficient to tempt DOE or the industrial partner to sell it. See the Hittman Report, p. 23. If the process heat boilers are to be built without the best available particulate emission controls, then DOE and the industrial partner must make a binding commitment to use only gaseous fuels. The commitment must be binding on both the Department and the industrial partner, for both operation of the demonstration plant, and the commercial plant if it is built. It must also be enforceable against any other party who may assume responsibility for operating the plant at any time.

The DEIS states that the question whether to buy electricity from elsewhere or to build a generator on-site has not yet been decided. DEIS, p. 2-33. This is a major design decision that must be made before an adequate DEIS can be prepared.¹⁴

The air quality analysis assumes that on-site generation will be chosen, and appears to assume that such a facility, like the process heat generators, would be fueled by SRC-II product, and therefore that extensive technological emission controls will not be needed. DEIS, p. 2-33. As above, we are skeptical that SRC-II product will in fact be used for this purpose, in view of its market value. If on-site generation is chosen, a binding commitment to use only gaseous fuels as described above is essential here, too.

(c) Insufficient remaining PSD increment for commercial plant or other growth. The demonstration plant is projected to consume 94 percent of the PSD increment for particulates and 41 percent of the available increment for SO₂. The commercial plant would be five times larger than the demonstration. It is not conceivable that the plant as presently designed can be expanded five-fold and not exceed the PSD increments, certainly for particulates, and almost beyond doubt for SO₂. Thus, it

^{14/} If off-site generation is selected, then the DEIS must include analysis of the environmental impacts attributable to the additional generating capacity elsewhere needed to supply the plant.

would appear that without major design changes to lower these emissions the commercial plant may not be built. The DEIS admits this: "Consumption of PSD increments could limit the construction of a commercial facility at this site." DEIS, p. 4-39.

The efforts of the DEIS to explain this problem away will not withstand even cursory analysis. The DEIS states that the TSP modeling projections are thought to exaggerate the true impacts. DEIS, p. 4-38. As discussed above, this statement is not substantiated by data.

The DEIS also states that "SO₂ and particulate emissions from a commercial facility could not increase in proportion to the increase in capacity." DEIS, p. 4-38. Absolutely no support is given for this statement. Nonetheless, it has intriguing implications. The statement implies that it is possible for the plant to expand capacity by five times and still consume less than six percent more of the PSD increment. No description of the technology to accomplish this comparatively amazing reduction is given. If such technology is available, then it should be used on the demonstration plant. This would lower its consumption of the increment well below 94 percent.

As for sulfur dioxide, the DEIS appeals to the prospect that unspecified SO₂ removal technologies, which the document apparently concludes are not "available" for the demonstration plant, will in fact be "available" by the time the commercial plant is built. DEIS, p. 4-38. No details are offered of what technologies fall into that "in-between" state now, why they

are not available for use at the demonstration plant, and why they can be relied on to be available in time for commercialization. DOE would rely on a "deus ex machina" we have insufficient grounds to count on.

The DEIS identifies one other planned industrial facility that would be precluded by the demonstration plant's consumption of so much of the PSD increments, the Alka Ohio Coke Plant. DEIS, p. 4-39. There may well be others; a more thorough investigation of the region's economic development plans and needs seems to be called for before a major step so limiting future options is taken. At the same page, the DEIS states:

[PSD] increments were established to allow for carefully planned growth and restrictions on development due to consumption of an increment must be weighed against benefit to the area.

Yet, though this is the correct question, the DEIS reveals no meaningful effort to explore or answer it. There is not even any indication that State and local governments, whose developmental choices may be severely limited by the plant as designed, have been involved in these critical choices.

3. Contribution to Acid Rain

Finally, the DEIS gives absolutely no attention to the contribution of this plant to the acid rain phenomenon afflicting the entire Northeastern region of the United States. The demonstration plant will emit considerable sulfur, nitrogen, and particulate precursors to the prevailing weather pattern that carries this pollution for hundreds of miles and finally brings it down to earth in the form of acid precipitation.

It is now well known that the acidification of precipitation is killing all fish life in hundreds of lakes, changing the pH of waters and soils, and diminishing forest and agricultural productivity. It even accelerates the deterioration of buildings and other man-made objects, at a great economic cost. Avoiding this potential contribution to acid rain is another reason for using truly the best available control technologies at the demonstration stage, and especially if the plant is expanded to commercial scale. The DEIS will not be adequate until this problem is adequately discussed.

4. Conclusion

These comments on air pollution problems from this plant demonstrate that DOE has a great deal of additional work to do before it has adequately analyzed the potential impacts and opportunities for mitigation as NEPA requires.

C. The DEIS Water Quality Analysis Is Based Upon Unsupported Assumptions and Fails to Consider Likely Changes in Conditions

The water quality analyses contained in the DEIS and the Ohio River Basin Commission Water Assessment for Monongahela Synfuel Plant (ORBC) sketch a comforting image of the plant's impact upon water quality and quantity, concluding, in essence, that the SRC-II plant will have minimal adverse effects upon the aquatic environment. However, both documents are premised upon unsupported assertions, questionable assumptions, and doubtful predictions of future conditions.

1. Discharges of Process Waste Water

Both documents assume that SRC-II will not discharge process wastes since the plant is designed for zero discharge, as well as for retention and treatment of spills. Accordingly, no analysis has been done regarding the pollution effects of such discharges. Several questions should be raised.

a. As the review of the DEIS prepared for EPA by Hittman Associates points out,

Zero discharge is the level designated for wastewater and wastewater contaminants. It is our suggestion that achieving zero discharge of wastewater contaminants is difficult in any plant; in a partially experimental plant of this nature, it is likely not to be achievable.

Hittman Report, at p. iv.

b. The plant will discharge contaminated runoff in the event of rainfall which exceeds the 10-year, 24-hour storm. (ORBC, p. 27; DEIS, p. 4-28). Is that an acceptable design

storm? What will be the effects of such discharges when they do occur? The DEIS merely concludes that potential chemical loadings will be "uncertain," and predicts that effects will not be serious since flows (and dilution) will be high during such storms (DEIS, p. 4-28). This prediction is not supported by any analysis, and in any event ignores long-term effects that could be caused by these chemicals. Finally, DOE apparently is considering other plant designs with less evaporation that would involve more frequent discharges, i.e., during less severe storms. DEIS, App. C, p. C-20. What could be the effects of these?

2. Water Quality Standards

The reports make two important assumptions with respect to the yardsticks by which water quality impacts will be measured: (1) the parameters to be assessed; and (2) the ambient levels for those parameters. There is no basis to suppose these parameters will remain unchanged. The DEIS should evaluate possible changes between now and 2020.

a. The parameters. ORBC concluded, without explanation, that the only relevant parameters are Dissolved Oxygen (DO), pH, and Total Dissolved Solids (TDS). ORBC, p. 12. On the other hand, water quality data and standards exist for a large number of other pollutants, including toxics. See DEIS, Tables 3.2-3.4, pp. 3-19 through 3-22. Indeed, Table 3.4 (p. 3-22) shows substantial numbers of violations with respect to EPA water quality criteria (concentration levels) under existing conditions.

Even if the plant does not discharge these pollutants, it is conceivable that flow reductions caused by the plant's consumption of water could contribute to increases in the ambient levels (by reducing dilution), and exacerbate what appears to be an existing problem. The DEIS should at least address the potential for this effect.

Moreover, EPA has issued criteria for a number of pollutants that are not yet incorporated into West Virginia standards. See DEIS, Table S.1, pp. S-2 through S-3. This situation could change as the states revise their standards over the years, resulting in new state standards for which violations are likely (compare Table S.1 with Table 3.3, for example, with respect to Phenol and Sulfates¹⁵). If SRC-II causes flow reductions which decrease dilution, these parameters would become relevant.

Furthermore, as a result of upcoming EPA proposals, additional water quality criteria and standards may be in the offing, particularly for toxics. The Agency will publish final criteria for 65 toxics this fall and expects to implement at least some of those through state water quality standards. Preliminary criteria are available now. Thus, it seems likely that during the life of the plant quite a few new standards will be adopted. DOE should address these to the extent permitted before the final EIS must be completed.

^{15/} Indeed, the ORBC report points out that sulfates are the major components of TDS in the Monongahela, then notes that "no instream standards exist for sulfates" (p. 12) and proceeds to ignore that parameter even through the DEIS (Tables 3.3 and 3.4) shows violations of EPA's criteria under existing conditions.

b. Ambient levels. The reports also seem to assume that the regulatory ambient levels (water quality standards) will not change over the life of the product. The Monongahela and its tributaries are classified for all uses, including water supply, contact recreation, and fish propagation. DEIS, p. 3-18. So the "use classifications" for these water bodies cannot get more stringent. But the ambient levels needed to support those uses can change whenever better knowledge of pollutant effects is developed. This is true particularly for toxic pollutants. Note, for example, the DEIS discussion of toxics at p. 4-29.

3. Effects of Water Consumption

The documents address in some detail the effects of SRC-II on ambient DO and TDS conditions downstream. It is the plant's consumption of water that will affect water quality to the greatest extent. Both studies begin by calculating the volumes of water necessary to maintain ambient concentrations under certain low-flow conditions. They then predict the extent to which future discharges and consumption by other sources will affect those volumes and concentrations. Finally, they express the impact of SRC-II in terms of the percentage of "surplus" water (above that necessary to meet standards) that is consumed.

If wet cooling is used, the demonstration plant will consume approximately 2% of the current desired minimum flow (DEIS, p. 4-20), and the commercial plant approximately 7% (DEIS, p. 4-21). In 1990 and 2020, the results are not drastically

different, but due to increased consumption from other sources there are likely violations of water quality standards (ORBC, pp. 2-3). These conclusions, of course, depend on several assumptions.

a. ORBC assumes that BAT treatment by other sources will reduce DO loadings from 354,000 lb/day to 77,000 lb/day by 1990 (p. 19). This is a huge, important reduction that even ORBC admits is speculative. BAT regulations are under review, and probably will not be as restrictive as has been assumed (ORBC, p. 20). Yet, neither report assesses the impact of such less restrictive controls on the plant's water quality effects.

Moreover, as the Pennsylvania DER points out (ORBC, p. 42), BAT technologies (especially for thermal discharges) may result in consumptive uses "several times higher than that projected by the Pa. State Water Plan." Apparently, ORBC relied on these Pennsylvania projections (p. 13). Most important, the predictions of future consumptive use assume no increase for electric power generation through 2020 (p. 25). And, even at present capacity, the use of cooling towers at generating plants and other industrial facilities (under new BAT regulations) would cause a "major increase in consumptive use projections" (p. 25).

b. The major water quality problem from the commercial plant will be TDS violations. ORBC predicts that TDS standards will not be met from 1980-2020 (p. 32), and even that conclusion is based on questionable assumptions. Contrary to ORBC's

statement (p. 32), Pennsylvania does not presently achieve its TDS standard (see p. 46). Moreover, ORBC assumes a 50% reduction of TDS from newly active and newly abandoned mines (p. 18), but admits that EPA regulations presently do not even regulate that parameter (p. 19). And, as with the DO standard discussed above, ORBC's questionable predictions of future consumption could affect this problem.

c. A significant assumption throughout these documents is that 80 cfs of flow will be available from the new Stonewall Jackson Dam. See, e.g., ORBC, pp. 21, 30. But, Pennsylvania DER has recommended against allocating this supply to SRC-II consumption (ORBC, pp. 4, 43); the storage capacity of the Dam is at issue in current litigation (ORBC, p. 45); and it is uncertain in any event whether the 80 cfs will even reach the point at which it is needed (ORBC, p. 46).

d. Although no data are given, ORBC assumes that "major leakage problems" at some lock-and-dam sites will be corrected before 1985 (p. 22). DOE should spell this situation out in some detail.

e. The projections for the commercial plant assume that water consumption will not increase in proportion to the increase in production capacity (five-fold). DEIS, pp. 4-20 through 4-21. The basis for that assumption is not presented.

4. Sludge Disposal

Sludges will be incinerated and the residue placed in a hazardous waste landfill. ORBC, p. 27. Given present doubts about future landfill capacity, these conclusions should be

questioned. If residue is stored on-site because space is unavailable in RCRA-approved landfills, water quality problems could result. ^{15a/}

5. Spills

DOE admits that "the possibility of a product spill is recognized as a serious threat to river water quality," but goes no further because "the probability of its occurrence is unknown." DEIS, pp, 4-29, 4-21 through 4-32. As noted elsewhere in these comments, DOE was aware that a series of significant spills have taken place at the Fort Lewis Pilot Plant. The failure to report that fact in the DEIS is outrageous.

6. Entrainment

There may be significant impacts from entrainment of aquatic organisms in intake structures. DEIS, pp. 4-31, 4-32. The discussion on p. 4-31 is illogical and inconclusive, and DOE's prediction of no significant effect apparently is based on modifying the design and, again, using Stonewall Jackson Dam (p. 4-32).

The water quality assessment is inadequate to the point of uselessness. It cannot purport to supply the information for a reasoned decision.

^{15a/} Whether the sludge can in fact be satisfactorily incinerated is doubtful. See Part D, below.

D. THE DEIS DOES NOT CONTAIN EVEN A MINIMALLY ADEQUATE DISCUSSION OF THE KNOWN AND POTENTIAL HEALTH AND ENVIRONMENTAL IMPACTS OF TOXIC CHEMICALS USED IN, AND RELEASED BY THE SRC-II PROCESS, OR OF OPPORTUNITIES TO MITIGATE THESE IMPACTS

The DEIS grossly fails to present a complete evaluation of the chemicals that are known and potential dangers to human health and the environment associated with the SRC-II-process. It completely fails to discuss either the number of dangerous substances found in the process streams, wastes, and products, or the full range of adverse effects (ranging from cancer and mutation to neurological disorders), reported to be associated with them. This failure is all the more serious since much of the voluminous data available was prepared under contract to DOE, and since the agency has ready access to that prepared for EPA and other agencies or reported in the open literature.

The DEIS also fails to portray the consequences of operating at that site a commercial plant five times the size of the demonstration plant.

The chemical hazards that this DEIS so inadequately surveys have convinced some analysts that the direct coal liquefaction methods are the dirtiest and most dangerous of all the synthetic fuels processes. A full review of the chemical hazards in the SRC-II process will forcefully indicate the need for the best possible control measures at the demonstration plant. This is especially the case since the demonstration plant is to serve as a proving ground for pollution control technology as well as for the conversion process itself.

Yet the DEIS gives only the sketchiest, most superficial description of the measures available to contain or destroy these substances. Insufficient data is given to determine a "materials balance" for the potentially dangerous substances in the SRC-II process. Few design details have been offered. An inadequate basis has been given on which to judge the effectiveness and completeness of measures to contain or destroy toxic organic chemicals or trace metals that may escape into the workplace, the air, water, or groundwater, or the cost of alternatives.

The deficiencies of the DEIS may well be due to the fact that the list of preparers in Section V includes no one with professional training and experience in toxicology, epidemiology, or other disciplines concerned with evaluation of chemical health hazards (e.g., biochemistry, biophysiology, pathology, pharmacology, or medicine). DOE will have to enlist the assistance of professionals with appropriate expertise to prepare an adequate analysis of the health and environmental hazards posed by this plant.

A review of just a portion of the voluminous literature prepared for or available to DOE reveals far more detailed information on the known and potential health and environmental hazards from the chemical substances associated with the SRC-II process than one would guess existed from reading the DEIS.

Below we discuss some of the substances that may be released for human and environmental exposure, the hazards associated

with them. This is only a start; DOE has an obligation to prepare a complete analysis in the EIS of the known and potential hazards.

These substances should be regarded as "signal" compounds, which may be accompanied in the same process streams and emissions by many other hazardous compounds as well. They indicate the presence of hazards requiring the very best control measures.

1. Hazardous Substances in the SRC-II Process Streams, Wastes, and Products Which Are Potentially Available for Human and Environmental Exposure

Coal conversion processes in general, and the SRC-II process in particular, generate a large number of toxic chemicals, each of which needs to be addressed for its potential toxicity.

A recent ^{16/} report for DOE by the Battelle Pacific Northwest Laboratories concluded that the heavy distillate fraction of the SRC-II product was carcinogenic, mutagenic, and teratogenic. In skin painting experiments in mice, SRC-II heavy distillate caused 100% tumor incidence at the high and medium doses, and a significant tumor incidence at the low dose as well. The heavy distillate also was mutagenic in the Ames test and caused cell transformation in Syrian hamster embryo cells. Furthermore, it caused cleft palates, immature lungs, and herniated diaphragms in up to 74% of fetuses when given on days 12-16 of gestation.

16/

Department of Energy, "Biomedical Studies on Solvent Refined Coal (SRC-II) Liquefaction Materials: A Status Report. Report Prepared by Battelle Pacific Northwest Laboratory for the U.S. Department of Energy," Publication PNL-3189 (1979) (hereinafter cited as "Battelle Health Studies Report")

The carcinogenic, mutagenic, and teratogenic properties of the heavy distillate were said to be due to primary amine polycyclic aromatic hydrocarbons (PAH).

This raises an important issue with respect to the DEIS. The DEIS states that most of the significant human exposure to SRC-II materials would be from acute rather than chronic episodes, and would arise from occasional accidental emissions or spills. However, the PAH benzo[a]pyrene is known to be carcinogenic in single dose experiments;^{17/} and other polycyclic aromatic hydrocarbons present in coal, such as chrysene, methylchrysenes, benzantracenes, benzacridines, aminoanthracenes, aminofluorenes, and naphthylamines are also among the most potent carcinogens known.^{18/} This raises the very real possibility of significant carcinogenic risk arising from short-term leaks and spills, and this should be addressed in the DEIS.

^{17/} Pierce, "Tumor-Promotion by Lime Oil in the Mouse Forestomach," *Nature* vol. 189, p. 164 (1961); Huggins & Yang, "Induction and Extinction of Mammary Cancer Science, vol. 137 p. 257 (1962); Lombard & Vesselinovitch, "Renal Carcinogenesis by Benzo[a]pyrene *Proc. Amer. Assoc. Cancer Research*, vol. 13, p. 49 (March 1972).

^{18/} International Agency for Research on Cancer, *IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Man*:
Vol. 3, "Certain Polycyclic Aromatic Hydrocarbons and Heterocyclic Compounds" (1973),
Vol. 4, "Some Aromatic Amines, Hydrazine and Related Substances and Miscellaneous Alkylating Agents" (1974), World Health Organization, Lyon, France.

The Battelle Health Studies Report did not find the light distillate or the middle distillates to be carcinogenic or genotoxic. However, this appears to be a function of the type of test systems Battelle used, rather than a testament to the relative safety of these products. Both the light and middle distillates, as well as the gases generated in the SRC-II process, contain numerous chemicals which are known to be carcinogenic or genotoxic, or to be developmental toxics or potent neurotoxins. These include:

Benzene. Present in the light distillate, benzene is a known human carcinogen. It has been identified as a cause of leukemia in humans^{19/} even though it does not cause skin tumors in animal skin-painting experiments, the only type of carcinogenesis bioassay used in the DOE study.

Aniline. Aniline, present in the light and middle distillates, was carcinogenic in rats in a bioassay conducted by the National Cancer Institute.^{20/}

Indole. Indole is also found in the light fraction of SRC-II distillates, and, like benzene, has also been implicated as a cause of leukemia. One study found that subcutaneous

^{19/} Infante et al., "Leukemia in Benzene Workers," *Lancet*, July 9, 1977, pp. 76-78 (1977);

Ott et al., "Mortality Among Individuals Occupationally Exposed to Benzene," Exhibit 154, OSHA Benzene Hearings, July 19-August 10, 1977.

^{20/} National Cancer Institute "Bioassay of Aniline Hydrochloride for Possible Carcinogenicity, National Cancer Institute Carcinogenesis Technical Report Series No. 130, Washington, D.C., DHEW Publication No. (NIH) 78-1385 (1978).

injections of 1% indole in 50% propylene glycol produced myeloid leukemia in rats within 6 months.^{21/}

Quinoline. Quinoline, found in light and medium distillates, induces liver tumors in rats and in mice.^{22/} It is mutagenic in the Ames test,^{23/} and causes chromosomal aberrations in Chinese hamster cells.^{24/}

Phenol and Cresols. Mixed phenols from shade oils, although not carcinogenic themselves, promoted the carcinogenic activity of benzo[a]pyrene in skin painting experiments in mice.^{25/} A recent literature review noted that all phenols and cresols tested caused chromosome damage in a variety of *in vitro* test systems,^{26/} even though at least some were not mutagenic in the specific tests used in the Battelle studies.

^{21/} Ehrhart, & Stich, "Untersuchungen über Experimentelle Leukämien: II. Die Indol-Leukämie bei der weissen Maus," *Klin. Wochenschr.* Vol. 35, pp. 504-511 (1957)

^{22/} Hiraro et al., "Carcinogenic Activity of Quinoline on Rat Liver," *Cancer Research*, vol. 36, pp. 329-335 (1976); Shinohara, et. al., "Effects of Various Factors on the Induction of Liver Tumors in Animals by Quinoline," *Gann*, vol. 68, pp. 785-796 (1977).

^{23/} Hollstein, et al., "Quinoline: Conversion to a Mutagen by Human and Rodent Liver," *Journal of the National Cancer Institute*, vol. 60, pp. 403-410 (1978).

^{24/} Matsuoka, et al., "Chromosomal Aberration Tests on 29 Chemicals Combined with S9 Mix *in Vitro*," *Mutation Research*, vol. 66, pp. 277-290 (1979)

^{25/} Bogovski, & Mirme, "Co-carcinogenicity of Phenols from Estonian Shale Tars (Oils)," *Environmental Health Perspectives*, vol. 30, pp. 177-178 (1979).

^{26/} Dean, "Genetic Toxicology of Benzene, Toluene, Xylenes, and Phenols," *Mutation Research* vol. 47, pp. 75-97 (1978)

Phenol and creols are present in the light and medium distillate SRC-II fractions, and we believe that a more extensive battery of genetic testing than Battelle performed would demonstrate the potential of these fractions to cause chromosome damage.

Thiophene. Thiophenes are present in the light and medium distillates, and their presence raises the possibility of neurotoxicity of these fractions. Daily injections of thiophene have been found to cause degeneration of the cerebellum and other brain areas of dogs.^{27/} Other investigators have found the same type of brain degeneration when they administered thiophene to rats.^{28/} Another study has reported that inhalation of thiophene effects the flexor reflexes in rabbits,^{29/} and one investigator stated that inhalation of only 0.8 mg/m³ of thiophene caused changes in human electroencephalograms.^{30/}

^{27/} Clinton, "Thiophene and Derivatives," *API Toxicological Reviews*, American Petroleum Institute, Washington, D.C., (1948).

^{28/} Bradley & Berry, "Effects of Thiophene on the Purkinje Cell Dendritic Tree: A Quantitative Golgi Study," *Neuropathology and Applied Neurobiology*, vol. 5; pp. 9-16 (1979);

Herndon, "Thiophene-Induced Granule Cell Necrosis in the Rat Cerebellum: An Electron Microscopic Study," *Experimental Brain Research*, vol. 6, pp. 49-68 (1968).

^{29/} Mikhaillets, et al., "Toxicology of Thiophene," *Gig. Tr. Prof. Zabol.* vol. 10, pp. 57-58. *Biological Abstracts*, vol. 48, p. 23256.

^{30/} Khikmatullaeva, "Data to Substantiate the Maximum Permissible Concentration of Thiophene in the Atmosphere" *Gig. Sanit.* vol. 32, pp. 3-6 (1977) (*Biological Abstracts*, vol. 49, p. 63743).

Hydrogen sulfide and carbon disulfide. H_2S and CS_2 will be present in the gases generated by the coal liquefaction process. H_2S is partially dangerous, because a single exposure to more than 300 mg/m^3 can cause unconsciousness and death, and those who survive exposure at such levels often experience long-lasting damage to the nervous system.^{31/} Even currently accepted occupational exposure limits may not provide an adequate margin of safety for the neurotoxic effects of H_2S . The threshold limit value-time weighted average (TLV-TWA) standard adopted by the American Conference of Governmental Industrial Hygienists is 15 mg/m^3 .^{32/} One investigator reported that exposure to only 10 mg/m^3 for 12 hours per day over 90 days caused brain damage and abnormal nerve conduction in rats.^{33/} Carbon disulfide is also a human neurotoxin. Several human epidemiologic studies reviewed by NIOSH indicate that occupational exposure to carbon disulfide is associated with both psychological disturbances and severe polyneuropathies.

^{31/} National Institute for Occupational Safety and Health, "Criteria for a Recommended Standard...Occupational Exposure to Hydrogen Sulfide," Washington, D.C. DHEW Publication No. (NIOSH) 77-158 (1977).

^{32/} American Conference of Governmental Industrial Hygienists, "Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment with Intended Changes for 1978." ACGIH, Cincinnati (1978).

^{33/} Duan, "Data for Determining the Maximum Permissible Concentration of Hydrogen Sulfide in the Atmospheric Air."

Pregnancy complications and various ovarian and menstrual cycle disorders were also noted in women exposed to carbon disulfide.^{34/} Mixtures of hydrogen sulfide and carbon disulfide are teratogenic in rats.^{35/} In addition to the chemicals listed above, there are several metals with known toxicity that are likely to be present in one or more of the fractions during the SRC-II process and possibly also in the end products.

Arsenic. Arsenic is a known human carcinogen.^{36/} Studies have shown that certain smelter workers who inhaled high levels of arsenic trioxide were at 4 to 12 times the risk of developing lung cancer than unexposed workers.^{37/}

^{34/} See NIOSH, note 31 above

^{35/} Barilyak et al., "Effects of Small Concentrations of Carbon Disulfide and Hydrogen Sulfide on Intrauterine Development in Rats," *Ark. Anat. Histol. Embriol.*, vol. 68, pp. 77-81 (Russian with English summary) (1975).

^{36/} Althouse, et al., "An Evaluation of Chemicals and Industrial Processes Associated with Cancer in Humans Based on Human and Animal Data: IARC Monographs 1 to 20," *Cancer Research*, vol. 40, pp. 1-12 (1980).

^{37/} International Agency for Research on Cancer, IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Man, vol. 2, pp. 48-73, World Health Organization, Lyon, France (1973); Kuratsune, et al., "Occupational Lung Cancer Among Copper Smelters," *International Journal of Cancer*, vol. 13, pp. 552-558 (1974); Tokdome & Kuratsune, "A Cohort Study on Mortality from Cancer and Other Causes Among Workers at a Metal Refinery," *International Journal of Cancer*, vol. 17, pp. 310-317 (1976).

Arsenic pollution in the general environment also appears to be associated with increased risk of lung cancer.^{38/} Skin cancer in humans is also causally associated with exposure to arsenic.^{39/}

Mercury. A discussion of the toxic potential of mercury must be based on considerations of the toxicity of mercury and inorganic mercury compounds, as well as that of the alkyl mercury compounds (especially methylmercury). Mercury and inorganic mercury compounds are central nervous system toxins, producing signs of irritability, excitability, etc. They also accumulate in the kidney, leading to proteinuria, renal failure, etc. Several alkyl mercury compounds are also known to induce central nervous system disorders and renal effects. In addition, methyl mercury is known to be a human teratogen.^{40/}

Nickel. Several forms of nickel are carcinogenic in animals.^{41/} Nickel subsulfide produces lung cancer when inhaled by rats. Nickel carbonyl increases the incidence of lung tumors when inhaled by rats. Intra-muscular injection of several other nickel compounds (nickel powder, oxide, carbonate, subsulfide, and nickelocene) has produced local sarcomas in rats,

^{38/} Blot & Fraumeni, "Arsenical Air Pollution and Lung Cancer," *Lancet* (1975) vol. ii, p. 142.

^{39/} Althouse, *et al.*, note 36, above.

^{40/} National Academy of Sciences, Assessment of Mercury in the Environment, Washington, D. C. (1978)

^{41/} Althouse, *et al.*, note 36, above.

mice and hamster.^{42/} Increased incidences of cancer of the nasal cavity, lung, and probably larynx, have been observed in nickel refinery workers. Exposure to nickel also produces dermatitis.

Chromium. Chromium is a human and animal carcinogen.^{43/} An increased incidence of lung cancer has been observed among chromate workers, chromium plater, and chromium alloy workers.^{44/} Several forms of chromium have also been found to produce local sarcomas in rats.^{45/} Chromic acid and the chro-

^{42/} International Agency for Research on Cancer, IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Man, vol. 11, pp. 75-112, World Health Organization, Lyon, France (1976)

^{43/} Althouse, *et al.*, note 36 above.

^{44/} IARC, vol. 2, note 37 above.

Taylor, "The Relationship of Mortality and Duration of Employment as Reflected by a Cohort of Chromate Workers," American Journal of Public Health, vol. 56, pp. 218-229 (1975);

Davies, "Lung-Cancer Mortality of Workers Making Chrome Pigments," Lancet, (1978) vol. 1, p. 384;

Waterhouse, "Cancer Among Chromium Platers," British Journal of Cancer, vol. 32, p. 262 (1975);

Royle, "Toxicity of Chromic Acid in the Chromium Plating Industry," Environmental Research, vol. 10, pp. 39-53 (1975)

Pokrovskaya & Shabynina, "Carcinogenous Hazards in Production of Chromium Ferroalloys," Gig. Tr. Prof. Zabol., vol. 10, pp. 23-26 (1973).

^{45/} IARC, vol. 2, note 37 above.

mates are also skin irritants, and, at lower exposure levels, the chromates are sensitizers.^{46/}

Lead. Lead is a general metabolic poison, documented in both humans and laboratory animals, that affects the central and peripheral nervous system, the kidneys, the reproductive system, and behavior.^{47/} Furthermore, lead acetate induces kidney tumors in mice and rats upon oral administration. Lead acetate, lead subacetate, and lead phosphate are carcinogenic in rats when administered by various routes.^{48/} Limited epidemiological evidence of lead exposure in smelter and lead workers showed increased cancer mortality. The excess of tumors was seen in the respiratory, urinary, and digestive systems, although tumors at no site alone were significantly increased.^{49/}

Cadmium. Exposure to cadmium and/or certain cadmium compounds may result in a wide range of toxic effects. A number of investigators have found that workers exposed to some form of cadmium are at increased risk of developing cancer of the pos-

^{46/} National Academy of Sciences, Chromium: Medical and Biological Effects of Environmental Pollutants, Washington, D.C. (1974).

^{47/} National Academy of Sciences, Lead in the Environment, Washington, D. C. (1980).

^{48/} International Agency for Research on Cancer, IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Man, vol. 1, pp. 40-50 (1972).

^{49/} Althouse, et al., note 36, above.

tate, respiratory system, and kidney.^{50/} Several forms of cadmium are also carcinogenic in rats and mice following subcutaneous and intramuscular administration.^{51/} Cadmium is also a mutagen, capable of causing point (gene) mutations and chromosomal damage.^{52/} Numerous investigators have found cadmium to be a potent teratogen and fetotoxic agent. In a recent review of these studies, the Battelle Memorial Laboratory concluded that a no-observable-effect-level could not be established.^{53/}

Some of the toxic properties of SRC-II-related chemicals are summarized in Table II-1.

^{50/} IARC, vol. 11, note 42 above.

Kjellstrom, et al., "Mortality and Cancer Morbidity Among Cadmium-Exposed Workers: A Preliminary Report. Environmental Health Perspectives, vol. 28, pp. 199-204 (1979).

^{51/} Althouse, et al., "An Evaluation of Chemicals and Industrial Processes Associated With Cancer in Humans Based on Human and Animal Data: IARC Monographs 1-20," Cancer Research, vol. 40, pp. 1-13 (1980)

^{52/} Environmental Protection Agency, "Rebuttable Presumption Against Registration and Continued Registration of Pesticide Products Containing Cadmium," 42 Fed. Reg. 56574. (1977)

^{53/} See EPA, note 52, above.

Table II-1: Summary of Toxic Chemicals and Effects

<u>Chemical</u>	<u>Carcinogenic</u>	<u>Causes Chromosome Damage</u>	<u>Teratogenic</u>	<u>Other Reproductive and Developmental Toxicity</u>	<u>Neurotoxic</u>	<u>Toxic to Other Organ Systems</u>
Polycyclic aromatic hydrocarbons	+	+				
Benzene	+					
Aniline	+					+(interferes with blood's ability to carry oxygen)
Indole	+					
Quinoline	+					+(skin, eye)
Phenols (promoters)		+				
Cresols		+				
Thiophene					+	+(liver, kidneys, heart, blood)
Hydrogen sulfide			+		+	
Carbon disulfide			+	+	+	
Arsenic	+					
Mercury			+		+	+(kidneys)
Nickel	+					+(skin)
Chromium	+					+(skin)
Lead	+			+	+	+(kidneys, blood-forming system)
Cadmium	+	+	+	+		

The forgoing is not an exhaustive list of all the toxic chemicals in the SRC-II process; it is merely intended to illustrate some of the potential human health problems that have not been dealt with in the DEIS. Each of these toxic chemicals may be present in

- . Waste streams
- . Fugitive emissions from the plant
- . End-products.

For this reason, we believe that the DEIS should attempt to quantify the amount of possible human exposure to these toxics, and should also address specific measures which will be taken to mitigate exposure.

From this review, it should be clear that there are very serious hazards associated with the chemicals in the SRC-II process. From the disingenuous statements in the DEIS, however, one would get no inkling of the fact that this data exists and that it is a matter of serious concern. The DEIS attempts to summarize and pass off these problems in one paragraph (p. 4-1, footnote omitted):

Certain SRC process intermediates, products, by-products, and wastes will contain trace metals and organometallic compounds. Selected streams may also contain a broad range of complex organic materials, including polynuclear aromatic hydrocarbons (PAHs), aromatic amines, and heterocyclic sulfur compounds that are known or suspected to be (1) mutagenic or teratogenic in microbial systems or (2) carcinogenic or toxic in laboratory animals. Although not proven by direct experiments, it is suspected that these materials are carcinogenic or toxic to man.

This is an unacceptable understatement. ^{54/}

2. The DEIS's Discussion of Occupational Health Risk Is Inadequate and Blatantly Irresponsible

The DEIS states at p. 4-1:

In an SRC plant, these complex organic compounds result primarily from the hydrogenation reaction.

Screening chemical and biological analyses of available SRC pilot plant materials by Battelle Pacific Northwest Laboratory do indicate that selected materials are biologically active. However, the extensive industrial hygiene program in place since startup of the Fort Lewis SRC pilot

^{54/} It is also erroneous and incomplete. Teratogenesis is revealed by human and animal studies, not microbial tests, and the statement contains no reference to the direct human evidence of cancer and other toxicity in humans.

plant (5 years) has prevented any chemically traceable incidents in the work force. (It should be noted that this period is well beyond the latency period of about 100 days for the appearance of skin tumors in experiments with laboratory animals.) This is in distinct contrast to experiences in previous coal hydrogenation plants where equivalent industrial hygiene practices were not employed. [Footnote omitted.]

This paragraph is incorrect, misleading, and shows either a great ignorance of the scientific principles for evaluating occupational health hazards or a callous disregard for workers' safety.

First, the reference to "biologically active" compounds is an understatement of the available data to a point approaching cover-up.

Second, DOE has no basis to conclude from the Fort Lewis experience that its industrial hygiene practices have been effective and that workers are not subject to serious risks. Most cancers have an average latency period of more than 20 years between the onset of exposure and diagnosis of disease. Five years experience without "chemically traceable incidents" is simply too short a time to draw any conclusions, especially considering the known hazards of the chemicals involved.

Third, the Fort Lewis work force is too small a sample to warrant putting faith in the absence of observed effects. Effects occurring at very serious rates can escape detection in small studies.

Fourth, the DEIS provides no details on the kinds of industrial hygiene measures that are followed at Fort Lewis, the kind of monitoring of exposure being done, and the kind of medical surveillance being performed. Without this data, there is no basis for evaluating the Fort Lewis experience.

Experience at other pilot plants is not encouraging. We understand that workers at the H-Coal plant are not required to wear protective clothing, take no protective measures other than a shower at the end of a shift, and were given a medical exam only before beginning work.

Perhaps the most serious omission from the discussion of health and environmental hazards in the DEIS is the lack of any mention at all of the only major epidemiological experience available. This is the study of skin cancer incidence among workers employed at the coal hydrogenation plant at Institute, West Virginia, in the 1950's. Among the 359 workers examined over a period of five years, 10 developed skin cancer. This was 16-37 times the expected incidence.^{55/} The cryptic reference in the paragraph quoted above to "experiences in previous coal hydrogenation plants" would alert no reader unfamiliar with this literature to the Institute experience.

^{55/} Sexton, "The Hazards to Health in the Hydrogenation of Coal: IV. The Control Program and the Clinic Effects," Archives of Environmental Health, Vol. 1, pp. 208-31 (1960). Follow-up studies have not found a demonstrably high rate of systemic cancers among the 10 workers, but this is too small a sample on which to base any negative conclusions; the possibility of a significantly elevated risk's escaping notice in so small a sample are very high.

The DEIS's evasive attempt to distinguish this data away cannot possibly succeed without more data on the Fort Lewis experience yielding convincing reasons why the Institute experience should not be accorded great weight.

Finally, the DEIS makes the incredible statement that, since the workers at Fort Lewis have been exposed to these chemicals for longer than the 100-day period usually necessary to generate skin cancers in rodents, they have nothing to worry about. Any beginning student of toxicology knows that, since a rodent's lifespan is about 2 years and a human's is about 70 years, one cannot make these direct comparisons. The 100-day stretch of an animal's life more nearly corresponds to 10-15 years of a human's life. The Hittman Report, on p. 26, stated: "This comment is both uncalled for and irresponsible."

In sum, the National Institute for Occupational Safety and Health, an agency far more expert in matters of worker safety than the preparers of this DEIS, has stated that more serious occupational hazards should be expected than what is already evident, as time accumulates and the number of workers increases:

Coal liquefaction materials contain potentially hazardous and biologically active substances. Many of these materials have not been characterized as to their composition and/or health effects. Although some of the available information has demonstrated a direct association between coal liquefaction materials and carcinogenicity, NIOSH believes that future investigations may find a greater occupational hazard than is currently documented in the literature. This belief arises from the apparent similarities of the potential toxicities of coal liquefaction process

materials and those materials known to be produced in coke oven and coal tar processes, which have been associated with a higher cancer risk. ^{56/}

The DEIS shows no prudent caution that suggests DOE understands this.

3. The DEIS Has Not Fully or Adequately Described the Potential for Fugitive Emissions or the Means to Minimize Them

The DEIS contains an inadequate discussion of the potential for exposure to hazardous chemicals from fugitive emissions. This encompasses risks to both employees and the general public. Fugitive emissions will contain many of the most chemically and biologically active compounds associated with the process. Fugitive emissions can be expected under both normal and upset conditions.

At several points in the SRC-II process, reducing atmospheres are created under conditions of elevated temperature and pressure -- for example, during hydrogenation stages. Emissions during these stages are likely to result in oxidized chemicals, particularly if the process chemicals go through radical intermediates. The DEIS does not discuss the probable nature of these intermediates and their fate upon exposure to the atmosphere nor does it assess whether the toxicity of the transformed compounds is similar, greater, or less than coal or the SRC-II product chemicals.

The vague block diagram of the plant (Figure 2.1, DEIS, p. 2-5) provides no useful information on potential fugitive

^{56/} Harris, et al., "Coal Liquefaction: Recent Findings in Occupational Safety and Health" (NIOSH, January 1980).

emission points, or of the chemical composition of the streams which may leak from them. The Hittman Report, p. 20, notes that without more detailed design fugitive emission points cannot be identified with any specificity, and the best controls cannot be described. Nonetheless, the Hittman Report presents more detailed discussion of fugitive emissions control than the DEIS. See Table 5 "Hydrocarbon Emission Control," pp. 18-19. This table identifies many serious data gaps in the DEIS, ranging from complete failure to discuss potential emission sources to specification of less than the best available methods to contain and repair leaks. The Report emphasizes the need to use the most advanced materials and best design to contain leaks and the need for intensive monitoring and maintenance. See Table 6, "Occupational Health Emission Control Technology," p. 31.

A common failure of many corporate fugitive emissions control programs is that low-level leaks are "tolerated" and fixed only on regular maintenance routines at long intervals, rather than being monitored for continuously and repaired immediately. With the numerous and potent toxins in the SRC-II process, such a practice would be unacceptable. The leak detection and repair program must be described in much more detail.

Much more attention must be paid to the potential for large fugitive emissions during "non-normal" conditions: upsets and emergencies. Upsets will be a frequent occurrence at a demonstration plant, and major equipment process failures

leading to enormous releases of chemicals are likely to occur as well. Many of the equipment upsets and failures that are described have to do with conditions of runaway temperature and pressure, which may require venting of equipment contents to the controlled combustor and flare. Little attention is given in the DEIS to the possibility of ruptures of pipes, valves, seals, and pumps from similar temperature and pressure excesses.

One extremely important question is the degree to which fugitive emissions can be captured and routed to the controlled combustor. The DEIS provides some indication that this will be done with some of the emission points, but it is not possible to appraise what untapped opportunities may exist, since no significant design information is available.

4. More Design Detail Is Necessary For Adequate Consideration of the Controlled Combustor and Flare

The controlled combustor and flare combination appear to be a reasonable approach, in concept, to minimizing toxic emissions from process leaks, upsets, and emergencies. However, far more detailed design information is needed before intelligent comment can be made on the adequacy of the planned units. No dimensions or operating characteristics of these units are given except in the most conceptual fashion. As the Hittman Report states (p-21-22): "Unfortunately, although the system is discussed at every opportunity in the draft EIS, absolutely no data are given." All we have been able to learn, from conversations with some government officials, is that the controlled combustor may be 40 feet in diameter, with 12 inch thick walls, and perhaps several hundred yards long. If this description is close to correct, this

is no trivial piece of equipment. No basis has been given for evaluating the completeness of the destruction of toxic chemicals to expect in normal circumstances, let alone during upsets or emergencies. The Hittman Report states (p. 22) that the flare may contain "significant quantities of PNAs [polynuclear aromatic hydrocarbons -- among the carcinogenic hydrocarbon emissions to be expected] and vaporized trace elements, while the ash from incineration will contain concentrated soluble sales." Much more data must be provided before there will be a sufficient basis for evaluating the degree of risk to public health.

5. The DEIS Exaggerates the Likelihood of Achieving Zero Discharge of Toxics-Laden Wastewater, and Discusses No Back-Up Water Pollution Treatment Plans

As mentioned previously, the DEIS's conclusion that there will be no toxic water pollutant problem from the demonstration plant is a critical assumption in assessing effects on the Monongahela River, aquatic life, and downstream users. The DEIS states, at p. C-20, that the wastewater will be evaporated off, and the sludge incinerated at a temperature sufficient to destroy toxic organic contaminants. But the Hittman Report indicates, at pp. 11-12, that it is very unlikely that sufficient water can be removed so that the sludge can be effectively incinerated. There is likely to be so much

water left in the sludge that the toxic components will not be destroyed. The energy requirements of a successful incineration system, under these conditions, would be very high.

Thus, the Hittman Report (p. 13) concludes that the options described in the DEIS "are not likely to achieve zero discharge, and as a result, some wastewater will have to be discharged." The Report adds: "The DEIS does not describe anything to handle this contingency." The Hittman Report describes candidate systems for this purpose at Table 3, "Summary of Applicable Coal Liquefaction Wastewater Control Technologies," pp. 14-15. A thorough, realistic analysis of the prospects of achieving zero discharge and an adequate facility for removing toxic pollutants from the wastewater before discharge must be a part of the DEIS.

Even if the cooling towers work as planned, there will be an enormous fogging and icing problem, since a very large volume of water has to be eliminated. The DEIS also states (pp. C-27 to C-29) that if a wet cooling tower system is used there will be some toxic discharge from the cooling towers. It has been suggested the towers be located where the toxic pollutants fall to earth on the plant site, so that they can be re-collected by the water processing system. This suggestion disregards the fact that employees will be exposed thereby. Hittman Report, p. 30. This is not an adequate solution. The cooling towers must be designed to avoid toxic contamination of the drift.

6. The DEIS Inadequately Addresses Toxic Contamination of SRC-II Products

The DEIS gives little treatment to the toxicity of the SRC-II products. Depending upon what they contain and how they are used, people may be exposed to increased risks of cancer and other serious diseases.

The Battelle studies on the SRC-II products discussed above, reveal that the middle fractions are heavily contaminated with carcinogens, mutagens, and teratogens. Also as discussed above, the lighter fractions of the products contain known carcinogens and other toxins. A recent report prepared for DOE indicates that most of these products are more heavily contaminated than the conventional oil-derived products they would substitute for. Enviro Control, "Relative Health Effects of Gasoline and Heating Fuel Derived from Petroleum or Synthetic Sources," (Draft, May 13, 1980). The DEIS should reflect consideration of this report and other available information that has been ignored.

The DEIS reports on a test burn of SRC-II product at a New York City electric generating station that normally used conventional oil. DEIS, p. 4-8. The SRC-II product resulted in higher emissions of polycyclic aromatic hydrocarbons and fine particles which cause cancer and chronic obstructive respiratory diseases and are especially hazardous in combination. See Perera and Ahmed, Respirable Particles:

Impact on Health and the Environment, pp. 38-39 (Ballinger, 1979). This extra pollution was being emitted in a very densely populated area. It is not enough to dismiss this extra pollution by saying it is less than would arise from direct use of coal. The DEIS should address the question whether restrictions in the kinds or location of certain uses are necessary.

Diesel fuels from SRC-II product will also elevate carcinogenic fine particulate emissions from diesel vehicles. This results from the higher aromaticity of SRC-derived fuel as compared with conventional diesel fuel. This problem must also be considered.

The DEIS (p. 4-2) states that hydrotreating SRC-II products significantly reduces their mutagenicity in the Ames assay. This process reduces levels of polycyclic aromatic hydrocarbons and other genotoxic organic compounds, thus presumably lessening the carcinogenic and mutagenic risk to humans in the use of these products. At p. 4-3 the DEIS states that hydrotreating would be seriously considered "only if further studies indicate the health hazards of SRC fuel produces to be much more serious than now anticipated." In view of the degree to which the DEIS has understated the health hazards associated with SRC-II chemicals, it is necessary that DOE completely re-evaluate the advisability of hydrotreating.

E. The DEIS Contains An Inadequate Discussion of Emergencies and Upsets

The proposed SRC-II process has never been commercially demonstrated. Since relatively little is known about the process it is likely that there will be unexpected occurrences at the plant. Many of those failures will doubtless be relatively minor: pumps will fail, seals will leak, lines will clog. But some of those failures may be extremely grave: fires or explosions may occur, there may be large spills of hazardous chemicals, unexpected pressure buildups may require a rapid release of large quantities of hazardous chemicals, floods may occur, or trains carrying SRC-II materials may be derailed.

There are several characteristics of coal liquefaction processes that render liquefaction plants prone to emergencies and upsets:

- o As the National Institute for Occupational Safety and Health recently noted, "... the combination of pressure temperature, solids, liquids, and handling found in this industry is not found in any other single industry." L.R. Harris, et al., Coal Liquefaction: Recent Findings in Occupational Safety and Health (Washington, D.C.: National Institute for Occupational Safety and Health, January 1980), p. 12. [Hereafter cited as "NIOSH Study."]

- o The pressures and temperatures employed in coal liquefaction processes tends to produce erosion, corrosion, and cavitation in plant equipment. Ibid., pp. 12-13.

- o The processing of mixtures of solids, liquids, and dissolved gases at high temperatures and pressures makes it

difficult to prevent leaks around rotary shafts in stirrers, centrifugal pumps, valves, and other process equipment. Ibid., p. 13.

Despite these unique conditions, the DEIS is almost totally barren of discussion of major emergencies and upsets or of methods for preventing, controlling, or responding to such emergencies or upsets. The three most prominent omissions are the failure to discuss chemical spills, the failure to discuss the possibility of fire and explosion, and the failure to adequately discuss the venting of large quantities of flammable and toxic material.

1. The DEIS Fails to Discuss the Possibility of Spills of Hazardous Materials

As noted in detail above, the SRC-II process involves numerous hazardous materials. Even the fuel to be produced at the plant will be highly toxic. There are a number of possible sources of spills at the proposed plant: valves may be accidentally left open by plant employees, equipment may break down or rupture, or operators may make mistakes while loading or unloading chemicals or fuel. Hazardous chemicals that escape can harm workers, damage plant equipment, or seep into the ground where they can degrade water supplies. The DEIS does not discuss the alternatives that are available for preventing these spills nor does it discuss approaches for minimizing the damages of spills that do occur.

The possibility of serious spills from the SRC-II plant is not merely a remote threat. The SRC-II pilot plant in Fort Lewis, Washington, has experienced a number of spills which

Secretary Duncan's Regional Representative has termed "significant." See Memorandum to George Fumich from Jack B. Robertson, Subject: Urgent Warning on Washington State Environmental Enforcement Action Against DOE Contractor, May 21, 1980, p. 1. The most recent of those significant spills occurred on December 19, 1980, while workers were transferring SRC-II distillate from a storage tank into 50-gallon drums. Because a plant worker failed to check a valve, 2,336 gallons of liquids drained from the tank and into the soil over a two-hour period. Ibid.; see also Energy Daily, July 29, 1980, p. 1. It appears that the spills that have occurred at the pilot plant may produce disastrous environmental consequences. As the Secretary's Regional Representative noted in his memo:

The State believes that the December 19, 1979, spill together with earlier unreported SRC spills pose a threat to nearby State waters, including a ground water aquifer used by residents of the Ft. Lewis Military Reservation for drinking water and a lake used as a salmon hatchery.

Ibid.

Incredibly, the DEIS makes no mention of the spills despite the fact that DOE had been aware of them for months prior to release of the DEIS. 57/

57/ The actions of DOE and P&M with respect to the spill raise serious questions concerning the integrity of the NEPA process and the suitability of P&M to serve as prime contractor for the SRC II project. Although the latest major spill occurred on December 19 and P&M's state water permit requires it to notify the state of any spills in excess of 500 gallons, P&M failed to notify the state until January 9. On May 7, the state issued P&M a Notice of Penalty, fining the company \$20,000 and ordering it

(footnote cont'd on next page)

It is critically important that the new draft or supplemental EIS issued on this project contain a detailed account of the pilot plant spills, their impacts, and their significance for the design of the demonstration plant. Among the questions that need to be answered are:

- o What accidental discharge prevention measures will be employed at the plant?
- o Will concrete pads, diking, and liners be used? If so, how will they be designed?
- o If chemicals do escape onto the ground what will happen to them? What are the precise soil characteristics at the plant site? What is the nature of the groundwater system?

(footnote cont'd from previous page)

to undertake certain cleanup, removal and assessment activities. Press reports indicate that, rather than promptly cleaning the spill, P&M spent its time attempting to "avoid the fine and limit the cost of disposal and remedial action." Energy Daily, July 29, 1980, p. 2. The actions of P&M in failing to report the spill and in attempting to avoid its cleanup responsibilities indicate that the company may not be the appropriate firm to provide environmental management of DOE's first major coal liquefaction plant. The revised draft of the EIS should specifically examine P&M's and Gulf's record of environmental management and should determine whether another firm would best build the SRC-II demonstration plant.

As for DOE's role with respect to the spill, it appears that the Department's interest in keeping news of the spill out of the newspapers and away from Congressmen and state officials interfered with its regulatory responsibilities. See footnote 3, supra. Although DOE learned of the spill on December 27, it did not report the spill to state officials. Energy Daily, July 29, 1980, p. 2. Sadly, the failure of DOE to report the spill to the state, the Department's attempts to keep information concerning the spill from the public, and the failure of the agency to even mention the spill in the DEIS cast doubt on the credibility of the entire DEIS and the NEPA process. All information concerning the spill should be released immediately to the public and DOE should act to assure that the persons responsible for keeping the spill out of the DEIS do not control preparation of the new draft or supplemental EIS.

- o How will DOE monitor the groundwater for leaks and spills?
- o If a major spill occurs and escapes from any safety system, what impacts would occur? What would be the effects on the groundwater? On the Monongahela River?

2. The DEIS Fails to Discuss the Prevention and Fighting of Fires and Explosions

The National Institute for Occupational Safety and Health's recent study of the health and safety problems associated with coal liquefaction concluded that:

Fire and explosion hazards are potentially significant as most coal liquefaction processes operate at high temperature and pressure and contain flammable materials.

NIOSH Study, p. 10.

The risk of fire and explosion at this plant is borne out by the experience of the petroleum industry. The American Petroleum Institute reports that there were 186 refinery fires and 5 tank farm fires in 1975.

Despite the significant risk of fire or explosions the DEIS contains no detailed analysis of the subject. As such, this EIS stands in sharp contrast to EISs on other large plants such as petroleum refineries. For example, the Army's final EIS on the Hampton Roads Petroleum Refinery contains data on the reported number of refinery fires, a discussion of possible evacuation of the surrounding community in the event of fire, a description of the design of the fire water distribution piping grid, a description of fire fighting equipment and procedures, and a description of the fire alarm system. U.S. Army, Final

Environmental Impact Statement, Hampton Roads Energy Company's Portsmouth Refinery and Terminal, Portsmouth, Virginia, August 1977, pp. 4-70 to 4-71, 4-80 to 4-82, C-7, B-160. This EIS should contain no less detailed an analysis. In addition, the EIS should discuss design methods that will be employed to minimize the possibility of explosions and fires.

3. The DEIS Fails to Adequately Discuss the Dangers of Sudden Venting of Flammable and Toxic Materials

During operation of the SRC-II plant it will sometimes be necessary to release large quantities of flammable and toxic materials in a very short period of time. As noted above, small routine upset releases will be burned in a control combustor. However, in an emergency, when the contents of a large unit such as the dissolver must be rapidly vented, the DEIS notes that it "will require bypassing the controlled combustor with the stream directed to the elevated flare." DEIS, p. 2-11. The DEIS contains no discussion of the impacts or dangers of such venting to the elevated flare. Officials at EPA indicate that such venting may produce a flame 600 feet high and two hundred feet across. ⁵⁸/ Many questions remain unanswered concerning this venting process. How often is it likely to occur? What will happen if the pilot in the flare isn't operating at the time of the venting? What emissions will result from the use of the flare? How will the

⁵⁸ One government official quipped that it "was nice of Gulf to put the flare high on top of a mountain so that the folks in New York can see the flame."

flare affect those living nearby? All of these questions should have been treated in the DEIS.

Particularly disturbing is the definition of an "emergency" as an event whose emissions exceed the capacity of the controlled combustor, when that unit has not even been designed yet. DEIS, p. 4-36. Presumably, the unit can be made larger or smaller. It is essential that the DEIS reflect more complete design than this, so that one can appraise the number and severity of emergencies and the need for a controlled combustor that is larger or smaller.

This slippery definition of "emergency" leads us to wonder about the distinction between "normal operating conditions" and "upsets," as well. So much of the DEIS's analysis of impacts is dependent on the qualifier "under normal circumstances." Without a solid definition of what constitutes an upset -- not in terms of equipment not even yet designed -- it is impossible to tell what portion of the operating time "normal circumstances" actually encompass.

4. DOE Must Perform a Safety System Analysis Before Preparation of the EIS

It apparently is DOE's intention to delay analysis of these emergency and upset issues until after the EIS process is complete. The DEIS indicates that these issues will be dealt with in a "safety analysis report" to be prepared "before operation is initiated." DEIS, pp. 1-18, 2-11. Such a delayed analysis, however, will not comport with the requirements of NEPA. Under NEPA, the decisionmaker must have an analysis of

all significant impacts before committing agency resources.

See, e.g., CEQ NEPA Regulations, 40 C.F.R. § 1506.1. There can be no doubt but that emergencies and upsets have the potential for producing significant impacts.

It is not surprising that DOE believes it would be advisable to delay preparation of a detailed safety analysis. Here, as elsewhere, effective analysis is frustrated by the attempt to base the DEIS on a conceptual plant design. Such safety analysis can be most useful when it occurs during plant design and, as discussed above, the design for the proposed plant is presently incomplete. As DOE and P&M complete the plant design, they should perform fault-free system analysis and failure-mode evaluation of the proposed project. These techniques will provide sufficient safety data for inclusion in the new or supplemental EIS for the plant. The National Institute for Occupational Safety and Health has recommended the use of these techniques in the design of coal gasification plants. Their recommendations apply with equal force to the SRC-II process. NIOSH explains that

Most health and safety hazards will arise during maintenance work or because of a failure in any one of a large number of pieces of equipment or process lines. Therefore, to reduce the potential for exposure, all possible failure modes during normal operation during maintenance must be anticipated, examined, rated for risk factors (frequency and severity), and controlled to the greatest extent possible.

One way of approaching this formidable task is fault-tree system analysis and failure-mode evaluation. The requirement of a system safety analysis imposes a disciplined and inclusive approach to safety and health considerations. The analysis should include, but not be limited to, procedures for operational start-up, normal onstream operation, shutdown, and emergencies. This technique should be used before and during plant construction, throughout the life of the plant, and whenever changes in the process are contemplated. Fault-tree analysis has been used in coal gasification pilot plants and is currently used by the world's oldest and largest plant to provide advice to engineers working on the design and construction of new facilities.

System safety analyses afford the opportunity for all responsible departments--including process engineering, mechanical engineering, safety engineering, maintenance, operations, and plant management--to become involved in decisions that will affect employee protection. (References omitted.)

National Institute for Occupational Safety and Health, Criteria for a Recommended Standard . . . Occupational Exposures in Coal Gasification Plants, September 1978, p. 59.

5. The Analysis of Potential Train Spills Is Misleading

The train accident analysis computing the likelihood that a spill will occur in the rail transport of the SRC-II product is misleading. The computation (p. 4-6) is based on a figure representing the number of accidents per million train miles on a national scale. This figure does not represent the likelihood of spills on the two transport routes being considered; hence, it ignores the effects of traffic congestion, population density and its associated intersecting with train routes, the type of car being used, and other factors which may influence accident rates along these routes. The accident data should be specific to the Northern and Southern transport rail lines.

Second, the data is based on a figure of 232 chemical spills per 1035 accidents (p. 4-6). The DEIS gives no indication of the type of accidents considered. The critical question is how many of the accidents considered involved trains including substantial numbers of chemical cars. Will the SRC-II product be transported in unit trains? If so, how does that affect the probability of an accident resulting in a major spill?

Finally, the DEIS dismisses the potential dangers of a major accident and spill with the observation that

the acute hazards to the public and to the environment associated with the transportation and storage of SRC distillate products are considered to be no greater than those presented by many other materials now in commerce.

DEIS, p. 4-7. Whether or not that observation is true, it cannot substitute for analysis of the potential impacts of and mitigation measures for the material this proposed federal action will cause to enter the stream of commerce.

F. The DEIS's Treatment of Fish and Wildlife Resources Is Inadequate

Unfortunately, the Department of Energy failed to consult with the U.S. Fish and Wildlife Service before completing the DEIS, as required by the Fish and Wildlife Coordination Act.^{59/} As a result of this lack of consultation, the DEIS's treatment of fish and wildlife resources is inadequate. As the Fish and Wildlife Service noted in its review of the DEIS:

The effects of air and water discharges from the proposed synfuel production plant on fish and wildlife and their habitats were not fully addressed in the draft statement. The impacts on fish and wildlife from project related streamflow diversions and solid wastes are not fully addressed. However, based on the information provided in the DEIS, the Department of Interior . . . is of the firm opinion that much additional environmental protective measures [sic] need to be incorporated into the final project (Demonstration and Commercial Projects).

FWS Memo, July 8, 1980, p. 7.

The deficiencies in the DEIS's treatment of fish and wildlife resources fall into two broad categories:

1. Inadequate analysis of impacts, and
2. Failure to address important mitigation measures.

1. Inadequate Analysis of Impacts

a. Site Analysis. In its comparison of alternative sites, the DEIS based conclusions on a number of questionable assumptions. First, in spite of repeated assertions that the

^{59/} United States Fish and Wildlife Service, July 8, 1980, Memorandum to Director of Environmental Project Review, from Area Manager, FWS Harrisburg, Pa., re Review of DEIS, SRC-II Demonstration Project (hereafter cited as "FWS Memo").

facility will occupy less than 300 acres (115 ha) (DEIS, p. 2-14), DOE refused to consider alternative sites with less than 1300 acres (525 ha) (DEIS, p. B-2). This figure appears arbitrary and precluded consideration of 11 of the 27 original sites.

Second, the site analysis process did not include fish and wildlife populations or habitats among the environmental parameters used to compare alternative sites. Resident or migrant fish and wildlife inventories should be variables in the consideration of alternatives, in order to substantiate the claim on page 2-23 that "alternative sites were evaluated to a degree of detail necessary to determine whether they offered potential for appreciably reduced impacts."

b. Effects at the Proposed Site. The DEIS has not adequately examined the impacts of construction and operation at the proposed site. A basic flaw which prevents this analysis is the lack of a specific site plan and design. A lack of a detailed site construction plan (DEIS, p. 4-14), of the siting of hazardous waste containment (*Ibid.*, p. xxvii), and of product storage facilities (*Ibid.*, p. 2-20) prevent an analysis of the quantity or quality of site disturbance of fish and wildlife resources.

Impacts of Water Consumption. The impacts of consumptive water use are underestimated. First, the DEIS claims that the increased productive capacity of the commercial phase will not have a proportionate impact on water consumption. DEIS, p. xxii. This statement is unsubstantiated and should be clarified.

The impacts on fish and wildlife are directly dependent on the quantity of water withdrawn from the river. The DEIS's claim that "consumptive water use is not expected to have a significant impact on the river's biological resources" (DEIS, p. xx), is unsupported and contradicted by other data in the EIS. In making this claim the DOE has ignored project-caused impingement and/or entrainment of larval and adult fin fishes and the associated destruction of phytoplankton. See DEIS, p. 4-31. It has ignored the reduction in the dilutive capacity of the river and the effect of the increased concentration of pollutants from other sources on the river habitat. It has based part of its conclusion that no significant impacts will occur on the construction of the proposed Stonewall Jackson Reservoir. This Dam is currently involved in a court suit and construction may be altered or prevented. In any event, the increase in water flow from this source has been planned for recreational and other uses and will not be available for use by this project.

The approach velocity at the intake structure is not identified in the DEIS. See DEIS, p. 4-31. Even if little adverse impact occurs as a result of consumption, an approach velocity as high as an intake velocity of 10 f/s could have severe effects on entrainment and impingement rates. The Fish and Wildlife Service recommends an approach velocity of .5 feet per second with adequate fish screening facilities and other protective devices. See FWS Memo, p. 5.

Floodplains and Wetlands. The effects of the project on floodplains and wetlands are insufficiently presented. On page 4-72, the DEIS states that those wetlands along the river are not valuable ecological resources. This is a ludicrous comment. The value of wetlands to wildlife is clearly demonstrated by the data showing that the wetlands in this area support greater diversity of species than other areas. DEIS, p. D-3; see also, FWS Memo, p. 5. Furthermore, the importance of floodplains and wetlands are well documented in Executive Orders 11988 and 11990.

The procedural requirements of Order 11988 are elucidated in guidelines of the Water Resources Council (43 F.R. 6030, February 10, 1978) and require federal agencies to:

1. Determine if the proposed action is in a base floodplain;
2. Provide early public review;
3. Identify and evaluate practicable alternatives to locating in the base floodplain;
4. Identify impacts of the proposed action (specifically address impacts on water resources including the natural storage and groundwater recharge functions of the floodplain);
5. Identify measures to minimize harm and restore and preserve natural floodplain values, including the control of wetland drainage, channelization, and water withdrawal;
6. Reevaluate alternatives to determine if the floodplain site is the only practicable alternative;
7. Issue findings and a public explanation, and provide a brief comment period prior to agency action; and
8. Implement the action, while insuring that the action is carried out in compliance with the order.

In addition, the CEQ regulations at 10 C.F.R. 1502.25(a) state:

(a) To the fullest extent possible, agencies shall prepare draft environmental impact statements concurrently with and integrated with environmental impact analyses and related surveys and studies required by the Fish and Wildlife Coordination Act (16 U.S.C. Sec. 661 et seq.), the National Historic Preservation Act of 1966 (16 U.S.C. Sec. 470 et seq.), the Endangered Species Act of 1973 (16 U.S.C. Sec. 1531 et seq.) and other environmental review laws and executive orders.

DOE has not complied with this requirement. It has not conducted the requisite Fish and Wildlife surveys. Nor has it prepared the floodplain/wetland assessment. These studies must be completed and integrated into the new draft or supplemental EIS.

The DEIS states that wetland impacts cannot be assessed because their abundance near the site is unknown. DEIS, p. 4-16. The abundance or relative number of wetlands does not affect the significance of any single wetland as this statement implies. This statement does indicate, however, that DOE has much to do in nature of a site analysis.

Furthermore, the DOE plans to fill the floodplain (p. 4-72) to 20 feet above the 500 year flood stage in order to provide coal storage. Is this the most reasonable alternative consistent with the Executive Order on Floodplain Development? On page 4-75, the DEIS considers three alternatives to the location of this storage facility -- (1) location near the process area; (2) pipeline ; and (3) location uphill from the plant with a pipeline down to the operation area. These should be further

developed and the environmental impacts of these considered. The Hittman Report recommends the third location above the plant as a preferable alternative to floodplain fill (Hittman Report, p. 23).

Grasslands. On page 4-17, the DEIS states that shrub and tree grasslands are not high quality habitats. This statement is incorrect; grasslands provide habitat for a wide diversity of wildlife and the DEIS should present information on grasslands after consulting with a fish and wildlife expert on the area.

Impacts on Erosion and Sedimentation. The DEIS calculated soil loss to the area using the Universal Soil Loss Equation. DEIS, p. 4-12. Use of this method is not particularly appropriate as it was not modelled from data on construction sites. The Universal Soil Loss Equation is designed for predicting agricultural soil losses during a single storm event and on a specific site. It cannot be used for averaging soil losses, either temporally or spatially, as was done in the DEIS. This is due to the extreme variations in vegetation, soil physics, and slope, unique to each site. The soil losses presented, therefore, cannot be accepted.

The DEIS has overlooked the extent to which haul roads contribute to sedimentation and erosion rates. DEIS, p. 4-12 and 4-13. Studies conducted on surface mines in West Virginia

have repeatedly demonstrated that haul roads produce significantly greater amounts of sediment and runoff than do the associated disturbed areas. The DOE must consider this factor in analysis of the impacts of these roads.

2. Mitigation Measures

Characteristic of most of the DEIS, the list of measures for mitigating fish and wildlife impacts is insufficient. Here as elsewhere the major obstacle is the lack of an adequate design. The following are some of the specific measures which should be addressed.

The DEIS does not discuss adequate measures to mitigate floodplain and wetland, or fish and wildlife impacts. The housekeeping practices and erosion control techniques (DEIS, pp. 4-30 and 4-31) will not compensate for the loss of these resources. Nor is the Stonewall Jackson Reservoir an acceptable mitigation measure for entrainment and impingement losses; the DEIS cites this as the sole measure on page 4-32. In fact, a reservoir will not mitigate entrainment losses; if anything, it would cause a decrease in water quality due to sedimentation and siltation.

Methods are available to offset these negative impacts. DOE should consider wetland creation measures, fishery development, and wildlife habitat improvement. The DEIS should include measures to compensate for the loss of on-site ponds which will occur with construction (DEIS, p. 4-30).

It should include information on location of mitigating areas and their management and utilization plans. Alternatives to floodplain fill (DEIS, p. 4-75) should be developed as mitigative methods. Entrainment and impingement losses may be reduced by various techniques including reduction of the approach velocity to the plant. Potential danger to the Monongahela's aquatic life may be reduced by redesigning and modifying intake and other plant specifications.

G. The Discussion of Socioeconomic Impacts and Mitigation Measures is Woefully Inadequate

It is well established that NEPA requires agencies to analyze the socioeconomic impacts of proposed actions in an EIS. The CEQ NEPA regulations require that an EIS must discuss "ecological . . . , aesthetic, historic, cultural, economic, social or health" effects, including indirect effects such as "growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate." 40 C.F.R. § 1508.8 (emphasis added).^{60/}

Unfortunately, the DEIS contains virtually no discussion of socioeconomic impacts or methods for mitigating those impacts. What little discussion can be found in the document is incomplete or inaccurate. Specifically, there are three major flaws with the EIS's treatment of socioeconomic impacts:

1. The DEIS's population estimates are highly questionable.
2. The DEIS contains no discussion of the classic "boom town" effects that are known to accompany energy development projects.
3. The DEIS contains no serious discussion of the many possible approaches for mitigating "boom town" and other socioeconomic impacts.

^{60/} A long line of court cases holds that EISs must consider socioeconomic impacts. For example, see Hanley v. Mitchell, 460 F.2d 640, 647 (2d Cir. 1972), certiorari denied 409 U.S. 990 (1972); Chelsea Neighborhood Ass'n v. U.S. Postal Service, 516 F.2d 378, 388 (2d Cir. 1975); Prince George's County, Maryland v. Holloway, 404 F.Supp. 1181 (D.D.C. 1975); McDowell v. Schlesinger, 404 F.Supp. 221 (W.D.Mo. 1975).

1. The Population Estimates are Highly Questionable

A sound analysis of socioeconomic impacts likely to be induced by an energy facility must begin with an accurate projection of the population increases likely to result from construction and operation of that facility. The DEIS estimates that construction of the demonstration project will increase the population by 1620 people. Although it is not entirely clear from the text of the DEIS, it appears that this figure was arrived at by multiplying the total number of workers expected to be needed to build the plant by 25% -- the percentage of workers who are expected to have to move into the area. In turn, this number was apparently multiplied by two in order to account for what the DEIS terms "dependents, administrative personnel, and part of the increased secondary employment induced by the project economic activity." DEIS, p. 4-40.

The DEIS does not appear to offer a projection of the total increase in population likely to be induced by construction of the full-size commercial plant. At one point, the DEIS states that 2,000 workers might have to move into the area and, "based on current family size, this would imply a population increase of 3,850." DEIS, p. 4-46. However, the figure of 3,850 does not appear to include any secondary employment induced by the project economic activity. At another point, the DEIS indicates that construction of the commercial plant would create 500 secondary jobs while plant operation would create approximately 465 secondary jobs, 90% of which are, according to the DEIS, expected to be filled by people living in the area. DEIS,

p. 2-20. There is no indication given of how these figures relate to the population projection of 3,850.

In any event, DOE does not offer any data to justify the assumptions used in making the population projections. This is an important point, since the assumptions apparently used vary significantly from those employed by other recent DOE studies.

First, the DEIS assumes that 75% of the construction workers for the demonstration plant and about 60% of the workers for the commercial plant can be hired from the local work force. It is hard to imagine where all those skilled workers will come from. According to one EIS, Monongahela County has a labor force of only 21,900 with a male unemployment rate of only 2.7%. Energy Research and Development Administration, Final Environmental Impact Statement, Alternative Fuels Demonstration Program, ERDA-1547, September 1977 (hereafter cited as "Alternative Fuels EIS"), p. III-32. This means that there are only about 600 available workers in the county -- a far cry from the 2377 people that the DEIS assumes will be available to build the demonstration plant.

Even were there thousands of available workers in the county, it appears highly unlikely that they would all have the skills required by this high-technology plant. DOE's major recent study of the environmental impacts of synthetic fuels concluded (Department of Energy, Synthetic Fuels and the Environment: An Environmental and Regulatory Analysis, DOE/EV-0087, June 1980 (hereafter cited as "DOE Synthetic Fuels Study") pp. 5-149 to 5-150):

Smaller, unindustrialized areas have far different labor forces than are required for industrial plant construction and operation in terms of types of skills. . . . The rapid demand for hundreds of workers with highly specialized skills requiring extensive training cannot be met by rapidly retraining workers.

The study further found that preliminary data on a recent power plant construction project indicates that only 2 to 3 percent of the total construction work force was derived from the local population. Ibid., p. 5-149. In light of these recent findings, it is incumbent upon DOE to present a detailed explanation of the basis upon which it concluded that 75% of the demonstration plant work force could be derived locally.

The second major flaw in the DEIS population increase projections is in the "multiplier" used to account for the secondary population increases likely to be induced by project economic activity, including families joining workers, the need for increased public services, and expanded wholesale and retail industry plus new growth in construction of housing, roads, sewers, etc. The DEIS apparently uses a multiplier of less than two. See DEIS, pp. 4-40, 2-20, 4-46. This figure is in sharp contrast to those used in DOE's recent study of the environmental impacts of synthetic fuel production. That study concluded that multipliers can vary from "over 4.5 to 7." DOE Synthetic Fuels Study, p. 5-146. The use of a low multiplier in the DEIS results in a significant underestimation of the population increase likely to result from the project.

2. The DEIS Contains No Discussion of "Boom Town" Effects

It is well established that rapid increases in population induced by construction of energy projects tend to produce significant social and economic dislocations. The dislocations are generally known as "boom town" effects. Surprisingly, the DEIS contains no discussion of the boom town effects.^{61/}

The boom town effects that may result from the SRC-II project, but which are not discussed in the DEIS, include:

- front-end financing problems, resulting from limitations in local capacity to finance needed public facilities and services;
- fiscal uncertainties, for local government, resulting from the uncertainty of the synthetic fuel plant maintaining stable production (and employment, and revenue production) throughout the normal 25 year operational phase;
- fiscal disparities, among local jurisdictions, resulting from the location of revenue-producing capital investment in one local taxing district, and the location of community development and public service needs in another;
- social problems, resulting from rapid influx of people different from the existing population in age, race, ethnicity, occupation and income; and having a different sense of identification with and commitment to the impacted community; and from rapid changes in living patterns for existing residents, as a result of energy development. Possible social problems include increases

^{61/} This failure of the DEIS is especially surprising in light of the fact that virtually all of the Government's major studies of synthetic fuels highlight the boom town impact problem. For example, see ERDA, Coal Research, Development and Demonstration Program, 1977, at V-13, List of Effects of Rapid Community Growth, a comprehensive description of effects based on experiences of towns in the Rocky Mountain states; Environmentally Based Siting Assessment for Synthetic Fuels Facilities, December 1979, Draft Final Report; DOE has characterized major socioeconomic impacts, "boom town" impacts, and "conflict" impacts at M-3 and M-4, App. M. At M-5 and M-6, the DOE outlines time and financial effects of rapid growth problems on expenditures for project development; FEIS, Synthetic Fuels and the Environment: An Environmental and Regulatory Impacts Analysis, June 1980. In this study the DOE has described differential impacts depending on the capacity of a region to absorb growth and characteristics of a region affecting capacity.

in violent and property crime; increases in drunkenness, drug abuse, prostitution, and other victimless crimes; lack of employment opportunities or other socially acceptable roles for participating in and contributing to community life; lack of a sense of community among persons who view each other (and perhaps also themselves) as transients; lack of a full array of recreational, educational, social service, and cultural opportunities for personal enrichment; resentments of immigrants by existing residents who find no benefits for themselves in rapid and disruptive community change; divisive political struggles for control of local government; feelings of loss of community control;

- inefficient regional settlement patterns, resulting from inadequate consideration of the effects of large-scale energy development programs on regional settlement patterns, and from inadequate consideration of these effects in energy development siting and timing decisions;
- local community development problems, resulting from an inadequate set of fiscal and regulatory tools for responding to community development pressures at the local level;
- resource depletion or community contraction problems, resulting from the phase-out or shut-down of the synthetic fuels plant once local energy resources are exhausted;
- community development management problems, resulting from imperfect adaptation of existing local, state, and Federal government structures for effective response to the special problems posed by large-scale energy resource development.

See Alternative Fuels EIS, pp. VIII-27 to VIII-39.

3. The DEIS Contains Virtually No Discussion of Approaches for Mitigating the Likely Socioeconomic Impacts

Finally, the DEIS's discussion of socioeconomic impacts is inadequate because it fails to include virtually any discussion of approaches for mitigating the likely serious boom town and other socioeconomic impacts. In what must appear to be a cruel joke to those who will be asked to bear the burdens of the proposed plant, the DEIS limits its discussion of socioeconomic

mitigation to the following two items (DEIS, p. 4-67):

- o Access to the Fort Martin church and the associated cemetery will be maintained and access to the private cemetery will be provided as appropriate.
- o The Fort Martin community center will not be disturbed by construction and current plans do not call for acquisition of this property.^{62/}

The absence of an analysis of possible mitigation measures is particularly distressing in light of the enormous potential that exists for reducing socioeconomic impacts. In a recent analysis of the environmental problem associated with siting synthetic fuels plants, a DOE contractor concluded (Synthetic Fuels Siting Study, p. M-6):

It is conceptually possible to avoid or ameliorate virtually any rapid growth impact. All of these problems relate to information, timing, expertise, and money. New relationships and/or institutions can be established, or old ones altered, to provide information and training, to assist in scheduling new investment, and to provide financial assistance.

The DEIS provides no indication of the information, training or financial assistance options available to the company, federal government, or local community. There are dozens of possible approaches for mitigating the socioeconomic impacts of the SRC-II plant. The following are a sample of just a few of the types of mitigation measures that should have been discussed in the DEIS:

^{62/} That the authors of the DEIS would choose these two mitigation measures is especially puzzling in light of their conclusion that Fort Martin "will probably cease to exist as a definable community." DEIS, p. xx.

- Since the demonstration plant will be jointly owned by the federal government, the project will not be obligated to pay property or other taxes. The government and company could voluntarily agree to make payments to local and state government in an amount equal to the taxes the project would have paid had it been entirely owned by a private company.
- A special trust or other fund could be established to assist in funding the impacts associated with community development. The fund could be lodged in a state agency or in a non-profit corporation or community development agency empowered to issue tax-free revenue bonds. See Alternative Fuels EIS, p. VIII-28.
- Action could be taken to lift legal controls on the ability of local government to raise funds for community development.
- The industrial participant in the project could fund needed community development and services either directly or indirectly through any of a number of measures such as purchase of a local bond issue or debt service payments.
- The federal government could assist in the planning and front-end financing of community development needs. This assistance could take the form of a special loan fund, financing guarantees or grants.

There are, of course, numerous other mitigation strategies that could and should have been discussed in the DEIS. Some of those are outlined in DOE's final EIS on the Alternative Fuels Demonstration Program, pp. VIII-27 to VIII-39. Others are outlined in Environmentally Based Siting Assessment for Synthetic Fuels Facilities, December 1979, Draft Final Report at Appendix M; Coal Research, Development and Demonstration Program, Draft Final Environmental Impact Statement, September 1977, ERDA, pp. VII-24 to VII-26; and Environmental Analysis of Synthetic Liquid Fuels, DOE, July 12, 1979, at pp. 66-68.

H. Other Deficiencies

1. Monitoring

The DEIS repeatedly asserts that questions will be answered and problems resolved during the course of the operation of the plant. The DEIS fails, however, to present any detailed information on the monitoring scheme that will produce the necessary data. Instead the monitoring section is full of references to plans that will be developed (see, e.g., § 4.5.3.2) and approaches that may be followed (see, e.g., § 4.5.4). General assurances provide no basis for review or for confidence in the effectiveness of the monitoring program.

Indeed where specifics are presented they are discouraging. The Hittman Report points out, for example, that the proposal to monitor only selected equipment is inadequate.

It is recommended that all environmental equipment be monitored, rather than selected equipment. It is also recommended that all important pollutants be analyzed. Often one may decrease while a second, perhaps unmonitored one may increase.

Hittman Report, pp. 33-34.

2. Other Reviewers

Both the Hittman Report and the Comments prepared by Black and Veatch (Comments Regarding Draft Environmental Impact Statement Solvent Refined Coal-II Demonstration Project, Fort Martin, West Virginia) suggest numerous deficiencies in the DEIS not mentioned in these comments. They are significant and DOE should respond to them.

I. The Comment Period Was Too Short

The DEIS was issued June 2, 1980. The comment period was initially scheduled to end on July 14, 1980. 45 Fed. Reg. 37277 (June 2, 1980). The comment period was subsequently extended to July 21. 45 Fed. Reg. 40217 (June 13, 1980). Later, in response to a request by the National Wildlife Federation for a sixty-day extension, due in part to DOE's failure to make documents available, the comment period was extended for nine days. 45 Fed. Reg. 47909 (July 17, 1980). The time allowed was too short. DOE prepared a long and shockingly inadequate document, and then allowed little time for review.

DOE and the public would be better served if DOE allowed reviewers sufficient time to explicitly and fully address the flaws in the work it has done and suggest the necessary work it has not even attempted to do. To do so requires research and thoughtful analysis, which in turn takes time, but would help DOE improve its own work in the future.

Conclusion

This DEIS on the proposed SRC-II project is a seriously flawed document. Its discussion of environmental impacts is incomplete or inaccurate and it fails to consider numerous alternatives for reducing or eliminating the environmental harm likely to be produced by the SRC-II plant. No decision-maker could possibly assess the environmental costs and benefits of the proposed plant based on this document.

Perhaps more serious, however, is the problem of which this EIS is a symptom. The DEIS is strong evidence of the lack of a sound environmental management program for synthetic fuels within the Department of Energy. Given the Nation's growing commitment to synthetic fuels, it is imperative that such a sound management program be developed. The Department should begin development of that program by writing a programmatic EIS and issuing a new or supplemental draft EIS on the SRC-II plant.

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ORPED-0

27 February 1975

Mr. V. R. Butler
Chief, Division of Dams and Encroachments
Department of Environmental Resources
P. O. Box 2063
Harrisburg, PA 17120

Application of Western Pennsylvania
Water Company for an increase in
Allocation for Monongahela River
Withdrawals

Dear Mr. Butler:

Consideration of the subject application was initiated by your letter dated 28 September 1973 announcing receipt of the application and requesting comments. Our response, which cited encroachment on the authorized purposes of the Tygart and Youghiogheny projects, was dated 16 October 1973.

Your letter of 13 November 1974, which transmitted for our further examination the company's 15 August 1973 application report and their more recent supplement dated 25 September 1974, is appreciated. These reports have been reviewed, and the comments which follow reflect consideration of their content.

For convenience of reference the requested 32 mgd increase in allocations are summarized, from data furnished, as follows:

Plant	Current Allocation (mgd)	Requested Increase (mgd)	Requested Allocation (mgd)
Becks Run (60 mgd*)	58	2	60
Elrama (Aldrich) (40 mgd*)	50	30	80**
TOTALS	108	32	140

* (Maximum reliable production)

** Plant designed for expansion to 80, then 120 mgd.

We have completed a 40 year daily simulation study of Tygart Dam operations for the years 1929 to 1969. Included in this period are two severe prolonged drought periods. The most recent occurred during the

Very truly yours,

W. F. Byrne
WILLIAM F. BYRNE

WFB:cef

Enclosures

A-108

ORPED-0

Mr. V. R. Butler, Jr.

27 February 1975

Fall of 1953. For the two consecutive months of October and November 1953, only 38 mgd of water was contributed by local flow between Tygart Dam and Elrama, as indicated by measurements taken during that two-month period. The 12 mgd difference between this amount and the present 50 mgd allocation is a reasonable assessment of the concurrent contribution of the inflow to Tygart from the upper basin area. It is clear, therefore, that any additional water would have to come from Tygart storage. Since the only authorized storage is for flood control and low flow augmentation, any additional withdrawals for water supply would, during periods of low flow, encroach upon the Tygart Reservoir release schedule for maintaining adequate flows. Such releases can not be increased to compensate for downstream withdrawals. I must then reassert, as stated in our earlier letter, that since such encroachment would materially affect and interfere with the authorized project purposes, we would be obliged to object to the approval of the requested increase.

It is recognized that after retirement of the Monongahela City Station (4.0 mgd) and the Elizabeth Station (5.5 mgd), the effective increase at Elrama would be 20.5 instead of 30 mgd. Similarly, after retirement of the Buena Vista Station (1.0 mgd) the Reeks Run increase would be 1.0 instead of 2.0 mgd. The total requested apparent net increase would then be 21.5 instead of 32 mgd. Encroachments of the reduced amounts remain of a magnitude considered significant in respect to their effect on project release schedules and authorized purposes.

A more severe drought occurred during the fall of 1930. In September 1930, the local flow between Tygart Dam and Elrama was only 12 mgd. With the flow at Tygart Dam being 2.6 mgd, the natural flow at Elrama averaged 14.6 mgd during the month of September 1930. The month of October 1930 is the driest of record and is estimated to be the driest during this century in the Monongahela River basin. An average flow of only 6.6 mgd was computed for the Elrama site during that month.

It is noted that only 33 percent of the treated water is to be returned to the Monongahela River, at Mile 7.1, Homestead, which is 18 miles downstream from the point of withdrawal. Apparently, the remaining 67 percent of water withdrawn would not be returned to the Monongahela River at all.

Your reference to the report dated 15 August 1973 concerning the adequacy of the Monongahela River flows for water supply is noted. We also do not agree with the statement that the Monongahela River will be adequate to meet public water supply needs for the indefinite future. We feel that any increase in water allocation from the Monongahela River, now or in the future, should make provisions for storage.

ORPED-0

Mr. V. R. Butler

27 February 1975

Although the Water Supply Act of 1958 established that non-Federal interests have the primary responsibility for the development of needed municipal and industrial water supplies, it also provided that the Federal Government should cooperate with local interests in developing such supplies in conjunction with other Federal projects. Accordingly, during our recent studies of the Monongahela River Basin, multiple-purpose reservoirs, which could have included water supply storage, were initially considered for development. After a more detailed examination, however, it was determined that reservoir projects could not be justified economically. At this time, therefore, the provision of any needed additional water supply facilities remain the exclusive responsibility of local interests.

The opportunity to re-examine the application request in light of the application report details is appreciated.

Sincerely,


MAX R. JANARO, JR.
Colonel, Corps of Engineers
District Engineer



DEPARTMENT OF THE ARMY
PITTSBURGH DISTRICT, CORPS OF ENGINEERS
FEDERAL BUILDING, 1000 LIBERTY AVENUE
PITTSBURGH, PENNSYLVANIA 15222

ORPFD-O -

16 October 1973

Mr. V. R. Butler
Chief, Division of Dams and Encroachments
Bureau of Water Quality Management
Department of Environmental Resources
Commonwealth of Pennsylvania
P. O. Box 2063
Harrisburg, Pennsylvania 17120

Your File No. 0273701, WA200
Monongahela River Withdrawal,
Western Pennsylvania Water Company

Dear Mr. Butler:

This is in reply to your letter of 28 September 1973 requesting our comments on the proposed withdrawal of 140 million gallons per day from the Monongahela River for water supply by the Western Pennsylvania Water Company.

As you know, the Monongahela River is regulated to a great degree by Tygart and Youghiogheny Reservoirs, especially during periods of low flow. Since Tygart Reservoir began operations, the lowest flow recorded at the Charleroi stream gaging station (about 16 miles upstream of the Elrama plant) was 269 c.f.s. on 20 November 1953. At this same time, a flow of 340 c.f.s. was being released from Tygart Dam. There is a deficit of 71 c.f.s. between the two points. This could not be explained at the time, but it seems that a considerable consumptive diversion or a tremendous amount of evaporation took place. The Elrama plant is located downstream of the Charleroi stream gage but the plant is still above the mouth of the Youghiogheny River where additional flow is contributed to the Monongahela River, principally from Youghiogheny Dam. On 20 November 1953, the flow from Youghiogheny Dam was 329 c.f.s. The total flow at Braddock, six miles above the Beck Run plant was 720 c.f.s. The combined flow from Tygart and Youghiogheny Dams was 669 c.f.s. or 93 percent of the flow at Braddock. The contribution of natural stream runoff below the two dams was only 51 c.f.s.

Tygart Lake and Youghiogheny River Lake are being operated to fulfill their Congressionally authorized purposes of flood control and low flow augmentation. Withdrawal of additional water during periods of low flow would encroach upon the Tygart and Youghiogheny reservoir release

UNPFD-O
Mr. V. R. Butler

16 October 1973

schedule, provided for maintaining adequate flows in dry periods. Such releases cannot be increased to compensate for downstream withdrawals. On the basis that such encroachment would materially affect and interfere with an authorized project purpose, we would be obliged to object to approval of the Western Pennsylvania Water Company request for a 30 percent increase in withdrawal from their present 108 mgd (167 c.f.s.) to 140 mgd (216 c.f.s.).

The Corps of Engineers considers water supply to be the primary responsibility of the municipalities and other non-Federal entities. However, if the Corps is constructing a multiple-purpose reservoir, storage space for water supply may be recommended for inclusion if such storage space is economically justified, if it is determined to be the least costly alternative method of providing the water supply, and if a non-Federal entity reimburses the Federal Government for the cost of such storage. This office has been working on a study of the Monongahela River basin which considered multiple-purpose reservoir development that could conceivably include storage for water supply for downstream use. However, we have been unable to find any justified multiple-purpose reservoir sites. The primary reason for this is that flood damages in the basin are not of sufficient magnitude to justify flood control as a project purpose in any of the multiple-purpose reservoir sites investigated. Also, the Environmental Protection Agency will not endorse water quality storage for our authorized Rowlesburg Lake project or other potential multiple-purpose reservoirs in the Monongahela River basin. Without the inclusion of flood control storage and water quality storage, it is not possible to justify construction of multiple-purpose reservoirs in the basin. Because we have been unable to find economically feasible projects, we plan to wind down the Monongahela River Basin Study and terminate it in Fiscal Year 1975. Mr. V. M. Beard, Director, Bureau of Engineering, Office of Engineering and Construction, Department of Environmental Resources, has been advised of our intentions to terminate the study.

Sincerely,

H. G. Delbridge
H. G. DELBRIDGE
Colonel, Corps of Engineers
District Engineer

REPORT
UPON THE APPLICATION FOR
WATER ALLOCATION 0273601

Permit to be issued: To Western Pennsylvania Water Company to acquire and use for water supply purposes water rights in the amount of sixty million (60,000,000) gallons of water per day to be taken from the Monongahela River at the existing intake along the west bank of the river upstream from the mouth of Becks Run in Baldwin Township, Allegheny County, and fifty million (50,000,000) gallons of water per day to be taken from the Monongahela River at the existing intake along the left bank at Elrama, Washington County.

Application and plans filed.....August 21, 1973
Supplemental information filed.....October 9, 1974
Meeting with representatives of
Company, U. S. Army Corps of
Engineers, DER.....September 23, 1975
Source.....Monongahela River
Watershed area above Becks Run
Intake.....approx. 7400 sq. mile
Watershed area above Elrama Intake.....approx. 5500 sq. mile
Amount of water allocated at
Becks Run Intake by order of
Confirmation WA-200 and Permit
WA-200-A.....58.0 mgd
Amount of water allocated at Elrama Intake
by Permit WA-200-B.....50.0 mgd
Amount of water requested.....60 mgd (Becks Run)
.....60 mgd (Elrama)

Harrisburg, Pa. April 28, 1977

ABSTRACT:

The Western Pennsylvania Water Company is the successor of the South Pittsburgh Water Company, and is part of the American Waterworks system. The Company is applying for a permit in the new name, along with a request for an additional 32 mgd from the Monongahela River, 30 mgd at the Elrama intake, and 2 mgd at Becks Run Intake. The Company now serves approximately 40 municipalities in a 200 square mile area including part of the City of Pittsburgh and southern Allegheny and northern Washington Counties.

The Company projects an increase to 150,000 customers and a maximum daily demand of 144 mgd by the year 1985. (Table No. 1) The Division of Comprehensive Resources Programming, DER, has projected a similar increase but at a much slower rate (Table No. 2).

The Monongahela River has an extremely low natural safe yield, and many conflicting water demands. In fact studies made by the Corps of Engineers show that it would dry up if it wasn't for the releases made by the Corps from Tygart Dam and Reservoir in West Virginia. These releases are mandated for navigation by the U. S. Congress. Under current federal law the United States has the power to claim the entire natural and augmented flow of the Monongahela River to maintain navigation. The United States can, without compensation, cut off all withdrawals which remove flows necessary or dedicated to navigation.

The Department has contacted and held meetings with all agencies which are considered to have an interest in this allocation. With the exception of the Fish Commission, the other agencies expressed concern and reservations with the proposal, if not outright opposition. The strongest opposition comes from the Corps of Engineers.

Following a meeting between the applicant, Corps of Engineers, and DER on September 23, 1975, the application was discussed in-house at DER. It was decided that no action would be taken pending the completion of the State Water Plan for sub-basin 19, the Monongahela River. The sub-basin 19 report is now complete in preliminary form. The sub-basin 19 report restates the critical nature of water quantity and quality in the Monongahela River. It stresses the need for the Rowlesburg Reservoir project. However there is a great deal of doubt as to whether the Rowlesburg Reservoir will ever be built. Further, Mr. Cosentino of Southwestern Pennsylvania Regional Planning Commission urges refusal of the application as a means of stressing that the Monongahela River is a finite source and that alternative sources of supply should be explored.

It is recommended that Western Pennsylvania Water Company be granted a permit for the water formerly allocated to South Pittsburgh Water Company with a two million gallon a day increase at the Becks Run intake to bring the allocation in line with the capacity at the Hays Mine Station Treatment Plant. This point is downstream from the critical reach above the confluence with the Youghiogheny River.

However, it is also recommended that the request for an increased allocation of 30 million gallons per day at the Elrama intake be disapproved. The capacity of the E. H. Aldrich Treatment Plant (at Elrama) is presently 40 million gallons per day which is 10 million gallons a day less than the existing allocation. Expanding the plant capacity to the amount of the allocation would provide sufficient capacity to approximately 1990. The Monongahela River is not adequate to provide additional withdrawals at the Elrama site. The years between now and 1990 should be used to explore the alternatives and decide on the best option to meet Western Pennsylvania Water Company's needs.

A special condition will be included in the new permit requiring Western Pennsylvania Water Company to periodically report on their progress with exploring alternatives. The Commonwealth through DER and local authorities through WPRPC will assist the Company where possible.

HISTORY OF WATER SYSTEM:

The Western Pennsylvania Water Company is the successor of the South Pittsburgh Water Company.

The South Pittsburgh Water Company was incorporated in July 1904, for the purpose of supplying water to the public in the Borough of Bridgeville. Through the subsequent purchase of the properties and franchises of 28 water companies, by 1942, when the South Pittsburgh Water Company applied for an Order of Confirmation

In compliance with the Water Allocation Acts of April 8, 1937, P. L. 258, No. 64 and June 24, 1939, P. L. 842, No. 365, the chartered territory covered four wards and portions of five other wards of the City of Pittsburgh, 16 boroughs and 11 townships. On June 10, 1942, the Water and Power Resources Board issued South Pittsburgh an Order of Confirmation to take 26 mgd from the Monongahela River at a point along the west bank immediately upstream from the mouth of Becks Run in Baldwin Township, Allegheny County.

In 1940, the Company served 263,000 people and had a maximum daily use of 24.7 mgd. By 1950, the number of people served had increased to 286,000 and the maximum daily use to 35.9 mgd. In June 1952, the Company applied for an additional 32 mgd at the existing taking point upstream from Becks Run. On August 13, 1952, a permit was issued for an additional taking of 32 mgd at the existing taking point.

In November 1958, the Company applied for a new allocation at a new taking point at Elrama, Washington County. By 1957, the population served had increased to 406,000 people. The existing plant near Becks Run was no longer able to satisfy peak demand from the Company's customers. The Company proposed a new site for an intake and treatment plant because the existing treatment plant (known as Hays Mine Station) was situated in a developed area where no space was available for expansion, and because the area of growth in water demand (southern portion of Allegheny County and part of Washington County) was located a considerable distance away from the existing plant. The Company projected that daily water use would increase to 72 mgd by 1971, with a maximum day use of 108 mgd (150% of the average). On this basis the Company requested a 50 mgd allocation at the new plant. A permit dated January 16, 1959, was obtained from the U. S. Army Corps of Engineers to dredge and construct an intake structure at the Elrama location, approximately 21 miles upstream from the existing intake near Becks Run, and one mile upstream of

the Monongahela River Navigation Dam No. 1. An encroachment permit (No. 13108) was issued by the Water and Power Resources Board on December 16, 1958, for the proposed intake. The Water Allocation Permit (WA-200-B) was issued on August 13, 1952, for 50 mgd from the Monongahela River at Elrama. The new treatment plant was constructed with a capacity of 40 mgd. The Company had obtained additional land at the Elrama site for future expansion of the water system. The present request is for an additional allocation of 30 mgd so that the capacity of the water treatment plant can be expanded to 80 mgd. The Company had planned on being able to expand the capacity of the plant and system further at a later date (1983 was mentioned in the application, although present indications are that demand is not expanding as fast as anticipated).

The Company name has been changed from the South Pittsburgh Water Company to the Western Pennsylvania Water Company. The Company has been operated as part of the American Waterworks system since at least 1942. The Company is applying for a permit in the new name, along with the request for an additional 32 mgd from the Monongahela River (30 mgd additional at Elrama, and 2 mgd additional at Becks Run).

OPERATION OF WATER SYSTEM:

The Western Pennsylvania Water Company now serves approximately 40 municipalities in a 200 square mile area, including a portion of the City of Pittsburgh, suburban communities south, east, and west of Pittsburgh in Allegheny County and a portion of Washington County. The population served is approximately 500,000.

Western Pennsylvania Water Company sources consist of two water treatment plants and intakes on the Monongahela River. The downstream facility consists of an intake upstream from the mouth of Becks Run and a treatment plant approximately two miles southwest along Becks Run Road known as the Hays Mine Station. The treatment plant has a capacity of 60 mgd, but is old and there is no room for

expansion. The Company has indicated no plans to phase out the Hays Mine Treatment plant in the immediate future, but the possibility exists of it being phased out in the longer range. South Pittsburgh Water Company was granted allocations for 58 mgd at the Becks Run intake, the amount granted under two water allocation permits (for 16 mgd by Permit WA-200 issued on June 10, 1942, and an additional 32 mgd by Permit WA-200A issued on August 13, 1952). As the Company name has been changed to Western Pennsylvania Water Company, and the plant capacity is 60 mgd, the applicant wishes to obtain a new permit for 60 mgd at the Becks Run intake.

The upstream facility consists of an intake and a water treatment plant at Elrama, Washington County. The Elrama treatment plant (known as the E. H. Aldrich Station) is located across the Penn Central Sire Oaks railroad yard from the intake on the Monongahela River. The South Pittsburgh Water Company was granted a water allocation permit for 50 mgd at Elrama (Permit No. WA-200-B issued on February 11, 1959). The present capacity of the water treatment plant is 40 mgd. However, one of the reasons for locating the treatment plant at Elrama was that there is room at the site for expansion. The Company wishes to increase the treatment capacity of the water plant from 40 mgd to 80 mgd. The Company has applied for an additional 30 mgd for a total increase of 32 mgd (and a total allocation of 140 mgd, 60 mgd at Becks Run and 80 mgd at Elrama).

The Company has taken over the service area of two small water supply agencies in the vicinity of the E. H. Aldrich treatment plant. These systems serve Elizabeth Township and the Borough of Elizabeth in Allegheny County. This area was previously served by the Monongahela Valley Water Company and Elizabeth Township Authority. The Monongahela Valley Water Company has a water allocation permit (No. WA-154-A) issued on March 9, 1955 for 5.5 mgd from the Monongahela River in Elizabeth Borough, Allegheny County. The Elizabeth Township Authority has a permit (No. 316A

issued on February 11, 1969) for 2.0 mgd from the Youghiogheny River at the north end of Buena Vista in Elizabeth Township, Allegheny County. The Company stated that they understood the Elizabeth Township Authority allocation to be 1.0 mgd from the Youghiogheny, and used the 1.0 mgd figure in their calculations. However, the correct figure is 2.0 mgd, and 2.0 mgd will be used throughout this report. The treatment plants at Elizabeth and Buena Vista will be retired and the allocation permit given up.

The Company also plans to take over the service area of the Monongahela City Water Company which supplies the area south of the E. H. Aldrich treatment plant. The Monongahela City Water Company has a water allocation permit (No. 109-A, issued on September 10, 1966) for 4.0 mgd from the Monongahela River on the left bank at the foot of Factory Street in Monongahela City, Washington County. The Company anticipates that this permit will be given up sometime in the future.

The Company makes the point that while the Company is asking for a 32 mgd increase, they would be giving up allocations of 5.5 mgd, 2.0 mgd, and 4.0 mgd for a total of 11.5 mgd, or a net increase of 20.5 mgd. However, it should be noted that as the treatment plant at Elrama only has a capacity of 40 mgd while the existing allocation is for 50 mgd, a 50 mgd increase in the treatment plant capacity would have the effective result of increasing withdrawals 40 mgd, or 30.5 mgd if the three allocations for Monongahela Valley, Elizabeth Township and Monongahela City are given up.

NEED FOR INCREASED ALLOCATION:

The water demand has shown considerable growth in both customers and demand over the last 30 years. The following table has been prepared from the Company's analysis of August 15, 1973, and an analysis of previous data submitted by South Pittsburgh Water Company.

Table No. 1. Historic & Projected Water Use

Year	Number of Customers	Average Daily Consumption (mgd)	Maximum Day Consumption (mgd)
1940	48,000	16.5	24.7
1945	54,500	26.0	31.4
1950	67,000	29.0	35.9
1955	91,700	42.3	62.2
1960	108,200	48.6	64.0
1965	115,800	53.9	82.7
1966	117,100	57.5	87.6
1967	118,500	57.3	88.0
1968	121,000	60.5	92.5
1969	126,700	62.7	89.2
1970	127,400	65.5	86.5
1971	128,300	64.1	93.1
1972	129,700	62.2	78.5
*1975	135,000	78.3	117.0
*1980	142,500	85.5	130.0
*1985	150,000	93.1	144.1

*Projections by American Waterworks Service Company.

The Division of Comprehensive Resources Programming of the Bureau of Resources Programming have prepared projection which are shown in Table No. 2 for comparison with the applicant's projections. The table has been prepared by the writer and is in somewhat different form from that prepared by Comprehensive Resources Programming.

Table No. 2. Projections Made by DCR

Year	Number of Customers	Average Daily Consumption	Maximum Day Consumption
1970	127,400	66.9	94.6
1980	123,000	69.6	98.4
1990	129,000	76.8	108
2000	131,000	82.5	116
2010	135,000	88.9	126
2020	149,000	102	144

A comparison of Tables Nos. 1 and 2 shows close agreement on future demand, but a disagreement on how soon this demand will mature. The applicant's projections show

150,000 customers and a maximum day demand of 144 mgd by 1985, while DER projections show 149,000 customers and a maximum day demand of 144 mgd only by the year 2020.

A preliminary copy of the State Water Plan for Sub Basin 19 (Monongahela River basin) projects adequate allocation through 1990, with an allocation deficiency of 12.5 mgd by the year 2020. The same report projects a treatment plant deficiency of 9.0 mgd in 1990, and 37 mgd by the year 2020.

Expanding the treatment plant capacity at the E. H. Aldrich Plant (at Elrama) by 10 mgd (from 40 mgd to 50 mgd, equal to the existing allocation at the Elrama site) would meet the 9.0 mgd deficiency projected in the State Water Plan. After 1990 there will be both an allocation deficiency and a treatment plant deficiency. The Monongahela River is not adequate to provide additional withdrawals at the Elrama site (see section on Adequacy of Sources), and the years between now and 1990 should be used to explore the alternatives and decide on the best option to meet Western Pennsylvania's Water Company's needs.

The Company reports that for the year 1972 the division between various uses was as follows:

Domestic	31.04 mgd
Commercial	10.10 mgd
Industrial	11.30 mgd
Bulk Sales	9.05 mgd
Non-revenue use	6.68 mgd
Total	62.17 mgd

From the above breakdown it can be seen that use is approximately one-half domestic, and the rest commercial, industrial, and bulk. This point could be important if priority of use were assigned during a period of drought (see Legal Problems on Monongahela River Sources).

ADEQUACY OF WATER SOURCES:

The present source of water supply to Western Pennsylvania Water Company's system is the Monongahela River. The Monongahela River has a large drainage area, but has an extremely poor natural low flow yield. In addition there is a problem of conflicting uses of the river. Substantial flows are dedicated to the maintenance of commercial navigation. Simultaneously, water supply demands for industrial, power, commercial and domestic water supply use are increasing, particularly in the Pittsburgh-Allegheny County metropolitan area.

The Pittsburgh District of the U. S. Army Corps of Engineers in letters dated October 16, 1973, and February 27, 1975, reports the result of analyzing low flow by their staff and the result of a simulation study of Tygart Dam operations.

The Corps of Engineers are directly concerned because they are authorized by Congress to operate Tygart Lake and Youghiogheny River Lake for flood control and low flow augmentation purposes. During periods of drought flow both the Monongahela River and the Youghiogheny River are sustained through releases from Tygart and Youghiogheny River Reservoirs. The Corps reports that since Tygart Reservoir began operations (since 1938) the lowest flow recorded at the U. S. Geological Survey stream gaging station at Charleroi (approximately 16 miles upstream from the Elrama intake) was 369 cfs (174 mgd) on November 20, 1953. At this time a flow of 340 cfs (220 mgd) was being released from Tygart Dam. There is an unexplained deficit of 71 cfs (46 mgd) between the two points. It should be noted that the drainage area at Tygart Dam is 1,184 square miles, while that at the Charleroi gage is 5,213 square miles. Therefore, it appears that there is a considerable consumption diversion which uses up the inflow from 4,000 square miles of watershed area as well as 71 cfs of releases from Tygart.

The Elrama Plant is located downstream from the Charlevoix gage, but upstream from the confluence of the Youghiogheny and Monongahela Rivers. An additional flow is contributed to the Monongahela River from the Youghiogheny River, principally from the Youghiogheny River Reservoir. On November 20, 1953, the flow from Youghiogheny Dam was 329 cfs (212 mgd). The total flow at the U. S. Geological Survey stream gaging station at Braddock (which includes the Youghiogheny River, and is 6 miles upstream from the Becks Run intake) was 720 cfs (465 mgd) on November 20, 1953. The combined releases from Tygart and Youghiogheny Dams was 669 cfs, or 93% of the total at the Braddock gage. This means that the total natural runoff below the two dams was only 51 cfs (33 mgd), not counting the consumptive diversions in both rivers.

The Corps of Engineers reported in the meeting on September 23, 1975, that a minimum flow of 340 cfs is presently required to operate the Corps navigation locks and dams on the upper Monongahela River. New locks which are under construction or already planned will necessitate a minimum flow of 450 cfs, an amount which exceeds the augmentation capacity of Tygart Reservoir. The Corps reports that releases from Tygart Reservoir cannot be increased to compensate for downstream withdrawals. Therefore, even under present conditions the occurrence of a major drought would result in flows barely sufficient for navigational purposes (with the existing lock system), and an insufficient flow for navigational purposes when the new locks are built.

The Corps reported in their letter of February 27, 1975, that they have completed a simulation study of Tygart Dam operations for the 40 year period 1929 to 1969 (simulating that Tygart have been completed prior to 1929 instead of 1938). This period included two severe prolonged drought periods the most recent of which occurred in the fall of 1953. For the two consecutive months of October and November, 1953, only 33 mgd was contributed by local inflow between Tygart and

Elrama (from a drainage area of over 4,000 square miles). The Corps of Engineers point out that 12 mgd of the present 50 mgd allocation already issued at Elrama would have had to be made up from water released from Tygart Dam.

A even more severe drought occurred during the fall of 1930. In September 1930, the total local inflow (not counting consumptive diversions) between Tygart Dam and Elrama was only 12 mgd. With the flow at Tygart Dam being 2.6 mgd, the natural flow at Elrama averaged 14.6 mgd during the month of September 1930. The month of October 1930, is the driest month of record and it is believed to be the driest month of this century in the Monongahela River basin. An average flow of only 6.6 mgd was computed for the Elrama site during that month.

To summarize the adequacy of the Monongahela River as a water source. Without the Tygart Dam the Monongahela River would just about dry up during drought periods. The Tygart Reservoir can only provide a release of 340 c.f.s., which is less than the 450 cfs which will be required to operate the new locks and navigation systems either planned or under construction. Finally, there are already impending requirements to cool heated waste discharge at three power plants along the Monongahela River and for increased industrial consumption, as well as possible requirements for coal gasification or other energy uses. Most of these latter uses will be consumptive, and are not regulated under the Water Allocation Act.

RETURN OF USED WATER:

One of the principal problems with large withdrawals at the Elrama intake is that only about one-fourth of the used water is returned to the Monongahela River at a series of sewage treatment plants on both sides of the river. The largest part of the used water is returned at the Alcosan Plant on the Ohio River below Brunot Island.

A study was prepared by the water company showing water use, treatment and discharge points for 1973. The study showed an average daily use of 64.52 mgd. Of this total, 55.48 mgd is in the service area which is sewered, and 10.04 mgd is in the unserved area. Of the 55.48 mgd in the sewered area, 10% is considered consumptive loss, and 90%, or 49.03 mgd is returned as treatment plant effluent.

Table No. 3 shows the points and amount returned in upstream to downstream order. The amount returned is the treated sewage after a deduction of 10% for consumptive losses:

Table No. 3. Used Water Returned

Point of Return	Returned To	Amount Returned (in mgd)	Capacity of Plant (in mgd)
Elizabeth Boro 2	Monongahela	0.65	0.77
Clairton 1	Peters Creek	1.38	2.0
Clairton 2	Piney Fork	2.69	3.0
Clairton 2	Lick Run	2.10	3.0
below Clairton 2	New England Hollow	.95	*2.5
Oravosburg 1	Monongahela	.25	.48
Glassport 2	Monongahela	.94	1.20
Sub-total - Above confluence with Youghiogheny		8.44	
Elizabeth Twp. 2	Youghiogheny	.20	.43
McKeesport 2	Youghiogheny	2.32	9.5
Sub-total - To Youghiogheny		2.52	
Duquense 2	Thompson Run	2.96	2.5
below Duquense 2	Trib. to Monongahela	.19	.40
Sub-total - Above Becks Run Intake		14.11	
McKees Rocks 2	Chartiers Creek	1.20	1.4
Alcosan Plant 2	Ohio	33.72	150
Total Effluent Returned		49.03	

*Proposed Increase
1 Primary Treatment
2 Secondary Treatment

From Table No. 3 it can be seen that only 8.44 mgd (or 12 cfs) is returned to the Monongahela River or its tributaries in the most critical reach between Elrama and the confluence with the Youghiogheny River. A further 5.67 mgd (8.0 cfs) is returned to the Youghiogheny River or to the Monongahela River above the Becks Run Intake. The largest part, 34.92 mgd (or 54 cfs), of the used water is returned to the Ohio River in the vicinity of Brunot Island at the Alcosan Plant or into Chartiers Creek which flows into the Ohio in the same vicinity. As far as the Monongahela River is concerned, all but 14.11 mgd (or 21.9 cfs) is consumed water in that it is not returned to the Monongahela River. Therefore, the concern of the U. S. Army Corps of Engineers and others is well justified.

LEGAL PROBLEMS OF MONONGAHELA RIVER SOURCES:

During periods of drought the Monongahela River has an extremely low yield. Because of the dams and locks system the water level remains fairly stable, even though the amount of water flowing in the river may be quite low. This gives the impression that there is adequate water available for all users. Actually there is not enough water available for all the competing uses during periods of drought. Because what flow there is available mostly comes from Tygart Reservoir the legal status of water use and allocations must be reviewed.

The following report is a portion of the legal status of current and proposed allocations which was prepared by R. Timothy Weston of the legal staff in a report dated October 6, 1975.

"All private and public water rights in waterways are subject to the plenary power of the United States to regulate commerce, and to the particular powers derived from the Federal navigation servitude. Under the servitude, the Federal government, without payment of compensation, may remove obstructions to navigation, construct navigation improvements, cut off access to navigable waters, appropriate

waters to support navigation, and raise water levels. All property rights below the mean high water line in navigable rivers are subordinate to the federal navigation servitude.

"Under current federal law, the United States has the power to claim a navigation servitude over the entire natural and augmented flow of the Monongahela River in order to support commercial navigation. All withdrawals of water initiated under state law, including riparian rights, municipal allocations and industrial takings, are subject to the servitude. The United States can, without compensation, cut off all withdrawals which remove flows necessary or dedicated to navigation.

"In light of the facts discussed above, it appears that the United States has a paramount claim to a minimum flow of 340 c.f.s. in the upper Monongahela River. At such time as new navigation facilities require 450 cfs, the United States can legally claim that amount, without compensation to state-authorized users. When river flows drop below 340 cfs (or 450 cfs in the future), the United States can insist that all consumptive takings or interbasin transfers from the upper Monongahela be ceased for the duration of the drought. Such a claim would be legally enforceable through injunctive relief issued by the appropriate federal courts, and perhaps even self-help by the Corps of Engineers.

"Moreover, any water user who withdraws water to the detriment of commercial navigation may be subject to civil liability for damages to shippers and transport owners. *** Although takings for purely domestic purposes may be justified by the doctrine of necessity, municipal withdrawals for commercial, industrial, power, and non-essential residential purposes which conflicts with navigation users are unlawful.

"The W. Pa. allocations serve a wide range of residential, commercial and industrial customers. They are not solely limited to domestic uses. As such, they would not be privileged under the doctrine of necessity, even assuming the doctrine is valid. Thus, there is little doubt that the current and proposed withdrawals by W. Pa. will be held subordinate to navigation uses of the Monongahela River.

"The W. Pa. application and its past allocations are subject to DER jurisdiction pursuant to the Water Rights Act of 1939, *** Section 7 of the Act specifically requires the Department to make three findings prior to issuance of an allocation to any public water supply entity. The Department must determine that:

- "(1) The proposed allocation 'will not conflict with the rights to such water or to water rights held by any other public water supply agency which are reasonably necessary for its present purposes and future needs;'
- (2) 'The water or the water rights proposed to be acquired are reasonable necessary for the present purposes and future needs of the public water supply agency making application; and
- (3) 'The taking of said water or the exercise of said water rights will not interfere with navigation, jeopardize public safety, or cause substantial injury to the Commonwealth...'

"In the past the Water and Power Resources Board occasionally issued allocations where the source was insufficient to support existing and proposed uses during low flows. Such a practice is clearly unauthorized by the Act, and contrary to the long term interests of the Commonwealth and its citizens.

"In light of the facts currently before the Department, I (Mr. Weston) can see no possibility that this agency can make the required findings to issue the allocation requested by W. Pa. The exercise of the proposed allocation at Eirama will interfere with navigation in 10 year - 7 day low flow conditions. Under the circumstances, DER cannot assure a reliable yield to the Company or its customers from the proposed source. Issuance of an allocation from the upper Monongahela

would be an invitation to further reliance on an unreliable source, and a certain blueprint for a drought disaster."

ALTERNATIVES:

Various alternatives have been discussed with the Company, within the Bureau of DER, and with the Corps of Engineers. At the meeting held on September 23, 1975, most of these alternatives was discussed in a superficial way. The alternatives considered are the following:

1. Construction of storage reservoirs.

The principal problems with construction of water supply reservoirs to meet Western Pennsylvania's need are financial and site. The construction of a dam and reservoir would be very expensive and the water company might have trouble financing it alone. In addition, the most suitable sites are located in West Virginia where neither the Commonwealth or the water company have the power to condemn sites.

A less costly alternative suggested by Mr. Cosentino of Southwestern Pennsylvania Regional Planning Commission might be to establish pump storage reservoirs which would skim the higher flows from the Monongahela River. He suggests location in Forward Township since there is little development existing or planned there, and it is close to Elrama.

The water company has indicated a willingness to buy storage in a water supply project constructed by the Corps of Engineers, State, or some other arrangement. The Corps of Engineers have two major reservoir projects under study in the Monongahela basin. Both are in West Virginia, and both would be multiple-purpose reservoirs. However, according to Corps of Engineers officials the water supply capacity of the proposed Stonewall Jackson dam and reservoir has already been committed to Clarkburg and Weston in West Virginia. The other project, Rowlesburg, at present has no water supply capacity included in its uses. Further studies are being made of

the feasibility of building some water supply storage into the Rowlesburg project. However, there is a great deal of doubt as to whether Rowlesburg Reservoir will ever be built.

Water supply storage in reservoirs built by the Company or jointly with Federal or State agencies may be a viable alternative for the future. However, reservoirs require a great deal of lead time for construction so that plans should be made now for storage in the not too distant future.

2. Withdrawals from other streams.

Other streams have been discussed as alternate sources. The streams in the southwest corner of Pennsylvania all exhibit the same low drought yield shown by the Monongahela River. With storage Indian Creek or Laurel Hill Creek could provide water supply, but are far removed from Western Pennsylvania's service area. The Ohio River and Allegheny River would be more logical choices as alternatives. However, the Allegheny River is outside Western Pennsylvania's service area. It would be more logical for the Company to buy treated water from the City of Pittsburgh which currently has a surplus water supply capacity. Problems with water mains sizes and political and financial considerations would have to be solved.

Western Pennsylvania expressed some interest in taking water at a site on the Ohio River below Pittsburgh. This solution would have the advantage of being close to the Company's service area. However, pumping would be required either to the treatment plant at Elrama, or to the service area. If the water should be treated by a new plant at the site. It would appear that the first proposal (pumping from the Ohio to Elrama) would be preferable as pumping would only be necessary during low flow periods.

3. Expansion of the Hays Mine Treatment Plant.

The intake just upstream from Becks Run avoids some of the objections raised to Elrama because the intake is in the pool formed by Emsworth Dam and Locks (located at Neville Island approximately 6 miles downstream from Pittsburgh). The main objection is that the existing Hays Mine Treatment Plant is relatively old and is in an urban area where expansion of the plant would be difficult. The possibility of pumping water to the Elrama site from the Becks Run intake might be worth investigating as an alternative to pumping from the Ohio River.

4. Use of sewage effluent for low flow augmentation.

As previously cited approximately 14.1 mgd is returned to the Monongahela River at various treatment plants, and 33.7 mgd to the Ohio River at the Alcosan treatment plant. All the plants have a capacity of 3.0 mgd or less except Alcosan (150 mgd) and McKeesport Municipal Sanitary Authority Plant (9.5 mgd). It might be feasible to augment the flow of the Monongahela River in the Elrama reach with effluent from one or both of these plants.

5. Pumping water from the navigational pool over one or more locks.

This alternative was not discussed at the September 23, 1975 meeting in Pittsburgh, but has been discussed within the Department since that date. The plan would be to pump water from the navigational pool at Pittsburgh (formed by Emsworth Dam and Locks) over one or more locks to supplement the upstream pools during periods of low flow. To reach the Elrama pool would require pumping over Dam and Lock No. 2 located at mile 11.2, and Dam and Lock No. 3 located at Mile 23.8 (slightly over a mile below the Elrama intake). The lifts would be approximately 9 feet at Dam No. 2, and approximately 8 feet at Dam No. 3. Pumping over Dam and Lock No. 4 located at mile 41.5 might also be considered as this would maintain the water level all the way to Maxwell Dam and Lock at Mile 61.2, upstream from Brownsville.

6. Other alternatives.

There are other alternatives which might be considered independently, or in combination with the alternatives already listed.

Conservation of water use could be considered. However, to be meaningful conservation should include industrial and commercial users. As industry and users other than public water systems do not require water allocation permits, it would be difficult to force rigid conservation measures on the public water supply agency while industry and commercial users are allowed to operate unaffected.

Finally, a last alternative would be to limit further expansion and development in the areas which rely on the Monongahela River as a water source. This alternative would involve zoning, planning, and encouragement to development elsewhere.

In summary, there are a number of alternatives which might be feasible. Construction of storage reservoirs or withdrawals from other streams would probably improve the stream quality as well as increase stream flow to meet the added demand. The other alternatives would increase stream flow during periods of low flow in the critical reaches although this would not necessarily improve water quality. Finally, serious thought should be given to one or more of the alternatives because Western Pennsylvania Water Company is not the only water user, or even the largest one. Indications are that large industrial and commercial demands are going to be made on the Monongahela River in the near future.

The problem of alternative sources or alternative methods to increase the low flow of the Monongahela River should be addressed as soon as possible. Most, if not all, of the alternative plans would require a long lead time between inception and completion. Most of the water users along the Monongahela River appear unaware of the crisis which a severe drought would impose on them. Public

Education may be required to advise the general public of the need for a long range solution to drought flows in the Monongahela River and to make reasons for the added cost understandable. Local interests (such as SPRPC, County Commissioners, or Chamber of Commerce) should be encouraged to take the initiative in plans for insuring sufficient capacity in the Monongahela River to supply all river uses. Federal and State agencies would assist the local agencies or interested parties to the extent practical. As a new permit is required to transfer water rights from South Pittsburgh to Western Pennsylvania Water Company, a special condition can be included requiring Western Pennsylvania Water Company to periodically report on their progress in exploring alternative sources of supply. The Commonwealth through DER and local authorities through SPRPC would assist the Company where possible.

COMMENTS BY OTHER AGENCIES:

The Department has contacted all agencies which are considered to have an interest in this allocation. Many meetings have been held as well as much correspondence exchanged and many telephone calls made. With the exception of the Fish Commission, the other agencies expressed concern and reservations with the proposal, if not outright opposition.

The most adamant opposition has come from the U. S. Army Corps of Engineers. The Corps expressed formal objection to the project in a letter dated October 16, 1973, and reasserted their objection in a letter dated February 27, 1975. At the meeting on September 23, 1975, the Corps spelled out their objections and the reasons for it in great detail. In view of the fact that the low flow of the Monongahela River is largely sustained by releases from the Corps' Tygart Reservoir in West Virginia the Corps' objection must be given great weight. The Corps has shown interest in basinwide planning and cooperation between Federal, State and local interests.

The Division of Water Quality and the Southwestern Pennsylvania Planning Commission have jointly reviewed the proposed allocation. In a memorandum dated April 22, 1975, they comment that the increased allocation will be needed at the E. M. Aldrich Station, but not before 1990. They consider the request premature and suggest that the Water Company await completion of the State Water Plan before action is made on the application. In a follow-up memorandum dated October 29, 1975, the Division of Water Quality advises that NPDES permits are impending for cooling water for heated waste discharges at three power plants along the Monongahela which will result in increased water consumption by industry. Division of Water Quality have estimated the water consumption due to requirements to meet NPDES requirements may reach 35 mgd, and could be larger with industrial growth. Division of Water Quality advises that augmentation of low flow by use of sewage effluent will require greater than secondary treatment. They further point out that water needs on the Monongahela River are likely to become even more critical than indicated by this particular project, especially with development of the large coal reserves in the basin.

The Bureau of Resources Programming have reviewed the proposed allocation at considerable depth. In memoranda dated February 6, 1975, and October 8, 1975, and in meetings within DER the Bureau of Resources Programming and with the Corps of Engineers, the Bureau of Resources Programming advise that they do not feel an increased allocation is necessary at this time since the present allocation should be sufficient until the year 2005. Based on the position taken by the Corps of Engineers they feel the present request should not be granted, and that by implication the existing allocations to the 19 water companies presently using water from the Monongahela River are in a precarious position. Resources Programming favors the early construction of Rowlesburg or pumping from the Ohio River as possible alternatives.

As cited in the section on LEGAL PROBLEMS OF MONONGAHELA RIVER SOURCES the DER legal staff have been deeply involved in this application and have had a great deal of input in dealing with it. Mr. Weston's report of October 6, 1975, suggests denying the requested increase with emphasis on the Department taking a non-adversory, cooperative role toward resolving the whole problem of low flow in the Monongahela River. Mr. Weston stresses the desirability of alerting Federal, State and local interests to the nature of the problem and DER's efforts to resolve them.

Mr. Richard Cosentino of Southwestern Pennsylvania Regional Planning Commission (SPKPC) comments in letter dated March 8, 1977, that the Monongahela River is simply not adequate to support the requested allocation and Western Pennsylvania Water Company should explore the options available for their future water supply.

Only the Fish Commission have no reservation concerning this application. In memoranda dated October 10, 1973, the Fish Commission give their approval of the proposed allocation.

RECOMMENDATION:

It is recommended that the principal request which is for an increase of 30 mgd from the Monongahela River at Elrama, Washington County be disapproved.

It is also recommended that Western Pennsylvania Water Company be granted a permit for the water rights formerly granted to the South Pittsburgh Water Company for 50 mgd at Elrama, and 60 mgd at Beck's Run intake in Allegheny County, an increase at Beck's Run of 2 mgd to bring the allocation and the treatment plant capacity in conformity.

Order of Confirmation No. WA-200 for 26 mgd from the Monongahela River at the Beck's Run intake had no time limit on it. Permit No. WA-200-A for an additional

32 mgd at the Beck's Run intake had a 50 year duration from date of issue (August 13, 1952). Permit No. WA-200-B for 50 mgd from the Monongahela River at Elrama had a 50 year duration from date of issue (February 11, 1959). It is recommended that the permit to be issued to Western Pennsylvania Water Company be given a duration of 50 years from date of issue.

Besides the special conditions requiring accurate measuring and recording instruments and reporting same to DER, it is recommended that another special condition be included requiring Western Pennsylvania Water Company to periodically report the progress in exploring and developing alternative sources to meet their needs after 1990.

Therefore, it is recommended that Western Pennsylvania Water Company be issued a permit for water rights for public water supply purposes for a total of sixty million (60,000,000) gallons per day to be taken from the Monongahela River at an existing intake along the west bank of the river immediately upstream from the mouth of Beck's Run, in Baldwin Township, Allegheny County, and for fifty million (50,000,000) gallons per day to be taken from the Monongahela River at an existing intake along the left bank (west bank) of the river at Elrama, Washington County, subject to the following conditions:

SEE ATTACHED PAGE FOR SPECIAL CONDITIONS:

Respectfully submitted,

Arthur T. Alter

Arthur T. Alter
Division of Dams and Encroachments

Concur:

V. R. Butler

V. R. Butler, Chief
Division of Dams and Encroachments

Jack Pavone

314 South High Street, Morgantown, 26505

July 16, 1980

Dear James Alexander;

This letter is addressed to you as a strong question. The question is . . . Why Solvent Refined Coal Process II (SRCII) in Fort Martin, West Virginia now ?

To begin with, why SRCII ? The Presidents Council on Environmental Quality several years ago stated that synthetic fuels give off up to 2.3 times the carbon dioxide as less processed fossil fuels on combustion. This problem is a significant negative entry on the environmental balance sheet against synthetically derived fuels; just one of many admitted problems attached to this technology.

The buildup of carbon dioxide in a spherical layer around the earth, " The Greenhouse Effect ", is becoming more of a concern to environmentalists every day. Why transport coal many miles from its source to a questionable facility to be processed into a liquid boiler fuel which will compound an already serious environmental situation (Greenhouse Effect) ? This same high sulphur coal could be treated much more simply and less expensively at or near its source so that it would be environmentally safe to burn.

Under Government auspices land is now being acquired, most cases under threat of condemnation, for this economically and environmentally questionable gamble with tax payers money. The SRCII plant, a multimillion dollar complex, which would virtually eliminate the historic rural community of Fort Martin, West Virginia. In its place we would have a monstrous air, water, land and people putrefier which without constant controls and possibly with such control may be a lethal neighbor to much of this part of the country. Not only during its period of active operation; but due to toxic seepage from solid waste piles for many years to come.

I I

We do not want another Love Canal situation. This is certainly not Government of, for or by its people. It seems to be an example of an administration running scared in the face of crises and grasping on to a straw for support. In this case a most inflammatory straw. If Gulf Oil feels SRCII may be the answer to the energy problem let them use their vast resources to support this multimillion dollar "experiment" and let them do it in an industrial area - not in a rural neighborhood on a historic river in the heart of a college, university, residential, agricultural complex.

The proposed SRCII plant would produce a liquid boiler fuel not a high grade fuel for aviation, auto or other mobile needs. This would require other facilities for further processing the boiler fuel final product; additional costs for technology development, construction and operation. More time and money we would have to spend on a costly questionable experiment to begin with. I feel that coal is now our best answer to many of our energy needs. Especially for feeding large stationary boilers such as the SRCII product would be used in.

The Draft Environmental Impact Statement contains much information in its more than four hundred pages. References time and time again to shifting variables which require new studies to update old statistics and admitted lack of statistics in areas which would be vital in a truly comprehensive study of environmental impacts on our lives. Surely the reports cannot be ready to be collated into the final plant design by the proposed deadlines for ground breaking and construction.

The DEIS on page 1-5 strongly urges conservation as our most immediate "means of dealing with the energy problem", and mentions promoting "protection of the environment by minimizing emissions.". The SRCII plant is diametrically opposed to this consideration. The DEIS explains this dilemma on page 2-19 in a discussion of pollutants expected from the plant.

Logged to LIST

A-123

I I I

DEIS

"Air Quality: . .

Based on conservative estimates of emissions (see Sect. 4.2.3.1 and Appendix c), dispersion modeling indicates consumption of up to 41% of the 24-h concentration increment for sulfur dioxide and 94% of the 24-h increment for particulates. "

And these are "conservative" figures for the demonstration plant; not the expanded commercial facility and not considering the possibility of the proposed coke facility being built just up river which would also consume over 90% of the allowable particulates. All this to be pumped into what is now for the most part, sweet smelling relatively clean air; not rotten eggs and smog. I do not see how the Department of Energy or any rational body could consider that "minimizing Emissions". Do You?

The DEIS further states in its section on Conservation that "...it alone cannot provide a long term solution. Solar and other renewable energy sources offer the Nation some of its best opportunities to become self-sufficient in energy over the long term. These technologies are already playing a small but increasing role..." "The potential exists for an even greater solar contribution by the year 2000 if the Federal government were to play a major role in encouraging further research and development: reducing social, legal, and financial barriers; and assisting in the commercialization of solar technologies."

Well there it is in black and white right in the Governments own voluminous environmental report. Why not take your own advice and our money and do that now. Let Gulf Oil work out the SRCII experiment on their own if they are still interested. Let us be both pragmatic and visionary and concentrate our resources on long term solutions to the problem now!

I I I I

Why divert millions possibly billions of dollars, years of time and manpower trying to develop and maintain a questionably useful, high maintenance, dirty stop-gap alternative to coal and oil? Let us conserve our available petroleum and gas by allocating them to priority needs and using scrubbed coal for stationary boilers and such. We can use our time, money and other resources on long term environmentally rational solutions now; not dissipating it all on short term stop-gap technological experimentation. Why SRCII in Fort Martin, West Virginia now???

Sincerely concerned;

Jack Pavone
Jack Pavone

A-124



GOVERNOR'S OFFICE
OFFICE OF THE BUDGET

Pennsylvania State Clearinghouse

P.O. BOX 1323 - HARRISBURG, PA. 17120 - (717) 787-8046
783-3133

00024

RE: PSC-SAI# 58006003

APPLICANT: U.S. Department of Energy

PROJECT: DEIS Solvent Refined Coal II
Demonstration Project

LOCATION: Fort Martin, West Virginia

Enclosed with this letter please find the comments of the
following State Agencies relative to the project identified above:

Department of Environmental Resources

Please consider these the comments of the Pennsylvania State
Clearinghouse at this time.

Thank you for your cooperation.

Sincerely,

Anne G. Ketchum
Supervisor

Dr. Larry M. Joseph
Director, SRC Division
Office of Project Management
E-333, Washington, D.C. 20545



COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
P. O. Box 2063
Harrisburg, PA 17120



July 16, 1980

SUBJECT: Review and Evaluation of PSCH No.: 5-80-06-003
DEIS - Solvent Refined Coal II
Demonstration Project, Fort Martin,
Monongalia County, West Virginia

TO: Ann Ketchum, Supervisor
Pennsylvania State Clearinghouse

FROM: CLIFFORD L. JONES
Secretary of Environmental Resources

The Department has reviewed the Draft EIS on the Solvent Refined
Coal II Demonstration Project proposed in Fort Martin, West Virginia, and
wishes to offer the following comments.

The Department feels it is not in Pennsylvania's best interest
to approve this project as proposed in the recommended alternative. Future
acceptability of the project would be contingent upon review and approval
of the option(s) selected from those discussed in the second paragraph
on page 4-21 to reduce water withdrawals.

The Department has been involved in other reviews of this project
during the past several months and has found cause for concern over the
water supply implications of the project. (See attached comments to the
Ohio River Basin Commission on the "Water Assessment For the Monongahela
Snyfuel Plant" prepared by ORBC for the U. S. Water Resources Council
at the request of the Department of Energy.) During low flow conditions
the project will rely upon releases from Stonewall Jackson Reservoir for
make up of consumptive losses, resulting from plant operations. It is
Pennsylvania's position that releases from Stonewall Jackson should be for
water quality augmentation, not consumptive use make up, since it is so
badly needed in the Monongahela River, where total dissolved solids and
sulfate standards are frequently violated because of insufficient flow.

A-125



COMMONWEALTH OF PENNSYLVANIA
PENNSYLVANIA FISH COMMISSION
Division of Fisheries
Fisheries Environmental Services Section

814/359-2754

Robinson Lane
Bellefonte, PA 16823

July 29, 1980

00031

Dr. Larry M. Joseph
Director, SRC Division
Department of Energy
Mail Station E-333
Washington, D.C. 20545

Re: Draft Environmental Impact Statement
Solvent Refined Coal - II
Demonstration Project
Fort Marion, Monongalia Co., WV
DOE/EIS-0069-D

Dear Dr. Joseph:

The Pennsylvania Fish Commission has reviewed the subject Draft EIS, and would like to make the following comments.

We agree with the principle of developing alternate sources of energy to reduce our dependence on foreign oil. However, such an alternate source must not be developed at the expense of harming existing environmental communities.

The Monongahela River in Pennsylvania supports an improving sport fishery which must be protected against any additional pollution which would adversely effect this fishery. We are therefore going to look very closely at any industry or portion of an industry which could pollute the drainage into the Monongahela River.

Page 2-16, paragraph 5. The awareness of the possible very serious adverse impact of an accidental release of process material to the surface water should demand design criteria which will minimize such an accident to the maximum degree possible even if this increases costs. One accidental release of certain process materials in sufficient quantity could cause a fish kill of very serious proportions.

Page 3-20 to 3-24. Aquatic Biology. This section and Appendix F appears to be rather inadequate to assess the potential effects of the plant on the aquatic environment. Since either accidental or normal discharges could effect the Monongahela River for many miles downstream on both a short term and long term basis, more information on the downstream aquatic biology is needed before construction begins in order to have baseline information from which future impacts can be evaluated. This should include water chemistry, benthic invertebrate studies as well as adequate fish sampling.

Dr. Larry M. Joseph
July 29, 1980
Page 2

We thank you for the opportunity to review this Draft EIS and we wish to be kept informed of the progress made on this project.

Sincerely,

Jack G. Miller

Jack G. Miller, Chief
Fisheries Environmental Services

JGM:dms

cc: D. Graff
B. Weirich
C. Kulp

A-126

244 Lebanon Avenue,
Morgantown, WV. 26505
July 24, 1980.

Dr. Larry Joseph,
Director, SRC Division,
Department of Energy,
Mail Station E-333,
Washington, D.C. 20545.

00028

Dear Sir;

I am very much opposed to the SRC-II plant being located very close to Morgantown. This plant will add to our considerable present pollution even when the anti-pollution equipment is working well and when it is working poorly will add greatly to our health and environmental problems. For many years there have been serious difficulty with these problems along the Monongahela River between here and Pittsburgh.

The pollution in this narrow valley will become greater as the number of people and university students with their many automobiles increase without any added emissions into the atmosphere and water. As this pollution becomes greater the health of the students, faculty and other persons living in this area will be affected. Also, there will be faster deterioration of buildings and equipment, and the house cleaning burdens will increase. Difficulty recruiting university faculty and skilled workers will become greater.

The pollution will add to that northeast of us where the air is already heavily laden with particles, acid rain and other undesirable chemicals which adversely affect other industries, farms, water and forests. What good is accomplished if we destroy as much as we gain from an industry?

Whenever possible air polluting industries should be located on land extending into the ocean, such as Cape Fear, North Carolina, and operated mainly when the pollution is carried out over the ocean rather than onto the land. Even in such a location the harmful by-products should be controlled as much as is possible.

Very sincerely yours,

J. Schaffer, M.D.



Sierra Club in West Virginia

00030

July 28, 1980

Dr. Larry Joseph
Director of the Department of Energy's SRC Division
Mail Station E-333
Washington, D.C. 20545

Dear Dr. Joseph:

As a conservation group, we agree that alternative energy sources are necessary. However we wish to go on record opposing the proposed SRC-II plant near Morgantown as we aren't convinced that all the necessary safety precautions have been taken into consideration.

We are interested in all future plans concerning the plant and wish to be continued on the mailing list.

Sincerely,

Diane Gnepp
Diane Gnepp,
Ex Comm member

*"Not blind opposition to progress,
but opposition to blind progress"*

25

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON, D.C. 20330



16 JUL 1980

Mr. John F. Pearson, Jr.
Assistant Manager for
Solvent Refined Coal Projects
Department of Energy
Oak Ridge Operations
P.O. Box E
Oak Ridge TN 37830

Dear Mr. Pearson

We appreciate the opportunity to review the Draft Environmental Impact Statement on SRC-11, and have completed our review. Due to the low level of Air Force activity within the area, implementation of any of the proposed alternatives will not adversely impact the Air Force.

Sincerely


HARRY P. RISHMAN
Associate Director
Directorate of Engineering
and Services

705448

A-129



DEPARTMENT OF THE ARMY
PITTSBURGH DISTRICT CORPS OF ENGINEERS
FEDERAL BUILDING, 1000 LIBERTY AVENUE
PITTSBURGH, PENNSYLVANIA 15222

ORPED-PE

4 August 1980

Dr. Larry M. Joseph, Director
SRC Division
Mail Station E-333
Washington, D.C. 20545

00049

Draft Environmental Impact Statement
Review, Solvent Refined Coal-II, Demon-
stration Project, Fort Martin, West
Virginia

Dear Dr. Joseph:

Our review and comments on the subject DEIS are centered primarily around the aspects of the proposed project dealing with water resources. In general, we found this DEIS to be notably deficient in its discussion on the impacts of the proposed SRC-II plant on water resources, particularly relating to the operation of a commercial-sized plant. Since one goal of the demonstration program is to facilitate the construction and operation of a commercial facility, we feel the EIS should discuss the impacts of commercial operation on an equal level with the demonstration plant.

More specifically, the EIS should discuss the effects of a commercial plant on terrestrial and aquatic ecology; hazardous wastes should be quantified and characterized, and alternative disposal plans discussed along with other projected impacts; and the impact of the commitment of water to the SRC-II facility on downstream water users and potential development should be discussed. The impacts of a commercial-sized facility on other aspects of the natural and socio-economic environment should be addressed in a similar manner.

In the discussion on aquatic ecology/operational impacts, Section 4.2.2.4, the water intake velocity of "10 m/s" (10 meters/second ?) is very high, not "relatively low" as stated in the text. Such an intake velocity could easily entrain adult fish. While the impact analysis in this section may apply to phytoplankton and zooplankton populations, it is probably not a valid representation of the potential impact on fish populations as true ichthyoplankton are not common in the Monongahela River. The actual impact of intake entrainment would depend on the intake's location, water velocity, and seasonality of the larval and juvenile stages of the local fish populations. Its prediction would require some field testing in the area of the proposed intake. The impacts, which would increase with the operation of the commercial facility, should also be discussed.

ORPED-PE
Dr. Larry M. Joseph, Director

4 August 1980

The statement in Section 4.8, and in paragraph 2.4 Appendix D, that, "Using the HEC-2 model, the U.S. Army Corps of Engineers estimates that the flood velocities would increase from" is incorrect. The Corps of Engineers developed the HEC-2 model, but we performed no analysis on the SRC-II facility. The model was used by Sterns-Roger, Inc., a private firm, for the analysis, and the results and conclusions are their own. We offered to verify their calculations, and were promised the opportunity to do so, but as of this date we have not received any material from them to review. We, therefore, cannot comment on the validity of the conclusions stated in Section 4.8 on the potential flooding effects caused by the SRC-II facility. Also, the hydraulic data presented in Table J.1 for "Before Construction" conditions has been revised by this office, most values showing increases, which may warrant the recalculation of "After Construction" conditions. We will gladly furnish these revised values upon request.

The flood flow frequency data was based on a statistical analysis covering a 46-year period at Morgantown Lock and Dam, and not a 26-year period at Lock and Dam 8 as stated in paragraph four of Section J.1. The last sentence of this paragraph should also read 46 instead of 26. The elevations expressed in Table J.1 represent feet, not meters.

In Section D.2.1, second paragraph, the 7 March 1967 flood level should read 245m (806 ft.) to agree with the similar statement on page 3-13. Also, the 1888 flood is not considered to be the flood of record because it occurred prior to the present system of locks and dams in the river where gaging records are maintained. It is not because of insufficient data or construction of the Tygart Dam as stated in the text. The last sentence of this paragraph should read, "The normal pool elevation of the Monongahela River at the proposed site is 797 ft." The 500-year flood elevation at the proposed site is 811.7 ft., not 808 ft. as stated on the bottom of page D-3.

In Sections 2.3.1 and 4.2.2.1, we regulate the Monongahela River's minimum flow (340 cfs) at Opekiska Lock and Dam, not at Lock and Dam 8 as stated. The system of locks and dams is used to maintain sufficient depth for river navigation, not "flow to transport coal . . . to Pittsburgh . . ." as stated in Section 3.2.2.1. Also in this section, first paragraph, "Crooked Creek" is actually "Crooked Run"; and in the fourth paragraph, the March 1967 flood discharged 80,000 cfs, not "71,000 cfs", and the 1888 flood is estimated to have reached elevation 815.3 feet, not "817.5 ft." In Figure 3.4, "Youghiogheny River Reservoir" is properly named "Youghiogheny River Lake."

Although the existing navigation system will adequately accommodate the barge transportation of coal to the demonstration plant (Sec. 4.2.4 and App. M), if all the coal required for the commercial operation (beginning in 1990) were hauled by

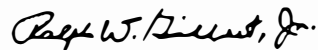
ORPED-PE

4 August 1980

Dr. Larry M. Joseph, Director

barge, the capacity of the navigation system would be significantly exceeded.
This problem should be addressed in the EIS.

Sincerely,



RALPH W. GILBERT, JR.
LTC, Corps of Engineers
Acting District Engineer



UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Productivity,
Technology and Innovation
Washington, D.C. 20230
(202) 377-3441 4335

July 17, 1980

00018

Dr. Larry M. Joseph
Director, SRC Division
U.S. Department of Energy
Mail Station E-333
Washington, D.C. 20545

Dear Dr. Joseph:

This is in reference to your draft environmental impact statement entitled, "Solvent Refined Coal--II Demonstration Project, Fort Martin, West Virginia." The enclosed comment from the National Oceanic and Atmospheric Administration is forwarded for your consideration.

Thank you for giving us an opportunity to provide this comment, which we hope will be of assistance to you. We would appreciate receiving ten (10) copies of the final statement.

Sincerely,

Bruce R. Barrett
Acting Director, Office
of Environmental Affairs

Enclosure Memo from: Mr. Kenneth Hadeen
Environmental Data and
Information Service
NOAA



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
ENVIRONMENTAL DATA AND INFORMATION SERVICE
Washington, D.C. 20235
Center for Environmental Assessment Services

July 8, 1980

OA:D242:MR

Rec'd PPIEC
JUL 10 1980

TO: PP/EC - Joyce Wood
FROM: OA/D2x1 - Kenneth Hadeen
SUBJECT: DEIS 8006.05 - Solvent Refined Coal - II Demonstration Project
Fort Martin, West Virginia

General Comments:

The DEIS discusses the numerous pollutants which may be discharged into the atmosphere. The DEIS would be enhanced if the effects of these pollutants on precipitation (both rain and snow) were discussed. Emphasis should be placed on "acid rain".

Specific Comments:

Page 3-24, paragraph 8: The DEIS states that snowfall can be expected from September through May. Although normals for the area may indicate a "Trace" (T) in those two months, the occurrence of snow then is rare and insignificant. If a trace occurs once in 100 years, it statistically is recorded as a trace in the normals, misleading the reader. Thus, the DEIS would be more accurate if it stated that snowfall can be expected from October through April.

(RF: D. LeComte, D242)

A-132



10TH ANNIVERSARY 1970-1980
National Oceanic and Atmospheric Administration
A young agency with a historic
tradition of service to the Nation



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
6TH AND WALNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

July 29, 1980

00037

Dr. Larry M. Joseph
Director, SRC Division
Department of Energy
Office of Project Management
Mail Section 5-333
Washington, DC 20545

Dear Dr. Joseph:

The U.S. Environmental Protection Agency (EPA), in accordance with Section 309 of the Clean Air Act, has reviewed the Draft Environmental Impact Statement (EIS) prepared for the SRC-II project. Our review has raised many questions which cannot be satisfactorily answered utilizing the information presented in the document. We realize that SRC-II is intended as a research and demonstration project for which design is still in its embryonic stage, consequently, much of the information necessary to assess its impacts simply is not yet available. EPA, therefore, believes that this project is not yet ripe for the preparation of an EIS and must rate the Draft EIS a "Category 3 - Inadequate" in EPA's EIS rating system. Our specific comments are attached.

We commend DOE's determination to begin the environmental assessment process as early as possible in the project planning and development stage. However, the deadlines which DOE has imposed upon itself are unrealistic and would tend to truncate this assessment process prematurely. EPA recognizes the real need for the Nation's effort in researching and demonstrating the utility of synfuel technology in general, and the SRC-II process in particular; and while this is a precedent setting project, EPA hopes that the goal is to demonstrate not only how to develop alternative fuels but how to develop these fuels in an environmentally acceptable and safe manner. We believe that the inadequacy of the Draft EIS and lack of information do not allow for sound project evaluation at this time; and as a Federal Agency responsible for safeguarding human health and welfare and environmental quality, we must urge that when you are operating in an area of such uncertainty, you err on the side of safety.

The Draft EIS does not contain a logical risk analysis or comparison of the research project's benefits with expected environmental, economic, social impacts, or safety risks. Environmental Impact Statements are to be used as decisionmaking tools and, therefore, must clearly outline to the public what will be achieved, and what precautionary or mitigative measures can be taken to offset unavoidable impacts. The SRC-II Draft EIS does not make this evaluation. Other major areas of deficiency which are elaborated on in our

attached comments include water supply, wastewater treatment, air pollution control, solid waste handling and disposal, impacts and safety of final product transportation and usage, and sufficiently detailed monitoring programs. In addition, greater consideration must be given to establishing the facility's initial size and production rate. Research and demonstration projects must be conducted under thoroughly controlled conditions. The complexities and unknowns involved in the SRC-II process demand a clear analysis of the need to operate at the rate of 6,000 tons per day.

Appendix R of the Draft EIS contains a very complete discussion of the various permits which will be required to initiate SRC-II. However, EPA believes that an NPDES permit will also be necessary for process water discharge. EPA, therefore, strongly recommends an early application for an effluent discharge permit as well as for all other required permits and pledges to assist in their coordination and review. To this end, we are prepared to work out a joint schedule with you for permit application and decision.

Although we have pointed out shortcomings in the SRC-II environmental analysis, EPA believes that in light of our national energy problems, if energy research and demonstration projects can be shown to be safe and environmentally sound, they should be explored as possible means to lift us from our energy dilemma. Consequently, EPA offers the following recommendations:

First, DOE reschedule the completion of the Final EIS to follow completion of design. It is evident that construction cannot begin before the Spring of 1981. Therefore, there is sufficient time to complete the EIS, utilizing design information without causing undue construction delays.

Second, DOE publish interim environmental and design reports prior to the publication of the Final EIS. This will enable reviewing agencies and the public to provide constructive criticism. It will also provide for a more thorough public understanding of the project and should enable DOE to produce a Final EIS that would be immune to allegations of procedural inadequacy.

Finally, we believe that DOE should commit to issuing a comprehensive supplement to the Final EIS if the demonstration phase succeeds and leads to an expansion of the facility to a commercial scale.

If we can be of any assistance, please contact me.

Sincerely yours,

Jack J. Schramm
Regional Administrator

Enclosure

A-133

9163
3

Detailed Comments: Draft Environmental Impact
Statement for Solvent Refined Coal-II

The following detailed comments are arranged according to general environmental media: water supply and wastewater, air pollution, solid wastes, monitoring and socio/economic considerations. These are followed by a section of general comments that do not fit with any particular section, but still should be filed.

Water Issues

As a result of incomplete project design and information presentation EPA has many concerns relative to water supply and water quality. These are presented below.

Confusion exists both within the DEIS itself as well as between it and the ORBC Water Assessment for Monongahela Synfuel Plant regarding the amount of water required for plant operation. The DEIS places the rate of use between 4 & 5 mgd while the ORBC study places it closer to 5.6 mgd, about 1/3 more than the DEIS. Usage at low flows appear to be consistent within each report, but the ORBC report states usage will be at 6.4% of the low flow, while the DEIS places it at 6.7% (Re: p.4-20 in the DEIS and p. 2 of the ORBC). In addition, little mention is made regarding other uses, e.g. dust control, slurry of gasifier waste (if this alternative is chosen), etc. The possibility exists that up to three times as much water as the DEIS indicates might be withdrawn from the Monongahela River. If this is true, then the water analyses being performed by the WRC will be in error and all the information developed up to now will be incorrect, with concomitant implications for low flows in the Monongahela. Along with these discrepancies are mutually exclusive remarks within the two regarding fish and wildlife impacts. The ORBC study appears to indicate further study on these effects is necessary while the DEIS seems to lay any such questions to rest. Such discrepancies should be resolved prior to the Final EIS.

It is appropriate, at this point in the review, to discuss units of measure. It would be a great deal easier for reviewers if a single system were used rather than using cfs in one area, gallons per second in another and cubic meters elsewhere, etc. Time constraints are such that much effort is wasted in conversions, especially where more than one document is under study.

Groundwater: The impact of the project on groundwater appears to be covered rather well except for the schedule for gathering baseline geohydrological data. However, if the possibility exists that deep well injection will ever be used for waste water disposal, contingencies should be made to contact appropriate State and Federal agencies. Spills should also be thoroughly analyzed for potential effects upon groundwater. This should be included in the spill prevention control and countermeasure plan (SPCC) to be filed with EPA.

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Groundwater monitoring should include a thorough assessment of the geohydrology prior to construction of the plant and slag disposal area; this should not coincide with the initial construction phase. This should be designed to present a picture of the aquifers, the recharge capacity at the site, and the flows as well as flow rates.

After construction, monitoring should be systematically carried out, especially at and around the slag area so that any failure in the containment system will be known. DOE states this will be done, but specific details are missing. Monitoring will also help to identify any problems associated with anaerobically produced groundwater contaminants. Of course, laboratory work in advance of operation is essential to this part of the monitoring program, as mentioned in the section of this letter on solid wastes. Anaerobic studies should also be carried out for products and any by-products that could cause contamination of groundwaters and benthos.

With regard for the river monitoring, information must be gathered several times annually for ichthyoplankton so that a species balance is known. It is conceivable that species diversity can change and successions develop with alterations of river uses. The entrainment potential for essential species naturally fall within this as well. Coordination with State officials may suffice, depending upon their program for fish population assessments.

River monitoring, as described on page 4-64, is inadequate. It should not be carried out only after "excessive runoff," but carried out regularly so that baseline information is developed.

Wastewater treatment and effluent discussions within the DEIS must be improved. It is freely and repeatedly admitted throughout the Draft that many of the product compounds (pp. XIX, 2-15, and elsewhere) are carcinogenic, mutagenic, teratogenic, etc. Among these are aminonaphthalenes, aminonaphthalenes, aminophenanthrenes, aminopyrenes, and aminochrysenes; all are associated with mutagenicity, and other hazards. This has been reinforced by work in several laboratories and, in fact, further refined through these studies. Statements are made throughout the Draft the DOE wants to control exposure of man and the environment to unscheduled releases of these hazardous compounds. At a plant with such innovative design, EPA believes strongly that design of control systems should be of comparable innovative design. Most of the compounds of interest are found mainly within the heavy distillate portion of the product, although research appears to be incomplete as yet. These are especially of concern in spill control along transportation routes. It appears that the heavy distillate will not float and therefore poses benthic problems and continuing downstream biological concerns for the long term. The range of compounds may exist, however, in other products and byproducts such as the solid wastes that may result from wastewater treatment, and therefore crosses all environmental media. The following is an item by item listing of EPA's water quality related concerns.

1. Wastewater Treatment: Throughout the DEIS it is intimated that water quality impacts should be minimal since zero discharge is expected from process areas, spill areas, runoff areas, etc.

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TABLE #3
WASTEWATER TREATMENT OPTIONS

INORGANICS

1. Mechanical type evaporators and concentrators
2. Covered evaporation ponds which collect the condensate for reuse
3. Reverse osmosis
4. Electrodialysis
5. Ion exchange
6. Dissolved air flotation
7. Sedimentation and plate separators
8. Ammonia removal
9. Chemical precipitation
10. Filtration
11. Stripping

ORGANICS

1. Wet air oxidation
2. Ozonation or UV-ozonation
3. Granular activated carbon adsorption
4. Incineration
5. Synthetic resin adsorption
6. Biological oxidation
7. Cyanide destruction
8. Stripping
9. Solvent extraction
10. Electrolytic decomposition
11. Phase separation including flotation, sedimentation, and plate separators

Zero discharge appears to be strictly conceptual in design, developed during phase "0" studies. It does not appear from the DEIS to be based upon any experimental work and therefore doubt exists as to its acceptability. The evaporation and condensations operations could conceivably result in concentrations of organics building up in the process water. This has implications not only for the acceptability of the recycled waters, but also for the cooling systems where a wide range of organic and inorganic contaminants could be both evaporated with the water vapor and precipitated in the tower itself, later to be removed by cleaning. This cleaning water will be highly charged with contaminants and require further attention before it can be disposed of.

When all is said and done, wastewater treatment for process waters will have to be designed and constructed. This is due to the fact that about 40 process streams will be involved, producing pollutants that will concentrate in the process waters as they are reclaimed; no doubt, a mix of treatment systems will have to be used.

The basic treatment approach proposed is ammonia recovery and tar acid/phenol recovery, followed by double-effect evaporation with re-use of the condensate, to give zero liquid discharge. The ammonia recovery and the tar acid recovery may well be BACT, depending upon the selection and design of these recovery operations, and how these recovery operations are integrated into the overall wastewater treatment system. For example, depending upon the individual sources of wastewater streams within the plant, it may be advisable to apply tar acid recovery only to selected individual streams, and not to the total combined plant wastewater stream; also, other types of recovery operations may be desirable. For a full evaluation, more information would be necessary regarding the individual wastewater streams within the plant, including conditions, composition and flow rate, and the design/operating details of the selected recovery processes.

The double-effect evaporation approach may not be BACT. Some experience with this system suggests that so much water may remain with the concentrate that the ensuing incineration step may not effectively destroy all of the contaminants. Moreover, as discussed previously, volatile organics might partially evaporate with the water and build up in the water recirculation system: such organics might subsequently be released in the wet cooling tower. Although zero discharge of liquids is an excellent goal, there is some concern whether zero discharge could reliably be maintained with this system over extended periods, considering the plant water balance. The DEIS does not effectively address how any water that did have to be discharged would be tested, in the event that zero discharge could not be maintained; this is felt to be a major potential problem area.

Other options exist for handling the wastewater (including treatment/discharge options) which might be better candidates for BACT. Some alternatives are listed in Table 3 attached. If the concerns expressed regarding the double-effect evaporator system cannot be adequately resolved through additional engineering evaluation or with additional data, it may be of value to further assess some of these optional approaches.

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In addition, the water reclamation system is not detailed with regard for energy needs. From the draft, it appears that a large amount of heat will be required for this system but as for the remainder of the draft, the conceptual nature of the design leaves much open to discussion before final decisions are reached.

In the discussions on alternative sites, most water quality parameters are fairly well addressed. However, on page 2-39, the discussion switches abruptly from sediment to water supply adequacy at low flows, leaving the sediment discussion incomplete. In addition, the ORSC assessment mentions Pennsylvania's concern over TDS (total dissolved solids), but as important as this is, sediment is worthy of exhaustive discussion as well. Settleable and colloidal fractions affect fish and carry pollutants, especially organics. Both TDS and sediment (settleable and non-settleable) deserve more attention than presented in the DEIS.

Again, for a full evaluation, further information would be needed regarding the composition and flows of individual wastewater streams within the plant, the design/operating details of the proposed equipment, and data supporting the expected performance of the controls.

2. Rainwater runoff: The DEIS proposes a rainwater collection/holding pond system to collect runoff (from the 10-year, 24-hour storm) from the plant process area, coal storage area, slag disposal area and shipping/storage area. Such a system, covering the indicated areas, would appear to be BACT, although further details are necessary regarding the design of the system. Should the system be designed for a larger storm? Short term storms of heavy intensities should also be evaluated vis-a-vis the proposed control system.

3. Spills: Storage tanks and major process units should be provided with primary containment consisting of a dike with impervious walls and floors; secondary containment (apparently consisting of the runoff collection system discussed above) would also be provided. Such a system could likely be BACT, depending upon the specific design. For example: What is the impervious material envisioned for the primary containment? (The spill that occurred at Ft. Lewis was from a tank surrounded by a dike; unfortunately, the floor and walls of the dike were a permeable gravel which allowed the spill to sink into the ground.) What tank spacing and fire suppression provisions are supplied? Will the secondary containment also include impervious materials to prevent the spilled material from sinking into the ground? The DEIS indicates that spills will be routed to the wastewater treatment system; the effect of such a heavy organic loading on the double-effect evaporator system should be assessed. Also, some discussion might be devoted to "minor" spills (e.g., 5 or 10 gallons when an operator accidentally leaves a valve open on some process component that is not diked).

4. Worst-case Analyses: In new, really experimental projects such as this, a worst case analysis for previously untested components is necessary along with supplemental information. An inexhaustive set of components is

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presented here; these are merely examples that should serve as a point of departure for DOE. It's really impossible to give a thorough analysis because the technology is actually experimental in many of the components still under design.

The most crucial area at the moment appears to be spills (see Item 3 above). The possibility of spills is acknowledged throughout the report and contingencies are mentioned all along the way. The one area where the DEIS is deficient, however, is transportation incidents. It is inappropriate to dismiss spills during rail transportation by saying that more hazardous substances than this product are transported all the time. The magnitude of a major rail accident looms as a heavy consideration for the entire length of the rail road route and such an accident should be analyzed for itself as well as for a spill coinciding with a severe storm. The water pollution potentials of this are staggering; but the ramifications both environmentally and for the safety and health of those exposed is merely mentioned without benefit of analysis. Preventing such an occurrence, with the prevalence of accidents, is practically impossible, yet this does not alleviate the responsibility of analyzing for risks. Table 1 in Appendix I contains a "laundry list" of items, many of which should have been completed in advance of the EIS. An example is the training for management of accidental spills.

In addition, location of the storage tanks seems to imply that river transportation of the final product is at least a consideration; it is probably a good idea in planning a plant of this kind to keep such options open. However, no mention is made of possible barge accidents if this alternative is used.

5. Floodplains and Wetlands: EPA notes that storage sites will be enclosed in a diked area on the floodplain, but a question is raised regarding diversion of waters to the reclamation system. From the discussions on page 4-20, Sect. 2.2.1, and appendices D & J, it is pretty obvious that floodplain issues are covered; however, analyses of alternatives, e.g., a pipeline to the rail area from storage facilities near the plant, is incomplete as stated in the last sentence in p. 2.6, page D-8, where it is indicated that analysis is still underway. It is curious to note that these storage facilities appear to be closer to the river than to the rail line, which is supposed to be the product transportation means of choice. Could this mean that ultimately barging will be depended upon as the plant gets up to capacity and on further into the commercial phase? This is especially curious in light of the 1988 limits on river traffic. Also, why would the pipeline alternative with storage at the plant receive such cursory analysis since a pipeline from storage on the river bank to the rail cars will probably be constructed anyway?

We note that the SRC-II facility will directly or indirectly impact approximately 25 ha of wetlands. Are the 25 ha of wetlands a single system or several separate systems? A rather good description and analysis of the effects of the facility upon flooding is presented but without apparent reference to the wetlands contribution to flood control. Wetlands are integral components of the natural flood protection system. Since these act as a "sponge" at times of flooding, the DEIS presented calculations covering

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flood levels may be too low should wetlands be filled. In addition, removal of wetlands from other stream systems within the site may influence runoff adversely, thus augmenting the flooding potential of the Monongahela River. This too should receive attention.

Wetlands have a great deal of benefit for water quality and wildlife populations. Those in turn reflect upon recreational qualities of an area. No mention has been made of these losses when the wetlands are gone. Wetlands in freshwater systems are fully as important to a balanced fish and wildlife system as those in estuarine areas are to coastal zones. Appendices D and J should reflect wetland concerns. Furthermore, significant damage to species uncommon to the area is acknowledged, but unknown. EPA suggests experts be contacted for their opinions.

Finally, it is proper to note here that should construction (filling) in wetlands be proposed in the final plant design a U.S. Army Corps of Engineers Section 404 permit would likely be required. EPA reviews such permits to insure adequate wetland protection. We strongly recommend that SRC-II plant design be modified to remove all facilities and fills from wetland areas and to preclude the drainage of toxic materials into wetland systems. As wetlands are prime components of the aquatic system and the food web, their loss would (as stated above) affect both hydrologic and wildlife patterns. Pollution of them may yield significant effects via biomagnification and transference of pollutants through the food web, possibly to man. Should EPA review a Section 404 permit for parts of the facility and find that alternative non-wetland sites could be utilized for these plant segments or that significant damage will occur due to filling, it is likely that we would recommend permit denial.

Air Pollution

The discussion within the DEIS pertaining to project related air pollution impacts and controls are incomplete. Our comments relative to these areas are presented below and in the attachments at the end of this Air Pollution Section.

Our review of the SRC-II project draft EIS indicates that there is insufficient information on the project design to review the DEIS for the accuracy of its stated conclusions and its potential to fulfill the regulatory requirements for construction of a major industrial source of air pollution. Information on key process areas, particularly from an environmental point of view, is not included or, where given, it is presented with various design options which will produce significant changes in the functions of the systems.

The major air pollution permit required is the Prevention of Significant Air Quality Deterioration (PSD) permit to construct the facility. The PSD regulations require the analysis of the air quality impact of the source on the PSD increments, the NAAQS, as well as an analysis of the effect on soils, visibility and vegetation, and CL I areas within 60 km of the construction site.

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The DEIS presents conclusions on the dispersion modeling analysis which indicate that the PSD increments and the NAAQS will not be violated by the initial 6,000 ton of coal per stream day (TPSD) facility. The goal of the project is to expand to a 10,000 TPSD facility. Since the initial facility is projected to consume 94% of the TSP PSD increment and 41% of the SO increment, a 5-fold increase in size may violate these PSD increments.

The DEIS' modeling discussion uses acceptable EPA models to predict the impact of the emissions. However, the absence of documentation on the modeling study does not allow an evaluation of its conclusions. Too little information on modeling is included due to the inconclusive stage of the design. Further information is needed for emissions of sulfur, hydrocarbons, NOx etc., as described on pages 2-28 and 2-29. Customarily, Draft EIS's are complete for these areas of concern and this is considered to be even a more serious deficiency because of the experimental ramifications of this project.

Since the DEIS states that the calculated concentrations are "undoubtedly in error," and the predicted TSP increment consumption is 94%, further documentation of the modeling is necessary to ensure its accuracy.

The DEIS presents options for control devices to reduce emissions from the various process and fugitive emission sources. The control devices finally selected should affect the modeling results.

The PSD regulations require Best Available Control Technology (BACT) which, as a minimum, will be the standards of performance for new stationary sources (NSPS). The absence of identifying the actual control technology which will be used in the demonstration plant, will not allow a determination of the adequacy of the design. The PSD application has been determined incomplete based upon substantial deficiencies in specific design data.

The PSD regulations have been evolving since December 1974. In response to the *Alabama Power Co. v. Costle* decision of the D.C. Circuit Court, final PSD regulations are anticipated 8/1/80. Substantial changes in the PSD regulations are expected which may significantly affect the PSD application. Major areas of concern include monitoring and modeling for all pollutants regulated by the Act, as opposed to the present requirements addressing criteria pollutants only. For details, please refer to the 6/23/80 letter to Mr. John F. Pearson, Jr., detailing Region III's PSD comments. This letter itemizes numerous concerns for additional data required to evaluate the PSD application and also indicates deficiencies in the DEIS as fulfilling the NEPA requirements.

Concerns raised through the PSD process are summarized above; however, it is important to remember that the NEPA process goes beyond the regulations limiting PSD application. For example, NEPA requires specific quality/quantity analyses for such devices as controlled combustor/flame systems. The following series of comments reflect concerns that go beyond the requirements of the PSD permit regulations and insofar as they can, reflect areas of concern that may require design adjustment.

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1. Coal handling: Coal storage/handling is the major source of particulate emissions in the plant; control of these emissions is conventional technology. Specific comments on controls for individual sources within the coal storage/handling system are listed in Table 1 attached. As indicated in Table 1, in many cases, the proposed controls appear to be BACT, depending upon system design. For the inactive coal pile, the alternative of a polymer crusting agent (mentioned as an option in the DEIS) would be preferred over the proposed water spray. The baghouses proposed in the PSD application for various locations throughout the coal handling system should be BACT if designed and operated properly. However, the information presented is not adequate to allow an independent assessment of baghouse performance in all cases (e.g. sometimes key information is missing, such as air/cloth ratio, bag material and cleaning mechanism).

2. Heaters/boilers (fired with naphtha and plant gas): These heaters/boilers would be the major source of NO_x emissions in the plant, as well as a contributor to hydrocarbon, SO_x and particulate emissions. Oxygen control, low-NO_x burners and firing pattern selection are, generically, reasonable choices of BACT for NO_x control (ammonia injection, another option mentioned but rejected, is probably beyond BACT). However, more design and operational details are necessary in order to confirm that these control approaches, as actually applied in the plant, are truly BACT; it should also be confirmed on which heaters/boilers these controls will be employed. Emissions of NO_x from the three 308 MM Btu/hr "power boilers" are 0.53 lb/MM Btu, above the applicable NSPS of 0.2 to 0.3 lb/MM Btu for gasand oil-fired units. The source of the emission factors which DOE used in estimating these NO_x (and other) emissions would be of interest. No controls are proposed for SO_x or particulates (or for RC's); this lack of controls should be acceptable so long as the sulfur content of the naphtha (0.1%) and plant gas (100 ppm) remain at those levels. (DOE should further support the estimate that sulfur contents will be at those levels). Sulfur emissions from the larger uncontrolled heaters/boilers are estimated to be 0.05 lb/MM Btu, and particulates to the 0.03 lb/MM Btu, compared to the applicable NSPS of 0.80 and 0.10 lb/MM Btu, respectively. The ability to reduce SO_x emissions further, through more efficient acid gas removal on the plant gas and additional hydrodesulfurization of the naphtha, might warrant assessment.

3. Sulfur recovery/Claus tail gas cleanup: Acid gas removal from the reduced gas stream is proposed using the Benfield and the DEA processes. These processes are fairly well-proven, and, generically, would seem to be reasonable BACT selections for acid gas removal. However, to confirm that the units will operate in the most effective manner, it would be useful to have additional information, including: the composition and conditions of the streams entering the units (with special attention to the nature of the sulfur species present in the gas, and the nature of any other species in the gas to which the processes might be sensitive); any pertinent design/operating information which can be provided, such as flow rate of solvent relative to the feed rate of gaseous sulfur species, and other important design details; and performance specifications for the units, including data supporting the performance estimates. Following acid gas removal, the gaseous sulfur species are converted to elemental sulfur using the Claus

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process. Claus is well proven, and would seem a logical selection as BACT for sulfur production over the other alternatives mentioned (Stretford, Giamarco-Vetrocoke). However to confirm, it would nevertheless be useful to provide further information concerning inlet streams; design/operation details and performance specifications. For cleanup of the Claus tail gas, Super-SCOT is proposed in the DEIS, over other alternatives (such as Beavon/Stratford) which have a reported superior sulfur removal capability. A key reason for selection of Super-SCOT is the reported higher reliability of that technique. More detailed information supporting the selection of Super-SCOT (demonstrating that its higher reliability offsets the reduced removals) is necessary. Also, information should be presented justifying the level of H₂S removal that the proposed Super-SCOT unit is designed to obtain, since other evidence indicates that Super-SCOT might be designed to obtain higher removals than those proposed. Again, stream compositions, design/operating details and performance specs are of interest.

4. Fugitive hydrocarbons: Fugitives are the major source of gaseous hydrocarbon emissions. Comments on the controls for individual sources of fugitives are listed in Table 2. The generic control options proposed (e.g., double mechanical seals on pumps, directed maintenance, vapor recovery on storage tanks) are reasonable selections of BACT. However, additional information would be helpful in confirming that the controls are indeed BACT; e.g., design details, directed maintenance protocols, etc. It would also be helpful to show estimates of: the approximate number of pumps, valves, and other fugitive sources in the plant; the approximate number of pumps which will have double mechanical seals; the approximate number of pumps/valves/etc. which will be enclosed; etc. Such estimates would indicate how thoroughly such controls will be incorporated into the plant; and would help reassure that all potential fugitive sources have been considered. If an overall system is planned whereby fugitive releases from enclosed pieces of equipment are channelled to the controlled combustor/flares, this overall system should be described in more detail.

5. Controlled combustor/flare system: The controlled combustor plus flare system would probably be BACT for routine hydrocarbon emissions and minor upsets; by comparison, the alternatives of an incinerator, or of solely a flare system without a controlled combustor or an incinerator, would provide less reliable destruction of some of the complex organics which might be released to the controlled combustion/flare system. The general description of how the combustion/flare system would be designed in order to preferentially receive, during upsets, those streams which are least amenable to straight flaring, indicates that some care has been put into the conceptual design of this system. However, for full analysis of this system, the design details of the controlled combustor and of the flares are necessary, as well as the design of the system which channels the various hydrocarbon emissions to these devices. Also of interest, in order to evaluate this system, is information on the composition and routine flow rates of the hydrocarbon feeds to the combustor and/or flares, including comprehensive identification of all contributing sources of hydrocarbons. The atmospheric emissions from the controlled combustor and flares are largely ignored; SO_x emissions during startup and upsets is discussed, but NO_x, particulates and hydrocarbons are not considered at all, except on page 4-66 under monitoring, where a cursory statement declares that it will be monitored.

But no mention is made either here or specifically as a task in Appendix T of the objectives of the monitoring program. Perhaps this too will be cleared up at such time when reaction kinetics have been worked out and design can be completed.

6. Wastewater treatment sludge incinerators: More details are necessary regarding the design of these incinerators (the PSD application leaves most of the details "unspecified"); also, more information is required concerning the nature, composition and flow rate of the concentrated residues to be fed to these incinerators. Baghouses, if properly designed and operated, could likely be BACT for particulate control for the incinerators, as proposed. However, the information identified above would be needed in order to assess what other pollutants may be emitted in addition to particulates. The method by which the emission rates for the incinerators were estimated (Table C-1, page C-9) would be of interest. Once concern regarding the double-effect evaporator approach to wastewater treatment, discussed later, is that a high water content will remain in the concentrated residue and will reduce the efficiency by which the organics in the residue will be destroyed during incineration; thus, potential emissions of organics in the incinerator off-gas may be increased. Emissions of NO_x and trace metal fumes might also be anticipated.

7. Cooling tower emissions: The DEIS acknowledges that organics (from, e.g., heat exchanger leaks) as well as some inorganics, may build up in the water circulation system and be released in the drift from the wet cooling tower. The DEIS does not indicate that, according to some experience with the double-effect evaporators proposed for wastewater treatment, lighter hydrocarbons (such as phenols) may volatilize in the evaporator and build up in the circulating water (rather than appearing in the evaporator concentrates). Such hydrocarbons could then add to the emissions from the wet cooling tower. Understandably, the DEIS cannot quantify such emissions from the wet cooling tower, and little is said about the control of these emissions, other than that alternative cooling systems (e.g., dry cooling towers) are being further assessed. Pending further review and the availability of further information, it would appear that a double-effect evaporator/zero liquid discharge system, in conjunction with wet cooling towers, may not be BACT; if evaporation is employed for wastewater treatment, dry cooling may be preferred unless data can be provided indicating that the concern about organics buildup is unfounded.

8. Storage tanks: The extent of controls applied to the storage tanks and loading facilities is unspecified. Compliance with applicable standards is not discussed nor are the tanks even identified as emissions sources. Identification of any emissions must be supplied as well as calculations of such emissions.

9. Monitoring: On page 4-7, words appear to the effect that the end products will depend to a large extent upon the quality of coal used as feedstock. Does this have any implications for the end use at power plants? That is, will the product represent large enough changes to warrant special monitoring at the use site and in its surroundings? If so, a program should be undertaken to this end or if not, reassuring statements should be included to allay fears.

Monitoring should be extended to the product use site for NO_x and any unexpected pollutants resulting from changes in feedstock. Major spills, with the word "major" relating to hazard of material spilled rather than amount, should be followed by local assessment of health implication. Past spill monitoring should extend to environmental effects, too, because those products adhere to soil particles and may leach for a long time.

With regard to miscellaneous comments on other pollutants, EPA raises the following questions:

- 1) What data can be provided to assure the claims that sulfur content of naphtha and plant gas will be 0.1% and 100ppm, respectively?
- 2) Is there a possibility that power boilers will be coal fired rather than fired with naphtha or plant gas? What controls would be installed if coal were used?
- 3) What controls will be employed to control emissions from the gasifier slag dewatering systems?
- 4) Would it be possible to include emissions inventories of all sources, analytical results, source interactions, and operating schedules? This could be a step-by-step map for the entire system along with any possible operations or upsets, and could appear as a supplemental environmental report preceding the Final EIS.

Several areas are unspecified for controls and EPA believes many of these will need attention. These are listed here with a suggestion for control system:

- 1) Conveyor transfer points: Vacuum hood with venturi scrubber.
- 2) Coal pile fires: rapid use of coal; isolation with quenching.
- 3) Coal recovery from storage: (storage alternatives are delineated, but a decision is yet to be made; transfer equipment depends on this decision).

Several areas where hydrocarbons may escape are either ignored or incompletely described regarding specific controls. These should receive attention (perhaps Appendix T will cover these, but they are unspecified).

- 1) leaking equipment; 2) low pressure valves; 3) high pressure valves; 4) vents; 5) storage tank vent vapor; 6) piping leaks; 7) flange leaks; 8) safety relief valves; 9) control valves; 10) pumps

Again as reiterated over and over throughout this letter, design may correct many of these problems, rendering comments like these superfluous, but innovative systems may require innovative control measures.

As a closing to our air pollution related comments we refer DOE to a statement made on page C-5 of the Draft EIS. Here it states that the conceptual design of the SRC-II facility contains insufficient information to accurately predict expected performance during operation. EPA acknowledges this statement. However, we note that there is no discussion presented regarding the possibility of designing appropriate equipment to meet or even exceed controls recommended by regulatory agencies. In other words, this project represents such new technology that it deserves innovative technology for controls.

Solid Wastes

The solid waste discussions within the DEIS incompletely address several problems, ranging from potential hazards of the materials through location of the disposal site. The summary, for example, should mention hazards that might be associated with waste components from the various processes. The document is deficient in pinpointing disposal measures other than for the gasifier options, which are to be delayed, according to page 4-22, until the demonstration phase has started. It is assumed that enough information from the pilot plant in Ft. Lewis has been gathered so that these materials can be characterized and quantified.

Solid waste disposal: There are three major sources of solid waste from the plant: a) gasifier slag, containing the ash from the feed coal (perhaps with some species in a reduced state), and perhaps containing some residual carbon; b) residue resulting from wastewater treatment (concentrate from the incinerators in the case of the proposed evaporation system, or, if alternative wastewater treatment techniques were employed, sludges from biological or chemical/physical treatment operations etc.); and c) spent catalysts from product upgrading. The gasifier slag, in general, would not be expected to be hazardous under RCRA, "under normal circumstances." The wastewater treatment residues and the spent catalysts might be "hazardous", due to high levels of certain trace metals, organics and water-soluble inorganics. If all three wastes are disposed of in a secure landfill under RCRA, as indicated in the DEIS, such disposal would presumably be BACT. The alternative of encapsulation, also being considered for low-volume wastes (spent catalysts), would also be BACT. However, further details on the landfill design/operation would be necessary in order to confirm that the landfill would indeed be "secure". For example, is the proposed liner (3 feet of clay compacted to a permeability of 10^{-8} cm/sec) equivalent to RCRA requirements? Is the liner slope and the leachate collection system designed in accordance with RCRA requirements in order to prevent moisture buildup at the bottom of the disposal basin? What data are available demonstrating that available soils/clays can be compacted to 10^{-8} cm/sec?

On 4-24, anaerobic conditions are mentioned for the second time. It would be a good idea to ascertain the results of anaerobic conditions on the waste since such conditions could exist in a variety of environments from the river to the disposal site. It also seems feasible to carry out laboratory studies to answer the following questions. First, what could be expected in low lying areas where incidental and small spills might occur? Second,

presumably a range of compounds could be produced anaerobically that might become mobile and monitoring systems could conceivably miss them. What are the implications for ground water, for surface waters, as well as natural areas? (In conjunction with any new products or by-product formed as either solid or liquid waste, bioassay tests should be performed so that a clear picture of toxicity is presented for all SRC-II products and by-products, as part of the plans referred to in Appendix I)

Slag Tests: Some questions have been raised regarding use of the term "slag". Is this really slag in the same sense that the term is used for related industries? Its chemical composition is such that it may deserve treatment wholly different from slags produced in other industrial operations.

If the slag is tested and is qualified as hazardous, then EPA must be notified under Sect. 3010-RCRA. Storage at the site requires notification to EPA and application for disposal permit. This is stated as an adjunct to Appendix B; with the addition that under this act monitoring is required. It appears that DOE has embarked on the right track in this regard.

Site Location

Appendix B shows extensive work has gone into site selection. Without becoming ensnared in the sets of determining factors themselves, no questions can be raised. One very important consideration that appears to have been left out of the analysis is transportation.

As part of the site alternative assessment no mention is made of the possibility of choosing a site closer to the point of final product use. The logistics of moving coal across the landscape rather than the highly toxic final product is merely one consideration. Storage of final product might be lessened since adjustments could conceivably be made in plant operation to accommodate seasonal or even daily demand.

In addition it seems apparent that either railroad capacity will have to be increased, if the decision is made to upgrade the plant to commercial scale, or that barging will be used to supplement feedstock/product transportation. Is undeveloped or unused railroad capacity available to fill this need in the future? If barging is not possible and increase in rail is unavailable, will storage require augmentation?

Information available indicates the navigation system for the Monogahela will not be able to handle feedstock transportation after 1988. What alternatives are available to fill this need after that date? If rail is used what will the increased traffic needs be in the face of using up the excess or added capacity for product shipments? These are important considerations in site location that are ignored in the DEIS.

Geological surveys described on pages 3-5 and 4-13 mention deep mine voids that have been encountered on the site. It is not clear that any of the solid waste operations will be located over these areas. Subsidence is definitely a possibility in areas overlying such abandoned workings and should be considered.

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Soils: The soils descriptions in Appendix L is commendably exhaustive except that it lacks site specificity. The possibility also exists that the parent material and bedding may contain pyritic minerals, as briefly discussed on page 4-13. Disturbance of these during construction could produce acid mine drainage that should be controlled during construction and mitigated so that soil pH remains at an acceptable level for operation. This goes a little beyond the controls mentioned in the DEIS.

Statements are made that soils will be depended upon for attenuation of spilled product so that it will not percolate into aquifers. We hope any spills will be controlled much more thoroughly through other means than depending upon the clay fraction.

What are the attenuation properties of the soil underneath the proposed disposal site? (Appendix L is not site-specific).

It is possible that since the facility's land is not owned by DOE on a Fee Simple basis, further mining could be undertaken at the whim of the mining companies in mineral ownership. With the techniques of mine sealing being as primitive as they are, two obvious possibilities come to mind: 1) subsidence could develop such that aquifers may be intersected; 2) large scale subsidence could occur that would disrupt the plant as well as disposal sites and other essential operations. Even though informal discussions have laid this concern to rest, statements should be made to the effect that no operations will be located over such areas and that no mining will ever take place in the deep geological formations at the site.

One of the major considerations in site location is water supply. The DEIS intimates that some water supply, especially at low flows, will come from the Stonewall Jackson Reservoir, yet to be built by COE. Information does not indicate that the COE intends to make releases from the Stonewall Jackson reservoir merely to satisfy the needs of the SRC-II plant, if the day comes that the plant would require such releases. This would constitute a significant change in the operation of that reservoir and would require a thorough evaluation within an EIS. Throughout the analyses in this EIS and the ORBC assessment, this supply is always considered for low flows augmentation. However, as far as we know that augmentation water is for other uses and cannot be considered for use by the plant. Analysis of the impact of a shutdown during low flows of the Monongahela River should be carried out. This is even more important in light of our statement that more water may be needed than the draft indicates. (See water section at first part of these detailed comments.)

EPA is concerned about the amount of land to be taken out of current production trends. The inordinately large amount of land dedicated to the project may imply greater ambitions for the site than described in this DEIS. If this is true, it is suggested that DOE describe future land uses to the fullest extent possible. Is it possible that the amount of wastes will be far larger than anticipated, based upon the experimental nature of the project? The solid products of numerous upsets may make for greater disposal plans than cited for requirements with highly reactive intermediate wastes.

Socio/economic

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Because of the vagaries of population shifts, economic needs and opportunity pressures on local political entities, socio/economic impact is one of the most difficult areas to assess and in which to make sound predictions. We believe a fairly good job has been done in pinpointing where problems may be expected, but solutions and effects are lacking.

It appears certain that the SRC-II induced influx of so many people will precipitate local disruptions beyond those addressed in the DEIS. Nothing is mentioned on page 4-46: The in-migration of about 5000 people over 8 years will place pressures on housing, but too little analyses are done on how and where these pressures will be absorbed. On p. 3-3, for example, the statement is made that development costs for permanent housing may be too high. If this is true, and certainly using the word "may" does not clarify things, what is the alternative? Presumably temporary housing is the answer, but too little information is presented to assess the impact of this alternative.

The age distribution of in-migrants is not mentioned. No doubt, a considerable number of children can be expected, but because too little is known about where the families will live some of the local systems may be overwhelmed. In an attempt to accommodate this sudden crunch, which may disappear as suddenly as it appears, what can be expected in the long run of happen to the teachers and facilities?

One alternative mentioned for reducing impact upon schools, is moving the children to Greene County, Pa. If facilities are available there, and this is not assured, an additional coat of bussing and teachers will be born by someone, but no analysis is presented.

The DEIS mentions the loss of land tax base without being specific on the magnitude. It also mentions that several million in sales taxes will be realized by the State. Will this sales tax revenue adequately cover the services required from local political bodies? Additionally, is it assured that the state will turn any of this revenue over to the local governmental units to help defray these additional costs of services?

On page 2-17, mention is made of the possible inadequacy of water and sewer service if the influx of people occurs. Aside from the failure to mention how this will be accommodated, no mention is made of the very real ancillary possibility that additional services may induce growth currently not planned or wanted by the locals where these services are required. The ramifications of these go far beyond the discussions in Sect. 4 where the commercial upgrading is discussed; an additive effect may be anticipated at that time and should be programmed into DOE's planning process now and mentioned in the Final EIS.

With all these considerations and with the skeletal information presented in the DEIS it is difficult to understand how the conclusion can be reached on p. 2-40 that impacts will be low. EPA, therefore, believes a thorough socio/economic monitoring program be established to allow for quick resolu-

tion of problems. The socio/economic monitoring should be carried out beyond the first quarter of the demonstration operation. The DEIS states throughout there will be changes in worker qualification configuration especially as the commercial/moth-balling/dismantling/phase is approached. This will result in population shifts and in-migration, with implications for the local and state services to be rendered.

General Comments

The following comments fall into the category of General Comments, not because they are less important than those above, but because they do not fit other categories presented.

Our first general comment relates to the updating of project information. Because of the lack of design data for the SRC-II project it will become necessary to expand, revise and correct previous statements. We've alluded to EIS supplements and environmental reports as means to achieve this updating. Coupled with these techniques, "tiering" as described in Sect. 1502.20 and 1508.28 of the CEQ Regulations, 40 CFR 1500-1508, should be considered. Such an approach will allow continued, organized updating of the SRC-II project.

Through our experience in preparing EIS's we appreciate that it is difficult to anticipate all the questions that will arise in the minds of reviewers. However, more information is required to clarify some points either casually mentioned in the EIS or not covered at all.

Though health and environmental ramifications of the molten sulfur by-product are low, still a few items should be cleared up. Where will this by-product be stored at the site? Not only is it important to isolate it from sources of high temperature flames, but assuring that no contact with any heat source or exposure to intense streams of water or steam is also important. Where will it be marketed? Presumably it will have to be transported and the production of 135 tons per day, although not an overwhelming amount still represents an item of concern.

Risk and benefit tradeoffs are generally lacking throughout the EIS. Glaring examples are in transportation accidents, increased production of NO_x at the site of use, production of potentially hazardous products and by-products, and analyses regarding scale down of the plant. These are implied strongly in the foregoing material and this is pointed out here merely to highlight and emphasize the importance of this. Decisionmaking in demonstration operations of this size must place risk analysis as high in the order of priorities as design.

As an example, it would also be desirable to compare the risk tradeoffs between locating the site far away from the end use point or closer so that the transportation of heavy-duty toxic and hazardous substances is minimized. Where spills are concerned, a rail or barge accident of solids is easier to deal with than a spill of liquids of differing viscosities.

It is noted in Appendix R that a list of permits required for operating this plant is presented. One item notable by its absence, but which is not actually a permitting process as such, falls under the Toxic Substances Control Act. We recommend that DOE review this act especially where it may relate to the plant, specifically sections 5 and 8. Section 5 refers to new substances and section 8 refers to notification if any of the compounds to be produced falling outside the list of compounds recently established by EPA. Our Toxic Substances group in Region III can be of service to you in this.

In addition to all the other permitting processes described in Appendix R, we believe DOE should seriously consider applying for wastewater discharge permits for treatment systems to be used in handling process wastewaters. Process waters, as mentioned in the "Water Issues" part of these detailed comments, will contain a build up of organic and inorganic compounds that will render recycling difficult. As design of process kinetics proceeds, EPA recommends strongly that DOE apply for NPDES permits to cover treatment of process and clean up waters.

By all measures the SRC-II is a very ambitious undertaking for a system so lacking in experimental or factual information regarding its operation. The EIS fails to mention any flexibility in operation for other than the 6000 tpd, while in reality such alternative capacity is probably being designed in. In fact, flexibility in design capacity may serve to achieve a much better handle on environmental issues as well as operational parameters.

The draft states on page XIX that within limitations DOE has a broad authority to modify the proposed project. The limitations are not specified except, for example, that the site location is a predication for industrial partner involvement. Do the limitations extend to the size of the facility? If not, EPA strongly suggests adjustments downwards from 6000 tpd so that efficiencies can be precisely worked out. It appears obvious through reading the draft that handling wastewater, for example, is still so uncertain that final plant design from this standpoint alone is a large task and one that may have implications for the plant as well as the river.

In addition, it is customary in experimental projects such as this to give a brief account of the qualifications of those who will be responsible for its operation. This is especially true in new industrial operations where human error is one of the prevalent reasons for upsets and breakdowns. It has been stated privately as well as publicly that no one can flatly state how this plant will work: it is to experimental and conceptual. It is a "design-as-you-go" project as well as a "learn-as-you-go" proposition in operation. A plan, at least, for training employees as well as an analysis for the possibility of failure due to human error should be included.

DEPARTMENT OF HEALTH AND HUMAN SERVICES
OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20201

00004

JUL 17 1980

Dr. Larry M. Joseph
Director
Solvent Refined Coal Division
Office of Project Management
Mail Station E-333
U.S. Department of Energy
Washington, D. C. 20545

Dear Dr. Joseph:

Thank you for the opportunity to review and comment on the Draft Environmental Impact Statement identified as Solvent Refined Coal II Demonstration Project to be located at Fort Martin, Monongalia County, West Virginia.

In general, we find that this draft statement was carefully prepared and gives extensive information on the anticipated construction and operation plans for a commercial solvent-refined coal process demonstration plant in West Virginia. The document clearly describes a number of beneficial and adverse impacts on people, animals, and nature resulting from the construction and operation of this demonstration project.

However, because certain process products and wastes contain organic materials which are toxic to man or which may present long-term health hazards, both in the operation of the plant and from off-site exposure, we are concerned about the health (physical and mental) of local residents as well as the in-migrating labor force and their families. This draft statement does not provide an analysis or discussion of the social, psychological, or economic problems that may be caused by living under conditions which may be actually or potentially hazardous. We are concerned not only about the physical health problems, but also about the anxieties, fears, and additional stress that may be evident, leading to other social, psychological, and economic problems.

Related to this concern, the draft statement does not indicate the existing resources available in the community to address these needs, nor does it include plans the project might take to make these and additional resources available. Specifically, we suggest that the statement include ways of making available basic social services to residents and incoming individuals and families (e.g., information and referral, marital and parent-child counseling, health-related services, transportation, housing

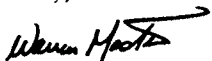
Page 2 - Dr. Larry M. Joseph

related services, etc.).

We would also suggest that the final environmental impact statement include a provision explicitly addressing the present need and possible future demand for human service programs for the people living in the vicinity of the SRC project site. We will appreciate your cooperation in providing us with this information.

If you have any questions about our concerns, please contact Mr. Max Wenk of my staff. Mr. Wenk can be reached on (202) 472-4415.

Sincerely,


Warren Master, Director
Office of Policy Development

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DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
CENTER FOR DISEASE CONTROL
ATLANTA, GEORGIA 30333

July 17, 1980

Dr. Larry M. Joseph
Director, SRC Division
Office of Project Management, ASFE
Mail Station E-333
Department of Energy
Washington, D.C. 20545

00017

Dear Dr. Joseph:

We have reviewed the Draft Environmental Impact Statement (EIS) for the Solvent Refined Coal--II Demonstration Project, Fort Martin, Monongalia County, West Virginia. We are responding on behalf of the Public Health Service and are offering the following comments for your consideration.

We have many concerns with the proposals in this document as can be seen by our detailed comments. While the potential for health effects are discussed, many of the potential effects are grossly understated. First, several statements are made that chronic exposures are of greatest concern. While it is true that chronic, low level exposures are a major concern, acute, life threatening exposures to such gases as carbon monoxide, hydrogen sulfide, or hydrogen cyanide, from leaks and during maintenance, should be of greater concern.

The proposals in this document assume that proposed equipment and components will be able to withstand the harsh environmental conditions of the process. Recent published reports (Chemical Engineering, June 2, pp. 35-38) indicate severe material problems--which translates into increased fugitive emissions and more frequent maintenance and repairs, i.e., increased worker exposure.

In accordance with the CEQ guidelines we believe at least a summary of the evaluation by the Water Resources Council, the report on noise impacts, and the final site plans for solid waste should be included in this Draft EIS not in the final as stated.

Other general comments we have concerning the project are as follows:

If the demonstration plant product facilities are stored in the floodplain, what will be stored and what are the potential hazards to surface and ground waters if flooding does occur?

The alternative designs section is not clear. It appears that some alternative designs will provide differing degrees of protection to the environment. However, it appears that some will provide more protection than others, but rather than use the maximum safety design "evaluations are ongoing and will be continued."

Page 2 - Dr. Larry M. Joseph

An example of the use of wet evaporative cooling is stated as "creating a potential pathway for process materials (including carcinogenic compounds) to be emitted to the atmosphere through the cooling system." Yet, it is also stated that alternative systems are presently available and commercially proven which could reduce or eliminate this potential. Why not use this proven system if it would reduce human and environmental exposure?

Specific comments we have are as follows:

Page xxviii - Why will the project be in the detail design phase before a decision to go to zero discharge is made or to decide what type of pressure venting will be used for emergencies?

Figure 2.2, page 2-7 - What is the location of Fort Martin's school to the facility? Also, is the school presently being used?

Section 2.2.2, page 2-14 - It would seem appropriate to know the boundaries of the facility prior to the final EIS and start up.

Section 2.3.1.1, page 2-16 - How close will storage of materials be to residences?

Section 2.3.2.1, page 2-27 - If the potential reductions in SO₂ warrant further consideration of alternative systems before completion of the final design, why are these alternatives not decided on before the EIS is completed?

Section 4.1.1, page 4-1 - Paragraph 3, last line, add by-products.

Section 4.1.1, page 4-1, paragraph 4, lines 3-6 - While it is true that implementation of industrial hygiene practices at the Ft. Lewis Plant has not resulted in any skin cancer incidences over the 5-plus years of operation, there are published reports of numerous cases of eye irritation, erythema and folliculitis. The implication that there is any association between the latency period of 100 days for skin tumors in animals and workers of 5 years is totally unfounded and should be deleted. On the last line of this paragraph it is stated "experienced in previous coal hydrogenation plants." Other than the Union Carbide, Institutes, West Virginia plant, which other one(s) are being cited?

Section 4.1.1, page 4-2, item 4 - What is considered representative SRC pilot materials? Is this a composite of various runs? Pilot plants generally do not operate for more than a few days continuously. The coal used at the Ft. Lewis plant, will that be used at the demo plant? Will the operating conditions be the same? Suggest at least deleting representative.

Section 4.1.1, page 4-2, paragraph 2, line 7 - What does "marked reductions" mean? Many PAHs and aromatic amines do not have any established exposure standards. Although a 99.999% reduction may be achieved, the compounds may still be present at hazardous concentrations.

Page 3 - Dr. Larry M. Joseph

Section 4.1.1, page 4-2, paragraph 2, penultimate line - As the demonstration plant does not exist yet, it is assumed that reference is to the proposed demo plant.

Section 4.1.1, page 4-2, paragraph 4 - While it may be true that the inclusion of hydrotreating would result in a small increase in the emission of criteria pollutants, the current level is not stated. If the current level is hazardous, even a small increase could not be tolerated. Many of the cited exposures are dismissed as being negligible or insignificant compared with a certain major source of exposure. All types of exposures must be considered, because together they could raise the exposure level of the worker appreciably.

Section 4.1.1, page 4-3, top paragraph, line 2 - "much more serious" - What constitutes a serious situation?

Section 4.1.1, page 4-3, paragraph 2 - As it appears that hydrotreating will eventually be needed, why isn't a complete assessment made now? Recent information shows the product materials are apparently unstable in air and may require further processing (hydrotreating) to enhance stability.

Section 4.1.2, 4th line from bottom - "essentially free of mutagenic and carcinogenic activity. . . ." It is true that microbiological and animal tests have shown little if any mutagenic or carcinogenic activity in the samples tested to date. However, because coal composition may vary within the same coal seam and because the conditions under which previously tested pilot plant samples were taken may vary from those proposed for the demo plant, a statistically valid number of demo samples will be needed to provide assurances that the light hydrocarbon fractions are "essentially free of mutagenic and carcinogenic activity in microbiological and animal test systems." One must not forget though that the light hydrocarbon fractions contain some potentially toxic materials.

Section 4.1.3, 1st paragraph, last line - "chronic exposures are of greatest concern" - See general comment, paragraph 2, 1st page of our letter.

Section 4.1.3, page 4-3, paragraph 1 - Inhalation exposures cannot be expected to be minimal as suggested in this paragraph. Recent experience at the Cattlesburg and Exxon facilities demonstrate the potential for equipment failure and the possibility for materials release. Such releases will not occur at ambient temperatures or pressures. Fugitive emissions and accidental spills from high pressure, high temperature piping, valves, pumps and associated equipment will result in the exposure of plant personnel to a variety of aerosols, vapors, and particulates. This will undoubtedly be the norm and not the exception until design engineers are able to meet the materials compatibility problems by the coal liquefaction process.

Section 4.1.3.1, page 4-4, paragraph 2 - The use of engineering controls is the first line of defense for protecting the safety and health of workers. As used in this occupational context, engineering controls refer to modification of design layout and specifications, modification of operating conditions, or

Page 4 - Dr. Larry M. Joseph

add-on control devices to prevent worker exposure to liquids, gases, or solids produced in the process. The emphasis is placed on design rather than retrofit controls. Ensuring that designs are reviewed and supported by the appropriate safety and health professionals, together with the engineers, maintenance and management staff provides for early recognition and potential resolution of occupational problems prior to commercialization. In general, the primary objectives of engineering controls are to minimize the potential for worker exposure to hazardous process materials and to maintain environmental contaminant levels within acceptable limits. All experience gained, in the design of engineering controls, at the pilot plant level should be qualitatively transferred to the demonstration plant design. Operating experience, with control technology, at a demonstration plant may lead to further design modification prior to commercialization. For these reasons and others, respiratory protection for the worker should be used in a judicious manner after other means have been exhausted.

Section 4.1.3.1, page 4-4, paragraph 2, line 5 - "such contact can be monitored by UV light examination." This is a controversial area. While some carcinogenic materials fluoresce, others do not. Conversely, many non-carcinogenic materials also fluoresce. There is also concern of the risk of skin sensitization and promotion of carcinogenic effects. Because of these potential risks, NIOSH is currently recommending that UV examination be conducted under medical supervision.

Section 4.1.3.1, page 4-4, paragraph 3, line 6-7 - "inhalation exposure. . . considered to be insignificant." A degree of caution may be warranted here. Because much of the off-the-shelf equipment has been failing under process conditions, the potential for fugitive emissions may similarly increase.

Section 4.1.3.1, page 4-4, paragraph 5, line 9 (item 2) - As just mentioned, this could become more common because of erosion/corrosion effects on process equipment and components. As stated in the previously cited Chemical Engineering article, "The equipment challenges created by high temperatures and pressures, and erosive and corrosive particulates. . . must be resolved before second generation plants, now nearing startup, can enter the commercial phase."

Section 4.1.3.2, page 4-5, paragraph 2, line 5-6 - "routine process emissions can be reliably controlled with existing technology. . ." This statement is questionable in view of the preceding comments, and the fact that we don't have reliable materials of construction for equipment and components yet.

Section 4.1.3.2, page 4-5, paragraph 3 - Are there "acceptable levels" of exposure to the public? What are they?

Section 4.1.3.2, page 4-5, paragraph 5 - The safety analysis report is mentioned and refers the reader to Section 1.3.3. Will this report or a summary be made available before the final EIS?

Section 4.1.3.2, page 4-6, paragraph 10 - Train accident statistics. Are two unit trains of 74 cars each sufficient to keep pace with the plant production? How is a train defined, when it is determined that in 1978 there were "15 accidents per million train miles?" Is a train 74 cars each? Is an accident

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defined by a dollar value? How much? Injuries or deaths were not discussed for the rail transport, are any expected? Increased traffic at railroad crossings may lead to an increased risk to the public.

Section 4.1.3.2, page 4-7, Table - It is assumed that one-half of all accidents will involve empty trains, why? Train accident statistics in the recent past suggest that larger, heavier railroad cars coupled with deferred track and equipment maintenance have led to a higher incidence of accidents caused by equipment (wheel) and track failure. One would expect that loaded trains may be involved in more accidents.

Section 4.1.3.2, page 4-7, paragraph 1, lines 3-5 - The comparison between SRC distillate and chlorine, etc. is like comparing "apples and oranges." The chlorine, ammonia, etc., would not be used by the public to run some type of combustion engine. There have also been recent reports of coal liquefaction product instability in air, e.g., increasing viscosity and chemical changes.

Section 4.1.3.2, page 4-7, paragraph 4, line 6 - Although particulates were measured, there is no mention of testing the particulates for adsorbed hydrocarbons. This could be a significant problem especially inhalation of high surface area respirable particles containing potentially toxic hydrocarbons.

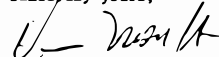
Section 4.1.3.2, page 4-8, paragraphs 2-3 - Again no mention of testing for hazardous adsorbed hydrocarbons or carbon particles.

Section 4.1.4.1, page 4-9, paragraph 1 - It is important to note that the composition of the slag or other waste streams can change with a change in feed stock coal or operating conditions. Therefore, while the organic fraction of the waste is in the ppb range, using Pittsburgh seam coal, it may be altered when processing different coals.

Section 4.1.4.3, page 4-9, paragraph 3 - A critical point missing is the fact that reliable materials for process equipment and components are now being researched. Of course it is possible to keep the plant running with redundant and spare equipment, but only at a higher cost and at potentially increased exposure to workers during maintenance and repair.

Thank you for the opportunity of reviewing this draft document. We would appreciate receiving a copy of the final EIS when it is issued.

Sincerely yours,



Frank S. Lisella, Ph.D.
Chief, Environmental Affairs Group
Environmental Health Services Division
Bureau of State Services

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00020

July 16, 1980

Dr. Larry M. Joseph, Director
 SRC Division
 U.S. Department of Energy
 Washington, D.C. 20545

Dear Dr. Joseph:

The draft Environmental Impact Statement for the Solvent Refined Coal-II Demonstration Plant dated May, 1980 has been reviewed and the following questions and comments are made.

--What did this Environmental Impact Statement cost?

--Page 2-1. The second paragraph states that the demonstration plant as currently proposed will comply with all environmental requirements now in effect and is capable of compliance with standards now being developed by various regulatory agencies. This is an extremely broad statement.

--Page 2-9. Under the heading "Gasification" the statement is made that a variety of carbon sources including coal and oil can be used as gasifier feed. This is an extremely broad statement.

--Page 2-26. It is our understanding that the Texaco gasification process has been chosen. This paragraph should be modified accordingly.

--Page 2-32 and following. Throughout the entire report, the decision is reiterated to discharge no liquid streams. This means that the chemical dump becomes the repository for all waste chemicals which evolve from the process. Somewhere emphasis should be made that the solid wastes are an unknown mixture and are being treated very, very carefully.

--Page 4-9. At the bottom of the page the association is now called the Chemical Manufacturers Association.

--Page 4-20. Why is the facility designed to raise elevation above the 500-year flood level? What is the justification?

Dr. Larry M. Joseph
 July 16, 1980
 Page Two

--Page 4-28. No mention is made about disposal of incineration ash.

--Page 4-34. Why was the design of the demonstration plant carried to reduce fugitive hydrocarbon emissions to only 90 tons per year?

Page 4-42. On what basis was the man-power estimate made? It appears to be low if a reasonable wage rate is applied to total man-hours and related to total estimated plant cost.

Page 4-67. Mention is made of high-integrity seals and packings. Is this a broad category or are they definite selections?

Page 4-72. Where is the plant located in relation to the floodplain elevation?

Page 4-74. The storage area grade level appears to be much higher than necessary.

Page C-9. The table C.1 should include the allowable standards for the named pollutants.

Page K-2 and following. The leaching tests must be conducted on all solids including slag, coal, chemicals, etc. singly and combined.

Appendix Q. There is no incorporation of the possible Fairmont coke plant in this appendix.

--Throughout the Environmental Impact Statement, the word "teratogenic" is used. Please substantiate the use of this word.

The above questions and comments are intended as input to the preparation of the Final Environmental Impact Statement. Response to this office by any other means is not necessary.

Sincerely,

Bill Harvey
 William T. Harvey, Jr.
 Technical Consultant

WTH/mb

A-147



DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
PITTSBURGH AREA OFFICE
440 FORT PITT BOULEVARD
PITTSBURGH, PENNSYLVANIA 15219

REGION III

July 21, 1980

IN REPLY REFER TO:

3.3CM

00021

Dr. Larry M. Joseph
SRC Division, Office of Project Management
under Assistant Secretary for Fossil Energy
Mail Station E-333
Washington, D. C. 20545

Dear Mr. Joseph:

Subject: HUD Professional Comments
Environmental Impact Statement
Proposed SRC-II Facility
Monongalia County, West Virginia

These comments are offered as constructive concerns and as positive-action recommendations, from one Federal agency to another. This HUD office has both a) housing and community development responsibilities for Western Pennsylvania and West Virginia, and b) over ten years of first-hand experience in both Monongalia and Greene Counties, which will be affected by SRC-II. We offer DOE our cooperation and technical assistance, regarding DOE's intentions to address the so-called "secondary effects" or "off-site, private market" effects of SRC-II, particularly during the construction stage over the next four years.

In reviewing the EIS Section 424, "Economic, social and cultural impacts," we have major concerns regarding possible direction that Federal agencies (DOE, ARC, FmHA, HUD) and local governments in West Virginia and Pennsylvania may be able to pursue, to cooperatively face the critical problems which can be expected to occur.

It is our professional judgement--albeit in the absence of uncontestable first-hand data--that the SRC-II will inadvertently create or complicate these Monongalia/Green Counties conditions:

1. The housing impacts, as presented, appear underestimated in the light of informed first-hand knowledge of Monongalia County and recent experience of the Pittsburgh Area Office. The Morgantown-Monongalia County area has few standard vacant units. Transient construction workers, with Davis-Bacon wages, will be able to pay higher prices for the few available standard units, and will in turn cause considerable displacement among low- to moderate-income households, including students. The housing shortage will

2

be further increased by a lack of available sewer and water facilities for proposed mobile home developments. The latter park or "pad" shortage is probably underestimated in the EIS.

HUD Suggestion: At this time, there is sufficient lead-time to avoid what could otherwise become a serious low- and moderate-income rental housing shortage. This office suggests, first, that a cooperative effort be established immediately between the Department of Energy and HUD to utilize DOE (or construction contractor's) funds to develop new mobile home parks for the workers in Monongalia and Greene Counties, on a well-planned and well-sited basis, with package water and sewer systems, if public facilities are not accessible. After the construction phase, such market-rate parks could be continued or be converted (if well planned) to single-family housing subdivisions.

We stress well planned because the lack of local land use controls in both counties will probably yield unattractive, possibly unsafe, crowded and speculative facilities at high costs.

Second, we urge DOE to consider funding 100 to 300 units of permanent rental housing for the workers, to further minimize, we believe, inevitable competition for available private rental units in the Morgantown/Mt. Morris/Waynesburg area. Created rental pressures on the elderly tenants and low/moderate income tenants of existing private facilities may cause inadvertent displacement. DOE-assisted new units could ease such inflationary, competitive market pressures. After the construction employment declines, the units could be sold, by prearrangement, to an owner for market-rate or Section 8 low/moderate income tenants. Again we stress, however, that careful, small-housing project planning, design, and siting should be followed to meet local small-town/semi-rural area needs.

2. In the absence of any land use controls in Monongalia and Greene Counties, the role of planning a) new housing sites, b) public facility extensions, and c) other community development concerns, must fall (in West Virginia) to the Regional Planning and Development Council, Region VI. Currently, it is conducting a housing needs analysis of the County; the Region will be able to best assess locations for temporary and permanent housing. At this time, the West Virginia county totally lacks the technical capacity to provide such feasibility information.

While no Federal agency can, or should, exercise what are essentially local powers and responsibilities under state laws, Federal agencies should encourage equivalent "anticipatory planning" through other available, reliable, and professionally-able planning agencies.

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HUD Suggestion: DOE should fund Region VI to perform SRC-II "secondary growth" public-action alternatives.

Overemphasis on the SRC-II plant itself and the assumption that other parties will address the "outside of the plant" problems is dangerous, and can lead to serious local problems which in turn will affect the plant's efficiency. We believe carefully-tailored, advance implementation planning by Region VI would be a prudent investment action by DOE.

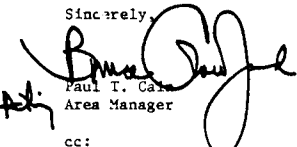
3. The Impact Statement did not consider any development effects upon neighboring Greene County, Pennsylvania. This largely rural county will absorb considerable scattered development.

HUD Suggestion: DOE should specifically support all efforts, by all parties, to encourage county governments' cooperation on a Pennsylvania-West Virginia basis. The SRC-II development will coincide with an increase in deep and surface mining in the immediate six-county Pennsylvania-West Virginia areas. DOE should openly support all voluntary, federated efforts towards such cooperation on planning and development.

Conclusion

The tone of the Environmental Impact Statement is positive and attuned to the development of SRC-II. This office accepts the inevitability of the development. But, we are concerned about the short term, as well as long range, effects of the energy industry in West Virginia and Western Pennsylvania. We believe that the Federal agencies responsible for promulgating this development must consciously exercise foresight and careful planning so as not to move to solve one national problem (synthetic fuels) and cause numerous others for the local communities.

Sincerely,


Paul T. Carr
Area Manager

cc:

John F. Pearson, Jr.
James K. Alexander



United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

ER 80/526

JUL 16 1980

Ms. Ruth C. Clusen
Assistant Secretary for Environment
Department of Energy
Washington, D.C. 20545

00023

Dear Ms. Clusen:

The Department of the Interior has reviewed the Draft Environmental Statement for Solvent Refined Coal II, Demonstration Project, Fort Martin, Monongalia County, West Virginia. We have the following comments.

General Comments

The draft environmental statement adequately describes fish and wildlife resources in the area of the proposed Demonstration Project, but does not thoroughly address project caused impacts to those resources. In particular, the statement inadequately assesses both the effects of air and water discharges from syn-fuel production as well as streamflow diversion and solid waste disposal on fish and wildlife and their habitats. This inadequacy can be contributed in part to the fact that the Department of Energy did not consult with the Department's Fish and Wildlife Service (FWS) as required under the Fish and Wildlife Coordination Act. It, therefore, appears that fish and wildlife resources were not equally considered with other project objectives.

We believe construction of the Demonstration Project constitutes an irretrievable commitment of fish and wildlife resources. Impacts of both the Demonstration Project and the Commercial Project should be carefully analyzed prior to making irretrievable commitments of resources and a decision on the projects. However, based on the information provided in the draft environmental statement, the Department of the Interior does not object to the selection of the Fort Martin site but is of the firm opinion that many additional environmentally protective measures need to be incorporated into the final project (Demonstration and Commercial Projects).

2

herefore, the Department of the Interior recommends that:

(1) prior to filing of the final environmental statement, the Department of Energy consult with the Fish and Wildlife Service, as required pursuant to the Fish and Wildlife Coordination Act, with the intent of preventing loss of fish and wildlife, as well as providing for the improvement thereof in connection with the proposed projects, and

(2) the selected floodplain and wetland areas not be filled as proposed and that one of the alternatives, given on pages 4-75 or D8, be used.

Specific Comments

Page xvi, paragraph 2: The purchase of land for the Demonstration Project prior to approval of the final environmental statement appears to conflict with Section 1502.2(f) of the CEQ Regulations.

Page xviii, paragraph 2. The statement "It is intended that, at the conclusion of the demonstration period, the facilities will be available for sale to the industrial participants for expansion to commercial capacity" shows intention that the commercial facility will be built on site if economical. The final environmental statement should, therefore, address the impacts of the larger commercial project as well as those of the Demonstration Project.

Page xviii, Section 5. Current status of the proposed action. This section should state that land purchases for the project have already been initiated.

Page xx, paragraph 8. The statement "...the consumptive use of water is not expected to have a significant impact on the river's biological resources..." is not substantiated in the text of this statement. For example, no information on project caused impingement and/or entrainment of larval and adult fin fishes was included, neither was information on mitigative measures for these impacts. The FWS was not consulted, as required by the Fish and Wildlife Coordination Act, during the planning stages of this project in relation to fish and wildlife conservation or mitigation except for endangered and threatened species.

Page xxii, paragraph 3. Use of potential water made available by the proposed Stonewall Jackson Dam should not be considered a viable supply for this project for several reasons: first, the Stonewall Jackson project is being challenged in court;

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second, the project, if constructed, would be a multipurpose project justified partially on recreation benefits, thus water for plant use could not be guaranteed during low flow periods; and third, since the State of West Virginia has no low flow policy regarding water use, water use upstream of the site could reduce the flows potentially available from Stonewall Jackson.

Page xxii, paragraph 4. The statement that water consumption of the commercial facility is not expected to increase in proportion to the increase in capacity is not substantiated in the text. If this cannot be substantiated a worst case situation should be evaluated.

Page xxvii. Alternative designs recommended for further evaluation. The evaluation concerning the use of alternatives should be concluded prior to making a decision on the least environmentally damaging alternative and the project as a whole.

Page xxviii, paragraph 1. The disposal method of hazardous materials should be clearly identified prior to making recommendations on the project.

Page xxix, paragraph 2. What fish and wildlife resource values were considered in the selection of alternatives? Impacts to fish and wildlife resources should be identified and included.

Page 1-2, paragraph 3, statement 8. See our general comments and comment regarding page xviii, paragraph 2. We reiterate that the impacts of the commercial facility should be included in the final environmental statement.

Page 1-14, Section 1.3.2. Current status of the proposed action. See our comments above for page xviii, Section 5.

Page 1-18, paragraph 1. We do not agree that the proposed barge facilities are in an area of low impact. Floodplains and wetlands are extremely valuable to fish and wildlife and are very limited in mountainous areas.

Page 2-2, Section 2.1.3. Summary comparison of alternatives. Water quality and supply, fish and wildlife resources, and floodplain and wetland values should have been considered in this evaluation.

Page 2-19, paragraph 2. The statement is made that a detailed evaluation of water resource impacts cannot be made until the Water Resources Council study is completed. We agree and suggest that preparation and release of the draft environmental statement was premature without the information.

Page 2-20. Increased encroachment in the floodplain. Since the volume and location of product storage depends on the method of shipment and cannot be determined at this time, the impacts of such storage cannot be determined.

Page 2-21. Generation of about 4,000 tpsd of slag. If waste characterization and groundwater monitoring have to be evaluated during the demonstration stage, how can it be stated that "...no significant additional impacts are expected?"

Page 2-23, Section 2.3.2. Selection of an alternative design or site. The statement, "Alternative sites were evaluated to a degree of detail necessary to determine whether they offered potential for appreciably reduced impacts" conflicts with the statements discussed above and found on page 2-19, paragraph 2, and page 2-20.

Page 2-23, Section 2.3.2.1. Alternative plant designs. Water quality and supply, fish and wildlife resources, and floodplain and wetland values should have been considered and evaluated to aid in the selection of the environmentally preferred alternative.

Page 2-25, paragraph 2. This paragraph includes the statement "The feasibility of alternatives that avoid or reduce encroachment on the floodplain are currently being evaluated." This Department cannot evaluate the effects or make recommendations on alternatives without this information.

Page 2-38. Comparison of impacts at proposed and alternative sites. It is stated that if process design remains the same, the significance of these impacts depends on site specific considerations. It is stated in the third paragraph of that section and other places in the draft that no plant layouts have been proposed for the alternative sites. It is not possible to select the best environmental alternative without this information.

Page 2-39. Surface water quality. This argument for use of the Fort Martin site is invalid. Water quality impacts from construction and operation at any site would be the same if all other factors are equal. If this discussion is to remain in the final, soil type, slopes, annual rainfall, and other factors should be used to determine at which site construction and operation impacts would be the least.

Regarding low flow water availability; this problem should have been thoroughly evaluated prior to selecting an alternative and/or issuing a draft environmental statement.

Page 3-17, Section 3.2.2.3. Surface water quality and aquatic ecology. This section should contain a discussion of aquatic life and their biological and recreational values in the ponds and streams in the project area.

Page 4-1, Section 4. Environmental consequences and mitigation measures. This section should contain a discussion of measures proposed to mitigate or offset floodplain, wetland, and fish and wildlife impacts. Mitigation concepts should include: wetland creation, fishery development, wildlife habitat improvements, and public access.

The potential effect of mine-roof collapse on foundation conditions is considered (p. 4-13, sec. 4.2.1.2). However, the effects of mine subsidence fissures, propagated by mine roof collapse, on the interconnection of ground and surface water within the project area also should be evaluated.

The final statement should include planned specifications for maximum permeabilities acceptable for the liners beneath the coal storage and solid waste disposal areas, in order to permit a more adequate evaluation of the potential for groundwater impacts.

Page 4-14, Section 4.2.1.3. Terrestrial ecology. Impacts cannot be quantified nor can decisions on alternative selection be made without the benefit of more detailed construction plans. We cannot assess impacts without knowing how much land will be disturbed.

Page 4-16, paragraphs 1, 2, and 3. The alternatives to floodplain utilization and wetland fill should be provided and all mitigative measures should be identified.

Page 4-17, paragraph 1. The statement that shrub and tree grasslands are not high quality wildlife habitats is not correct. These areas provide habitat for a wide diversity of wildlife species as the bird list included in that paragraph shows. Was a breeding bird census conducted on the project area? If not, what fish and wildlife expertise was consulted regarding breeding bird populations?

Page 4-17, paragraph 5. The FWS was not contacted in accordance with the Fish and Wildlife Coordination Act. The FWS was contacted in accordance with Section 7 of the Endangered Species Act. That contact and the FWS's response are included in Appendix E. The third paragraph of that response states, "This response relates only to endangered species under our jurisdiction. It does not address other FWS concerns under the Fish and Wildlife Coordination Act or other legislation."

Page 4-28. Mitigation measures. This list should contain measures to mitigate the loss of 2.5 acres of forested wetland.

Page 4-30, paragraph 6. What mitigative measures are planned to compensate for the loss of onsite ponds? Although these ponds may not be "unique aquatic resources" their loss should be mitigated.

Page 4-30 and 4-31. Mitigation measures. The erosion control techniques and good housekeeping practices discussed on page 4-28 do not compensate for the loss of fish, wildlife, riparian and aquatic resources.

Page 4-31. Operational impacts. What will the approach velocity at the intake structure be? If the approach velocity is similar to or the same as the "intake velocity" (10m/s) it is extremely high and could have severe effects on entrainment and impingement rates. A commonly recommended approach velocity is 0.5 feet per second with adequate fish screening facilities and other protective devices installed.

How does the stated discussion and evaluation relate to the commercial stage of the facility? Anticipated entrainment and impingement impacts of the commercial facility must be evaluated and mitigated (if necessary) prior to an irreversible and irretrievable commitment of resources.

Page 4-32. Mitigation measures. The only mitigative measures given for entrainment and impingement losses is the construction of Stonewall Jackson Reservoir. This is not acceptable mitigation. Many techniques are available to reduce entrainment and impingement losses and these should be thoroughly evaluated and the best technique utilized.

Page 4-64. Operations. Ichthyoplankton should be sampled at least weekly during spring, summer, and fall if statistically valid information is to be obtained.

Page 4-67, Section 4.6. Mitigation measures. This section should contain mitigation recommendations for the loss of floodplains, wetlands, bottomland hardwoods, and fish and wildlife resources.

Page 4-69, Section 4.6.5. Water. Mitigation for the loss of fresh water pond fishery habitat should be included.

Page 4-72, Section 4.8. Floodplain-wetlands assessment. Paragraph 4 of this section says that the floodplain and forested wetland areas along the river are not valuable ecological resources.

We strongly disagree, the values of floodplains and wetlands were well documented; Executive Orders 11988 and 11990 point out these values. In mountainous regions, such as where the proposed site is, the values of the resources are often greater than in other areas. These resources are generally of limited areal extent and thus more unique in mountainous areas.

Page 4-72. Paragraph 5 of this section states that the floodplain will be filled to approximately 20 feet above the 500 year storm. We are not convinced that this is the most practical alternative for coal storage.

Page 4-75, paragraphs 2 and 3. These alternatives to floodplain development and wetland fill appear to be consistent with the Executive Orders on Floodplains and Wetlands. We would prefer that one of these be selected over the proposed project.

Page B-2, Appendix B, paragraph 3. Why is the site selection criteria 1,300 acres, when less than 300 acres are needed for the project? Use of 1,300 acres rather than 300 acres extremely limits available alternatives and seems to be very arbitrary. According to Table B-1 on page B-3, this criteria eliminated 13 of the 27 alternative sites identified. Would these sites have been eliminated if 300 acres was the size criteria?

Page B-4, Table B-2. No adverse impact is recorded for the wetlands category for the selected site (assuming Ben's Run is the Fort Martin site). A definite adverse impact will occur to the 2.5-acre forested wetland from filling; additionally, the 60-acre emergent wetland on Crooked Run would be affected by construction of the plant site and disposal area as well as by their continued use. (These impacts are clearly identified in Appendix D.)

Page B-4, Table B-3. Water supply, floodplains, and fish and wildlife resources should be used as additional environmental variables during site selection.

Page B-5, Tables B-4 and B-5. These tables should be revised to show adverse wetland impacts at the selected site.

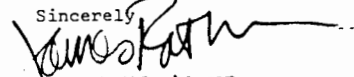
Page B-5, Table B-6. Water supply, floodplains, wetlands, and fish and wildlife should be used as additional environmental variables when determining final section of alternative sites.

Page B-6, Table B-7. This table should be revised according to above discussions for Tables, B-3, B-4, B-5, and B-6. The discussion included in Appendix B should be revised accordingly.

Page C-36. Slag disposal area design. What is the life expectancy of this area? Was the area designed for the life of the project or just for the demonstration facility? If additional areas are needed, where will they be located? What alternative sites were considered?

We hope these comments will be of assistance to you.

Sincerely,


James H. Rathlesberger
Special Assistant to
Assistant SECRETARY



DEPARTMENT OF TRANSPORTATION
REGIONAL REPRESENTATIVE OF THE SECRETARY
434 WALNUT STREET
PHILADELPHIA, PENNSYLVANIA 19106

July 14, 1980

000 16

MEMORANDUM TO: Dr. Larry M. Joseph
Director, SRC Division
Office of Project Management

SUBJECT: Draft Environmental Impact Statement--Solvent Refined Coal II
Demonstration Project, Fort Martin, West Virginia

We have reviewed the subject document which was sent to our headquarters office. The document identifies that the proposed project will have a significant impact on the local road network. Both the structural and operational capacity of the existing local network are considered inadequate to facilitate the construction and operation of the proposed project. Substantial upgrading of roads and bridges will be necessary.

As project development continues, close coordination with the West Virginia Department of Transportation is necessary. The transportation studies underway by the Department are critical to the orderly advancement of the demonstration project. The FEIS should document the available results of these studies and plans for implementing the identified transportation improvements.

We appreciate the opportunity to review and comment on the draft EIS.

George W. Bruckey
for Sally H. Cooper
Regional Representative
of the Secretary

cc: R. Davino, FHWA Region 3
J. Canny, DOT/OST, P-22

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Upper West Fork River Watershed Assoc.

-2-

CO-SPONSORS
Lewis County Court
West Fork Soil Conservation District
Tygart's Valley Soil Conservation District
Lewis County Watershed Assoc., Inc.

KENNETH PARKER, PRESIDENT
Rt. 3, Box 273
Weston, W. Va. 26452

Ruth C. Clusen
Assistant Secretary for Environment
U.S. Department of Energy
Washington DC

RE: Draft Environmental Impact Statement
Solvent Refined Coal-II Demonstration Project
Fort Martin, West Virginia

June 30, 1980

STATEMENT

You have prepared a detailed analysis of the environmental impacts of the SRC II plant to be located near Morgantown, West Virginia. We would like to provide some input into the discussion of water supply and water quality, specifically as these relate to the Army Corps of Engineers Stonewall Jackson dam project proposed for Lewis County, West Virginia.

The Upper West Fork River Watershed Association was organized in 1974 to promote a Soil Conservation Service small watershed dam project on the tributaries of the Upper West Fork River as an alternative to the costly and land-intensive high rise Stonewall Jackson dam. We have a current membership of over 1400 people with an additional 30 endorsing agencies.

The Stonewall Jackson dam project was authorized by Congress 14 years ago, with the original studies for the project dating back to the 1930's. Mainly because of the amount of productive farmland that would be inundated, local opposition to the dam has always been strong. Previous to 1974 at which time the project was specifically exempted from certain requirements of the Flood Control Act of 1970, any work other than planning was legally barred. The project is now in the land acquisition stage; the only construction near completion involves a 3 1/2 mile stretch of new road. Budget cutbacks and the 404 permit process has held up road relocations scheduled to begin this spring. Our opposition to Stonewall has taken several forms including the recent filing of a federal lawsuit, the support of candidates for public office who share our views on the project, and the education of the public and affected landowners who face low appraisals by the

Corps of Engineers for their property. The Corps has already had to resort to condemnation for one third of the acreage it has sought to acquire.

We attended the water availability meetings for SRC II conducted by the Ohio River Basin Commission. The draft assessment of water needs and availability was largely prepared by the Corps of Engineers and the Pennsylvania Department of Environmental Resources. It stated that not enough water would be available for the commercial coal plant unless the Stonewall Jackson dam was built (to the exclusion of all other alternatives). Upon analysis it was seen that the Stonewall dam could only provide 80 cfs at the most, and that no guarantee exists that that amount of water would reach Pennsylvania without being withdrawn downstream. We pointed out that EPA had never studied the amount of water which should be included in the reservoir for low flow augmentation while maintaining the economic feasibility of the project. We sought to bring to public attention a 1970 study prepared by the Federal Water Pollution Control Administration which concluded that only 1/3 (13,300 acre-feet) the amount now allocated is required. The Corps has allocated approximately 45,000 acre-feet of storage for water quality control based on a 1965 HEW study which we believe is clearly outdated, particularly in light of the new water pollution laws. This issue is one of those addressed in our current lawsuit.

It appears that Pennsylvania cannot meet certain water quality standards particularly those relating to TDS in the Monongahela River. With the Stonewall dam they still could not meet these water quality standards consistently. Pennsylvania emphatically stated that it would oppose any move by the Corps to reallocate low flow water from Stonewall to storage for consumptive use by the SRC II plant. In other words, with a little water from Stonewall, Pennsylvania might not have to cut one of its water users or hold up a mine permit during periods of low flow. Apparently it is on this basis that they have supported the Stonewall project and are protective of its low flow allocated water.

The water availability study which the Ohio River Basin Commission finally sent to the Water Resources Council differs from the draft in that the editorializing by the Corps and Pennsylvania have been eliminated. Graphs were prepared which showed how much the dam could increase the water flow. Pennsylvania data indicates that Stonewall could provide only 4% of the projected low flow requirements needed to meet TDS standards in that state. WRC's report is not yet available. We believe that the data in your report is more nearly correct; that is, that Stonewall could reduce

ENDORSEMENT AGENCIES: Braxton County Court, Braxton County Farm Bureau, Brooks Bird Club, Kentucky Rivers Coalition, Lewis County Farm Bureau, Lewis County Livestock Assoc., Lewis County Mountaineers for Rural Progress, Mountaineer Chapter of Nat. Audubon Soc., National Wildlife Federation, Potomac Branch of Sierra Club, Save Our Mountains, State Assoc. of Soil Cons. Districts, State Soil Conservation Committee, S.P.I.R.G., W. Va. Wesleyan College, Tri-District Soil & Water Supervisor's Assoc., Tri-District Soil & Water Sub. Assoc., Uppshur County Mountaineers for Rural Progress, Uppshur County Livestock Assoc., Uppshur Sportsman Conservation Club, W. Va. Assoc. of Agriculture Industries, W. Va. Citizens Action Group, W. Va. Highlands Conservancy, W. Va. Wildlife Federation, United Mine Workers of America, American Farm Bureau Federation, United Methodist Church Board of Church and Soc., Ohio County Farm Bureau, Pennsylvania Farmer Assoc., Roane County Comm., Environmental Policy Center of Wash., D.C.

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the impact of the SRC II water withdrawals during low flow periods by .4% for the demonstration plant. In short, if the Stonewall Jackson dam were built and if the Corps' data were reliable (rather than outdated), Stonewall would only help a small amount.

Let me reemphasize our position. The Stonewall Jackson dam project is a marginal, Depression-era idea which is opposed by many West Virginians. That opposition is being felt in the political arena where candidates who oppose the dam are being elected to office. We are not unsympathetic to the water needs of our state and neighbors; nor are we blind to the energy needs of our country. But if no plans existed for Stonewall and an agency sat down to design a project to meet these water and energy needs, we submit that the result would not remotely resemble the Stonewall Jackson dam.

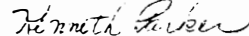
Let me also emphasize that we have always had two goals in mind - to stop Stonewall and to secure a small watershed dam project in our county. We believe that such a small dam project would provide the same amount of low flow augmentation as the big dam and would therefore serve the needs of all. We believe that saving our valuable farmland is prudent and wise, and that sacrificing our existing long-term agricultural industry is folly.

The SRC II plant does not depend on the completion of the Stonewall Jackson dam project. The need for the coal plant should not be used as a forum by the Corps, Pennsylvania and politicians who are locked into an outdated idea to mislead the public on the merits of Stonewall.

We, therefore, recommend that you study further the alternative water supply sources which you have pointed to in your draft EIS. If you should persist in your reliance on the small amount of water from Stonewall then we point out that the EIS on the SRC II plant must include a thorough study of the environmental impacts of the Stonewall Jackson dam project, including its \$170 million cost.

We submit that the multi-billion dollar coal conversion program should not be jeopardized by linking it to the controversial Stonewall project. which would create a 3400 acre lake with an average depth of 15 feet and which will probably never be built. We urge you to opt for other more realistic alternatives.

Respectfully Submitted,



Kenneth Parker, President
Upper West Fork River Watershed Association

Route 1, Box 35
Core, WV 26529
June 18, 1980

James K. Alexander
Department of Energy
SRC-II Public Hearing
P.O. Box E
Oak Ridge, Tennessee 37830

Dear Mr. Alexander:

I will be unable to attend the SRC-II hearing June 30-July 1, 1980. I have perused the draft EIS and on the basis of that and my other research, as well as broader-based concepts, I oppose and question the choice of the Morgantown site (reasons briefly below).

In a more far-reaching vein, it alarms me that the gigantic and corrupt and ineffectual bureaucracy that our good America has become, can devise no long-term, safe and sure way to keep our national culture on a stable course...the stopgap of fossil fuels/conversion, etc., is frighteningly ephemeral. The folly of our waste-based economy spells doom. We will turn back voluntarily or we will be stopped abruptly. The SRC-II, wealth- and waste-ordained, is a symbol and a forerunner of catastrophe.

But, as a technical writer, I recognize the emotion inherent in such philosophy, emotion that automatically disarms the concept of its stark reality. So, although the catastrophe is imminent and more important than any of its parts, such as SRC-II, I will ignore it and mention a few irrefutable facts that make the project seem impossible--all of which I am sure money will eradicate. Nevertheless, they include:

- Insufficient housing and suitable space to put more.
- Taxes will be raised--acknowledged by county government
- Insufficient space in schools despite EIS claims; schools poor quality despite school officials claims. Not comparable to other states.
- Roads and bridges inadequate and poor condition.
- Geographic configuration of area not suitable for dispersion of pollutants.
- Ineffective state and county government, marginally corrupt, serving development of industry, promoting citizen sacrifice; to the benefit of industrial giants and the detriment of the American citizen and his freedom of choice.
- River situation: marginal water supply--reliance on non-existent dam (commercial) inadequacy of locks.
- Misleading claims: risk/no risk ambivalence; media screwups.
- Highly suspicious promoters--conflict of interest--county development authority.
- Obvious takeover by energy conglomerates in the last big exploitation of West Virginia resources. Rockefeller, et al. Understandable and UnAmerican.

Some of these reasons are "real" enough to be obstacles; the last big reason is, the project is detrimental and in a few years most citizens will complain. I choose to do my complaining now.

Betty Wiley
Betty Wiley

446 Elm Street
Morgantown, W.Va. 26505
July 30, 1980

Dr. Larry Joseph, Director
DOE's SRC Division
Mail Station E-333
Washington, D.C. 20545

00039

Dear Mr. Joseph:

We wish to register our deep concern over the proposed SRC II plant proposed for the Morgantown area.

As pointed out by both Dr. George Pickett, State Health Director, and Mr. Carl Beard, State Air Pollution Control Director, far too much is unknown about the emissions from this process to assess its effects on the health and welfare of the citizens of this community.

We profoundly resent being used as guinea pigs for an experimental process about which there are so many unknowns. Please don't railroad us into what could be an environmental disaster.

Very truly yours,



Herbert G. and Carol Wilcox

R.D. #2
Pine Bank PA 15354
July 17, 1980

James Alexander
P.O. Box E
Oak Ridge TN 37830

Dear Mr. Alexander,

In reading over the draft environmental impact statement for the SRC-II synthetic fuel plant proposed for a site near Morgantown West Virginia I observed a serious omission in the report.

The report does not address the fact that in the future the SRC-II plant may be competing with other major water users, particularly other potential synfuel plants, for Monongahela River water. The vast coal reserves still present in the area, particularly in Greene and Washington counties in Pennsylvania, are already being eyed as potential feedstocks for synthetic fuel plants.

This EIS should address this possibility and should reflect a willingness to coordinate the use of Monongahela River water with any other potential large-scale water users. The EIS should consider alternate (supplemental) water sources for SRC-II and/or alternate plant designs, in the event that Monongahela River water might have to be shared to permit the operation of other synfuel plants downstream.

Sincerely,

Douglas B. Welker
Douglas B. Welker

LOGGED
ON LIST

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DEPARTMENT OF CULTURE AND HISTORY



STATE OF WEST VIRGINIA
JOHN D. ROCKEFELLER IV, GOVERNOR
Norman L. Fagan, Commissioner

HISTORIC PRESERVATION UNIT Clarence E. Moran, AIA, Director

July 11, 1980

0006

Dr. Larry M. Joseph, Director
SRC Division
Office of Project Management
Mail Station #E-333
Washington, D.C. 20545

Dear Dr. Joseph:

RE: Proposed SRC II Project DEIS
Monongalia County, West Virginia

My staff has reviewed the Draft Environmental Impact Statement for the proposed Fort Martin, West Virginia, plant site. Although the cultural resource situation has changed since publication of the DEIS, the Final EIS should be able to reflect the picture that is emerging.

We note that the consultation efforts of DOE with this office has been quite good.

Sincerely,


Clarence E. Moran, AIA
State Historic Preservation Officer

CEM/kfs;rw

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Comment #2
J.K. Alexander
Rec 7/21

STATE OF WEST VIRGINIA
GOVERNOR'S OFFICE
OF
ECONOMIC AND COMMUNITY DEVELOPMENT
CHARLESTON 25305

JOHN O. ROCKEFELLER IV
GOVERNOR

C. JOE MULLEN
DIRECTOR

July 8, 1980
File: PNRS-E-F
DEIS

Larry M. Joseph, Ph.D.
U. S. Department of Energy
SRC Division
Office of Project Management
under the Assistant Secretary for
Fossil Energy
Mail Station #33
Washington, D. C. 20545

Re: Draft Environmental Impact Statement - Solvent Refined
Coal-II Demonstration Project - Fort Martin, Monongalia
County, West Virginia

Dear Doctor Joseph:

As a follow up to our letter to you on above referenced project dated June 17, 1980, we are enclosing copies of the comments of Mr. Ronald Potesta, Assistant Director, Office of Fuel and Energy, Governor's Office of Economic and Community Development, and Mr. William W. Bradford, Office of Environmental Health Services, State Department of Health, for your further information and appropriate action.

Sincerely,

Daniel S. Green
Daniel S. Green
Director
Community Development

DSG:am

cc: William W. Bradford
Ronald Potesta

GOVERNOR'S OFFICE OF ECONOMIC AND COMMUNITY DEVELOPMENT
Community Development Division
WEST VIRGINIA STATE CLEARINGHOUSE
ROOM B-548, BUILDING #6
CHARLESTON, WEST VIRGINIA 25305

(DRAFT) ENVIRONMENTAL IMPACT STATEMENT
(DEIS)

TO: G. O. Fortney, Acting Director
Environmental Health Services
W. Va. Dept. of Health

FROM: Daniel S. Green, Director
Community Development

DEIS DESCRIPTION: Draft Environmental Impact Statement - Solvent Refined
Coal - II Demonstration Project

The attached (Draft) Environmental Impact Statement is referred to your agency for REVIEW and COMMENTS. If your agency has an interest in this Statement and desires to comment on it please CHECK THE APPROPRIATE BOX. Your cooperation is asked in returning this memo to the State Clearinghouse Office, indicating your interest or not, 10 days from its receipt.

- ☐ No comment (Please Indicate Reason In Space Below) ☐ Comments being developed
☒ Comments submitted herewith ☐ Comments should more appropriately (or also) come from Agency(s) as listed below.

We have reviewed the above-captioned Draft Environmental Impact Statement and also discussed it with the staff of Stearns and Rogers and the Pittsburgh and Midway Coal Mining Company.

We would recommend that a meeting be set up to brief the affected state agencies of the project's progress to date.

We expect that the appropriate permits and approvals for the water supply, sewerage and sewage disposal system and solid waste disposal will be obtained from our office with the appropriate cooperation on the project's facilities. It is requested that the consulting engineers be officially notified to work closely with this office on these environmental health problems.

CLEARINGHOUSE USE ONLY

DATE: 6/11/80
FILE NO: PNRS-F
Comments concerning this DE
should be received by this off
no later than: 6/24/80

A-161

(Please use reverse side if additional space is needed)

Reviewer's Signature *William W. Bradford*
G. O. Fortney
Title Acting Director, Office of Environmental Health Services Telephone 348-2970
Department of Health

RECEIVED
JUN 30 1980
STATE CLEARINGHOUSE COMMUNITY DEVELOPMENT
Date JUN 24, 1980

GOVERNOR'S OFFICE OF ECONOMIC AND COMMUNITY DEVELOPMENT
Community Development Division
WEST VIRGINIA STATE CLEARINGHOUSE
ROOM 8-548, BUILDING #6
CHARLESTON, WEST VIRGINIA 25305

Fuel Energy Office
(DRAFT) ENVIRONMENTAL IMPACT STATEMENT
(DEIS)

CLEARINGHOUSE USE ONLY

DATE: 6/11/80

FILE NO: PNRS-E

Comments concerning this DEIS

should be received by this office

no later than: 6/24/80

TO: John Herholdt, Director
Office of Fuel and Energy

FROM: Daniel S. Green, Director
Community Development Division

Draft Environmental Impact Statement - Solvent Refined
DEIS DESCRIPTION: Coal - II Demonstration Project

The attached (Draft) Environmental Impact Statement is referred to your agency for REVIEW and COMMENTS. If your agency has an interest in this Statement and desires to comment on it please CHECK THE APPROPRIATE BOX. Your cooperation is asked in returning this memo to the State Clearinghouse Office, indicating your interest or not, 10 days from its receipt.

- ☐ No comment (Please Indicate Reason In Space Below) ☐ Comments being developed
☐ Comments submitted herewith ☒ Comments should more appropriately (or also) come from Agency(s) as listed below.

W.Va. Air Pollution Control Commission
W.Va. Department of Natural Resources
W.Va. Department of Health

(Please use reverse side if additional space is needed)

Reviewer's Signature R. P. [Signature] Date June 17, 1980
Title Assistant Director Telephone 348-8860



WEST VIRGINIA SURFACE MINING RECLAMATION ASSOCIATION 1624 KANAWHA BOULEVARD, EAST • CHARLESTON WEST VIRGINIA 25311 • (304) 346-5318

00013

July 16, 1980

Dr. Larry M. Joseph, Director
SRC Program
Mailstop E-333
U.S. Department of Energy
Washington, D.C. 20545

Dear Dr. Joseph:

On behalf of 370 separate companies involved directly and indirectly in the coal mining industry of West Virginia, I am pleased to forward the following communication in support of the proposed SRC-II plant in Monongalia County.

With such a broad base of support in this state's major and leading industry, I strongly encourage your favorable consideration of proceeding with the construction of this plant without further delay.

Such a facility is sorely needed, not only for the benefit of that area's economy and progress, but for the entire state and as a critical first step toward the rebirth of this nation's independence. We have sacrificed our very freedom at the expense of every American, but most specifically to the detriment of the coal industry and its trained workforce.

The resource is available, the manpower to mine the resource is available, the facilities and equipment to transport the coal are available, and the need to refine the proposed technology is well documented.

Therefore, if you are counting witnesses at the hearing or letters received, please consider this communication as 370 affirmative West Virginia votes, for you to progress with SRC-II without delay. The overwhelming and tangible

Dr. Larry M. Joseph
July 16, 1980
Page 2

needs for such a plant in our state should far outweigh any environmental or sociological impacts. With the technology of today, the environmental impact should be easily minimized. Insofar as sociological impacts are concerned, I am sure you are aware that poverty and unemployment are far greater dilemmas than are those that have been expressed by the handful of Monongalia Countians.

With the sentiments of our 370 separate companies, representing thousands of West Virginians, I urge your balanced, objective and favorable review of the proposed SRC-II plant proposal.

Sincerely,

William B. Raney
William B. Raney
Vice-President

WBR/bsg

cc: Honorable Robert C. Byrd - U.S. Senate
Honorable Jennings Randolph - U.S. Senate
Honorable Robert Mollohan - U.S. Congress

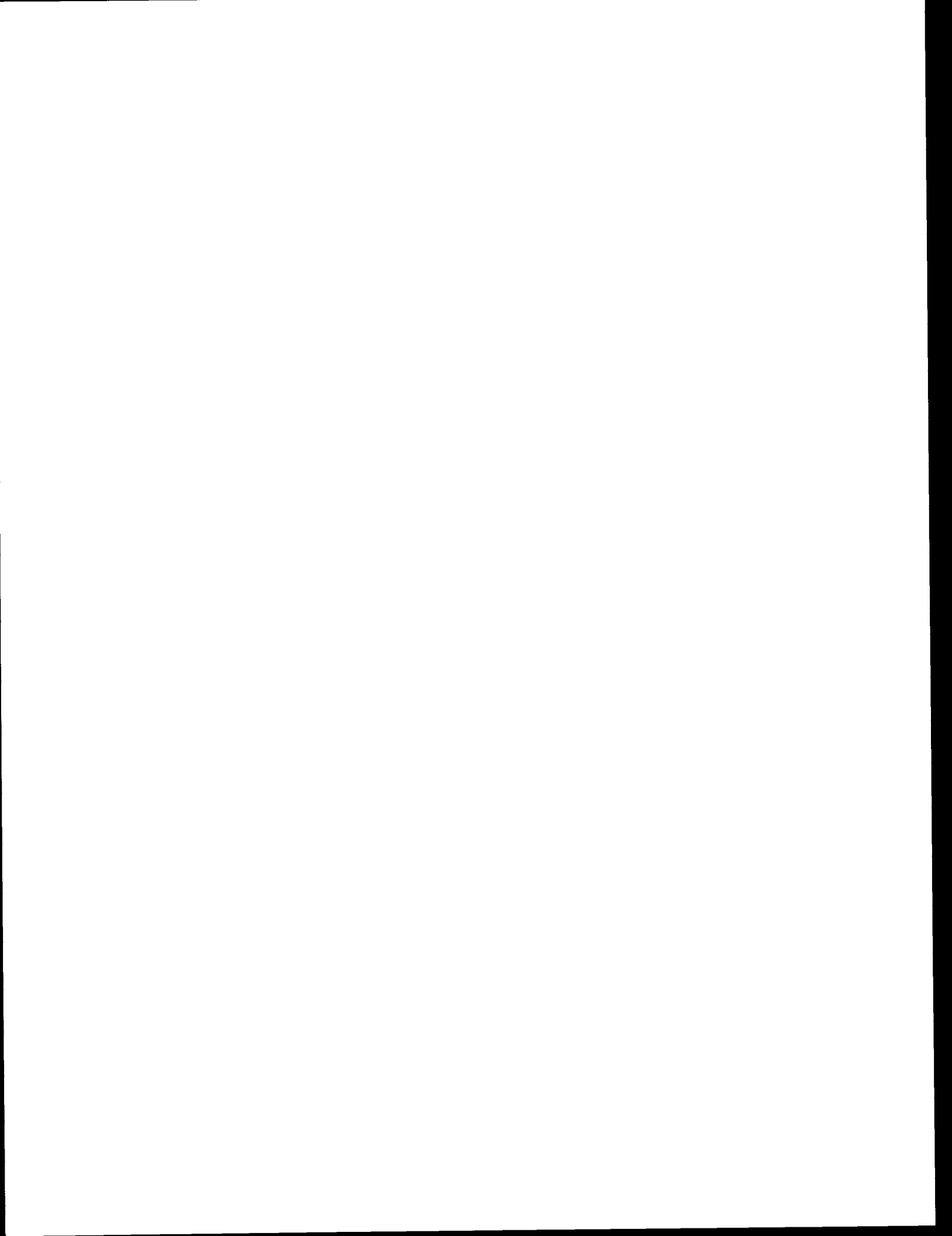
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Appendix A.3
RESPONSE TO COMMENTS

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1. PROGRAMMATIC AND POLICY ISSUES

- 1.1 Comment: No programmatic analysis of environmental issues has been prepared as required by NEPA. There is no evidence indicating that SRC program decisions are being made in consonance with a systematic environmental plan. (Commenter: 18, p. A-58)

Response: A programmatic analysis of the potential impacts of direct liquefaction and other alternate fuel technologies was contained in Sect. 1 of the DEIS and the referenced *Alternate Fuels Environmental Impact Statement* (ERDA-1547). This document was issued in September 1977 by the Energy Research and Development Administration prior to formation of the Department of Energy. Section 1 of this FEIS has been expanded to provide a more comprehensive programmatic analysis of the direct liquefaction program.

- 1.2 Comment: Alternative solutions to the "energy crisis" (i.e., conservation and solar and wind energy) were not adequately addressed. (Commenter: 8, p. A-25)

Response: As was discussed in Sect. 1.2.2 of the DEIS, the proposed SRC-II demonstration plant is only part of the program to implement the National Energy Act. This program also includes conservation and alternative energy technologies as was noted in Sect. 1.3 of the DEIS. These topics along with other programmatic options were discussed in Sect. 1.2.3 of the DEIS and in the alternate fuels EIS (ERDA-1547) noted in comment 1, as well as in the expanded Sect. 1 of this FEIS.

- 1.3 Comment: The DEIS does not address the impacts resulting from possible future expansion of the demonstration plant to commercial scale. (Commenters: 33, p. A-150; 1, p. A-12; 15, p. A-50; 9, p. A-26)

Response: The best available information regarding potential impacts resulting from commercial operation was given in the DEIS. Some additional information has been provided in Sects. 4 and C.8 of the FEIS. Also, see response to comment 1.4.

- 1.4 Comment: DOE should commit to issuing a comprehensive supplement to the final EIS if the demonstration phase is successful to address the impacts of a commercial plant at an expanded capacity. (Commenters: 28, p. A-133; 18, p. A-62)

Response: Commitments to prepare appropriate NEPA documentation before transferring the demonstration plant to the industrial partner for possible commercial expansion have been made. These are included in (1) a letter (see Appendix X) from John Sawhill, Deputy Administrator, Department of Energy, to Douglas M. Costle, Administrator, U.S. Environmental Protection Agency, September 17, 1980 and (2) U.S. Department of Energy, Solvent Refined Coal Demonstration Project (SRC-II), Contract No. DE-AC05-78OR03055, July 31, 1980, p. 113, Article XXXIV (the cost-sharing agreement). See also response to comments 2.1 and 3.1.

- 1.5 Comment: By signing the cost-sharing agreements, DOE has violated NEPA by making irrevocable commitments of resources before completing either a programmatic or a project-specific EIS. (Commenters: 15, p. A-48; 18, p. A-57)

Response: The cost-sharing agreement for the SRC-II project provides for full compliance with NEPA and limits DOE commitments of resources prior to completion of the FEIS. Articles IV, VI, and XIX of this agreement provide the limitations. Land purchases have been initiated by the industrial partner through the Monongalia Development Authority. These land purchases have been made solely by the industrial partner and are not part of any agreement with DOE. If DOE decides to proceed with the project at the proposed site, the land will be purchased by DOE. To the maximum extent possible, site-specific design work completed before issuance of this FEIS is being limited to that necessary for preparation of the FEIS and applications for permits required for construction. Site-specific environmental studies necessary for preparation of this FEIS have also been completed.

- 1.6 Comment: It should be made clear that this project alone will not significantly decrease our nation's dependency on foreign oil supplies. Figures showing the amount of fuel (boiler fuel) this plant will produce in its different stages and how much fuel (boiler fuel) is consumed yearly in the United States should be supplied. (Commenter: 8, p. A-25)

Response: The proposed SRC-II demonstration plant is intended to prove the technical, economic, and environmental feasibility of a solvent-refined coal process. The various products produced by the demonstration plant are shown in Table 2.1 of the FEIS. About 9000 bbl of fuel oils are expected to be produced each day that the demonstration plant is operating at capacity. This quantity of fuel oil is only a fraction of a percent of the fuel oil consumed yearly in the United States. However, if proven feasible in the demonstration phase, subsequent commercial-size plants could make significant contributions to future U.S. oil supplies.

- 1.7 Comment: DOE should hold meetings to brief the affected state agencies of the project's progress and work closely with them in obtaining permits and approvals for water supply, sewage and sewage disposal system, and solid waste disposal. (Commenter: 40, p. A-161)

Response: DOE has held public meetings as well as discussions with local, state, and Federal officials. DOE will continue to work closely with the various state and Federal agencies in obtaining the necessary permits for the project (see Appendix R for the schedule for permit procurement). See also response to comment 3.1.

- 1.8 Comment: DOE should arrange a small private information meeting with local residents of the Fort Martin area to discuss the impacts of the project. (Commenter: 6, p. A-23)

Response: As was noted on p. xv of the DEIS Summary, DOE held public scoping meetings on June 26, October 22, and October 23, 1979, to obtain public input prior to writing the DEIS. A public hearing was also held on June 30 and July 1, 1980, after the DEIS was issued. In addition, DOE participated in a public meeting held in Morgantown on December 8, 1980, which was sponsored by the University of West Virginia's Public Interest Research Group. DOE is also planning to participate in future meetings with local residents to discuss the project.

- 1.9 Comment: Due to its involvement in the project, DOE may have a conflict of interest in preparing the EIS. (Commenters: 8, p. A-25; 17, p. A-53)

Response: DOE is complying with Federal laws and regulations in preparing the EIS. The National Environmental Policy Act of 1969 (NEPA) directs agencies of the Federal government to prepare a detailed statement (EIS), where appropriate, on major Federal actions significantly affecting the human environment (Sect. 102). Council on Environmental Quality (CEQ) regulations implementing NEPA (*Fed. Regist.* 43: 55978-56007, Nov. 29, 1978) detail the specific procedures to be followed. The agency proposing the federal action is responsible for the preparation of the EIS. For the SRC-II project, DOE is the responsible agency.

- 1.10 Comment: The draft states on page xix that within limitations DOE has a broad authority to modify the proposed project. Do the limitations extend to the size of the facility? The EIS fails to mention any flexibility in operation other than the 6000 tpsd. (Commenter: 28, p. A-142)

Response: DOE specified a 6000-tpsd module as the size of plant necessary to substantiate commercial viability of SRC-II technology for such systems as coal handling and drying, coal liquefaction, solids separation, refining, gas treatment, and hydrogen production by gasification in a fully integrated plant. Successful operation of the 6000-tpsd module in an environmentally acceptable manner will provide technical and economic data for direct scaling to a nominal 30,000-tpsd commercial plant. Design provisions enable the demonstration plant to operate down to 25% of capacity (1500 tpsd of coal). This is described in the revised Appendix C, Sect. C.2.18, of this FEIS.

- 1.11 Comment: DOE failed to make important documents available: (Commenter: 18, p. A-63)

- 5 vols. of phase zero deliverables,
- cost-sharing agreement of July 30, 1980,
- Battelle health studies, and
- Water Resources Council Water Study, June 27, 1980.

Response: As they became available, pertinent documents referenced in the DEIS were made available to the DOE reading rooms and public libraries identified in Sect. 5 of the Summary in both the DEIS and FEIS. Specific comments related to the availability of documents noted follow:

5 vols. of the phase zero deliverables

The 5 vols. not included at the time the DEIS was issued contained no environmental data germane to the environmental impacts analysis. These volumes were Deliverable No. 3, Section 10, Confidence Analysis; Deliverable No. 10, Management Plan; Deliverable No. 11, Task Control Plans; Deliverable No. 13, Cost Sharing Plan; and Deliverable No. 15, General Reports.

The first three of these deliverables were subsequently provided as reference materials. The Cost Sharing Plan contains company-sensitive information and, since no pertinent design or environmental considerations are involved, this deliverable has been withheld from distribution. Deliverable No. 15 was established in error and no contractor deliverables were submitted to DOE.

Cost-sharing agreement of July 30, 1980

The cost-sharing agreement was being negotiated during the period following DEIS issuance and was not available for public review until after the public comment period for the DEIS. Copies are now available in the referenced locations, and the contract is a reference document for the FEIS.

Battelle health studies

A Battelle-issued report entitled *Biomedical Studies on Solvent Refined Coal (SRC-II) Liquefaction Materials: A Status Report*, July 1979, was made available in the referenced locations and through distribution of DOE reports. Subsequent reports issued by Battelle and approved by DOE have also been made available in the referenced locations and from the National Technical Information Service, Springfield, Virginia.

Water Resources Council (WRC) Water Study, June 27, 1980

DOE made available on June 27, 1980, with the consent of the WRC, the report by the Ohio River Basin Commission. This ORBC staff report was submitted to WRC for their use in preparation of the formal WRC report, which was issued for public comment on August 21, 1980 (*Federal Register*). The WRC report did not differ substantially from the ORBC study. The WRC issued a final 13b assessment on Jan. 9, 1981.

2. GENERAL COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT

- 2.1 Comment: DOE should reissue the DEIS and/or postpone issuance of the FEIS in order to accommodate final design and completed reports. (Commenters: 18, p. A-65; 8, p. A-25; 15, p. A-48; 28, p. A-142)

- schedule completion to follow completion of final design (28, p. A-133)
- publish interim environmental and design reports (28, p. A-133)
- references incomplete studies of acute hazards to work force and population (18, p. A-63)
- prevents decision maker from arriving at a fair decision (18, p. A-64)

Response: DOE believes that the FEIS must be completed prior to a decision to proceed with major detailed design and the commencement of construction. Completion of final design is considered a major Federal action since it is projected to cost approximately \$200,000,000. In order to make a decision prior to final design, incomplete information is an unavoidable condition in the early stages of a demonstration project such as SRC-II. While some studies on various aspects of the project have been completed, others are under way. Additional studies will be initiated if problem areas are identified as the demonstration program proceeds. DOE is committed to the following:

1. Where complete information relevant to the assessment of environmental impacts is not currently available, DOE has included a worst-case analysis.
2. DOE will employ a tiered approach to NEPA compliance and perform supplementary NEPA reviews, as necessary, to address the environmental impact of items not within the scope of the FEIS (letter from John Sawhill, Deputy Secretary, DOE, to Douglas M. Costle, Administrator, EPA, September 17, 1980). (See Appendix X.)

- 2.2 Comment: The comment period was too short. (Commenter: 18, p. A-107)

Response: The 45-day comment period is consistent with the time period for public comment specified by CEQ and was extended to 60 days (May 30 – July 31) by DOE.

- 2.3 Comment: Information concerning the December 19, 1979, product spill at the Fort Lewis pilot plant should be discussed in the EIS. (Commenter: 18, p. A-80)

Response: Data obtained from monitoring the Fort Lewis spill and its environmental effects are discussed in the new Appendix Z. Details on the spill are available in a report by Radian Corporation, which is entitled *Remedial Measures Plan for a Spill of SRC Liquid at the SRC Pilot Plant, Ft. Lewis, Washington*. This report is available at the locations identified in Sect. 5 of the Summary.

The SRC-II storage area for the demonstration plant will be diked and the floor lined with an impervious material, and effluents will be routed to the wastewater treatment system.

The spill prevention and containment systems proposed for the demonstration plant are discussed in Sect. 4.1.3.1 of the text, and Sects. C.2.16 and C.3.5.3 of revised Appendix C.

- 2.4 Comment: A single system of units of measure (cubic feet per second, gallons per second, cubic meters, etc.) should be used. (Commenter: 28, p. A-134)

Response: This problem appears to result from the use of metric units. The DEIS used the metric system with English conversions in parentheses. Units of measure related to water will vary depending on the subject area, for example, streamflow (cfs), well discharge (gpm), and water supply (mgd). A conversion table has been added as Appendix CC of this FEIS.

- 2.5 Comment: The Draft EIS does not contain a logical comparison of the research project's benefits with expected environmental, economic, and social impacts or safety risks. Environmental Impact Statements are to be used as decision-making tools and, therefore, must clearly outline to the public what will be achieved and what precautionary or mitigative measures can be taken to offset unavoidable impacts. (Commenter: 28, p. A-133)

Response: The project's benefits and risks were specifically included in the Summary of the DEIS and examined in detail in appropriate sections of the text. Sect. 1 (Purpose, Need, and Status) of the DEIS included a detailed discussion of what the project hopes to achieve in both a programmatic and project-specific context. Mitigating measures were discussed in Sect. 4.6. These subjects are also included in the revised and expanded Summary and Sects. 1, 4.5, and 4.6 of this FEIS.

- 2.6 Comment: The DES does not indicate "any irreversible and irretrievable commitments of resources involved in the proposed action should it be implemented." (Commenter: 9, p. A-26)

Response: Resource requirements related to construction and operation were specifically included in Appendix C (p. C-43) of the DEIS. Other resources (land, air, water, etc.) were discussed throughout Sect. 4.2 of the DEIS. Resource requirements are included in Sect. 4.2 and C.6 of this FEIS.

- 2.7 Comment: References to the proposed Roundbottom coke plant should be both consistent and correct, not Fairmont Energy Corporation Coke Plant (4-38) or Alla Ohio Coke Plant (4-39). (Commenter: 16, p. A-52)

Response: All text has been revised in the FEIS to correctly identify the coke plant as the Fairmont Energy Corporation coke plant.

- 2.8 Comment: The DEIS does not satisfactorily assess the short-term or long-term cumulative impacts of the SRC-II project. (Commenters: 9, p. A-26; 16, p. A-52; 26, p. A-130)

Response: Consideration of cumulative impacts has been included in revised Sects. 4.2.3 (Air Quality), 4.2.2.1 (Water Use), and 4.2.4 (Social, Economic, and Cultural) of this FEIS. Any cumulative impacts associated with the proposed plant are expected to be small.

- 2.9 Comment: In accordance with CEQ guidelines we believe at least a summary of the evaluation by the Water Resources Council, the report on noise impacts, and the final site plans for solid waste should be included in this Draft EIS not in the final as stated. (Commenter: 30, p. A-144)

Response: A summary of the WRC report has been included in Sect. 4.2.2.1 of the FEIS. See also response to comment 1.12. Based on design information developed since the DEIS was issued, the report on noise impacts has been completed. It is included as Appendix W of the FEIS and is summarized in revised Sect. 4.2.3.2 of the FEIS. Final site plans for solid waste are part of the final design program for the project and will be done with the concurrence of EPA as indicated in response to comment 2.1 and FEIS Sects. 2.2.1 and 4.6 and Appendix C, Sect. C.3.7. See also the response to comment 3.25.

- 2.10 Comment: The DES is not well documented. Most of the information does not rely on scientifically obtained evidence. The statement does not utilize a "systematic, interdisciplinary approach" as called for in the National Environmental Policy Act of 1969. The background of those who prepared the socioeconomic section and the DES material itself do not reflect knowledgeable use of current sociological, psychological, economic, and political science concepts. Clearly absent is socio-psychological analysis of costs and benefits of SRC-II. There is existing professional literature of this general topic which does not appear to be reflected in the report. (Commenter: 9, p. A-26)

Response: As was noted in Sect. 5, the DEIS was produced by an interdisciplinary team with experience both in scientific specialties and in environmental impact assessment.

The socioeconomic analyses have been revised to accommodate relevant comments received on the DEIS (Appendix A.8).

- 2.11 Comment: The EIS does not consider the effects to miners or the community of increased coal mining, referring to a couple of national studies on the environmental impact of strip mining. Will the additional coal come from strip or deep mines? And what will be the specific impacts here? (Commenter: 15, p. A-50)

Response: The proposed action will not require the opening of a dedicated coal mine or significant expansion of existing mines to supply the necessary feed coal. Therefore, mining impacts at specific mines are not addressed in this statement. However, because regional mining impacts will increase incrementally as a result of this project, these are discussed generically and on a regional basis in Appendix BB and Sect. 1.4.3.5. There will be no effects from increased coal mining to the local community, because coal for the project is expected to come from existing mines in the northern West Virginia panhandle and adjacent eastern Ohio area.

As discussed in Appendix C, Sect. C.2.1, coal from mines in the Morgantown area has been tested in the SRC-II process and been found to produce 25 to 30% less oil than the coal to be used in the demonstration plant. Future research may allow the economic use of Morgantown area coal in a commercial facility. If this occurs, the impacts of mining coal in the local area would be addressed at that time as discussed in response to comment 1.4.

3. PLANT DESIGN AND ENGINEERING

- 3.1 Comment: Because of the lack of final plant design data for the SRC-II project it will become necessary to expand, revise, and correct previous statements. Design specifications critical to evaluation of environmental, safety, and health impacts of the plant and the adequacy of proposed controls and mitigation measures are not available. (Commenters: 18, p. A-66-69; 28, p. A-142)

Response: A tiered approach to NEPA compliance will be followed, in which final design data as they become available are given in interim reports to EPA and made publicly available and in which the impact analysis is compared with the worst-case impact analysis given in this FEIS. Based on design or operating information, DOE will make a determination as to whether supplemental NEPA review is required. Also see Sect. 2.2.2.1 and Appendix X and the responses to comments 1.4 and 2.1.

- 3.2 Comment: Several areas are unspecified for controls, and EPA believes many of these will need attention. These are listed here with a suggestion for control system: (Commenter: 28, p. A-139)

1. Conveyor transfer points: vacuum hood with venturi scrubber.
2. Coal pile fires: rapid use of coal; isolation with quenching.
3. Coal recovery from storage: (storage alternatives are delineated, but a decision is yet to be made; transfer equipment depends on this decision).

Response: 1. Conveyors will be covered and transfer points enclosed for anti-wind dusting. The water-scrubber approach was ruled out as discussed in revised Appendix C, Sect. C.3.1.1, of this FEIS.
 2. Rapid turnover of coal stocks will alleviate coal pile fires.
 3. Drum type reclaim of coal will be used as described in revised Appendix C, Sect. C.2.1, of this FEIS.

- 3.3 Comment: Section 2.3.2.1, p. 2.27 — If the potential reductions in SO₂ warrant further consideration of alternative systems before completion of the final design, why are these alternatives not decided on before the EIS is completed? (Commenter: 30, p. A-144)

Response: The discussion of alternative SO₂ control systems has been expanded and is discussed in revised Appendix C, Sect. C.3.2.1, of this FEIS. This is highlighted in Sect. 2.3.2.1, which identifies alternative designs and incomplete designs requiring further evaluation. See the response to comment 2.1 also.

- 3.4 Comment: Zero discharge appears to be strictly conceptual in design, developed during phase "0" studies. It does not appear from the DEIS to be based upon any experimental work, and, therefore, doubt exists as to its acceptability. The DEIS does not effectively address how any water that did have to be discharged would be tested, in the event that zero discharge could not be maintained; this is felt to be a major potential problem area. (Commenter: 28, p. A-135)

Response: The zero-discharge design was included in the phase 0 conceptual design. Plant design has evolved since that time, and the current design, described in revised Appendix C, Sects. C.2.11 and C.3.6, provides for tertiary treatment and discharge of treated wastewater when river water quality will permit (about 95% of the time based on current estimates). Monitoring during operation will be part of the demonstration program. Both river water and the treated wastewater discharge will be monitored. The constituents of principal concern will be TDS, sulfate, and selenium. Many other constituents will be measured, including organics, metals, and trace elements. Process monitoring is discussed in Sect. 4.5.4, and water quality monitoring is discussed in Sect. 4.5.3.3 of this FEIS. By providing evaporation and brine storage or disposal, the elimination of discharge will be possible during times when the river cannot assimilate the treated wastewater without violating instream water quality standards.

- 3.5 Comment: Page xxxviii — Why will the project be in the detail design phase before a decision to go to zero discharge is made or to decide what type of pressure venting will be used for emergencies? (Commenter: 30, p. A-144)

Response: The decision has been made during the EIS process to propose a plant that will discharge treated wastewater whenever permissible (see Comment 3.4). Refer to revised Appendix C, Sect. C.3.5.4, for the vent and flare system. Details of vent valves and rupture discs will be generated during final design.

- 3.6 Comment: Section 4.1.1, p. 4-3, paragraph 2 — As it appears that hydrotreating will eventually be needed, why isn't a complete assessment made now? (Commenter: 30, p. A-145)

Response: The purpose of the demonstration project is to produce boiler fuel. Hydrotreatment capabilities are not planned for the demonstration facilities because hydrotreatment of the boiler fuel product would result in an upgrading of the product to gasoline or aviation fuel. For further information on the purpose of the project, see Sect. 1.3. As noted in Sect. 4.1.3.10 of this FEIS, preliminary results of health effects studies on hydro-treated SRC-II products are currently available and more exhaustive detailed studies are planned. At this time there is insufficient data to ascertain whether the currently proposed products from the demonstration plant will present health risks greater than those for many existing articles of commerce given the procedures planned for storage, transport, and end use of SRC-II products. As results of health effects studies and hydrotreating design studies become available, the necessity and viability of hydrotreating for commercial plants will be assessed.

- 3.7 Comment: The water reclamation system is not detailed with regard for energy needs. (Commenter: 28, p. A-136)

Response: An energy balance for the water treatment system will be prepared during final design. Evaporation is energy intensive, but the use of the zero-discharge operating mode may be necessary only 5% of the time for the demonstration plant as discussed in Appendix C, Sect. C.4.2.2 of this FEIS. The availability of excess 50-psi steam (from waste heat recovery) within the plant will influence the choice of evaporator type.

- 3.8 Comment: Storage tanks and major process units should be provided with primary containment consisting of a dike with impervious walls and floors; secondary containment (apparently consisting of the runoff collection system) should also be provided. (Commenter: 28, p. A-136)

Response: Primary and secondary containment are provided in the design and are described in revised Appendix C, Sects. C.2.16 and C.3.5.3, of this FEIS.

- 3.9 Comment: Page xxviii, paragraph 1. The disposal method of hazardous materials should be clearly identified prior to making recommendations on the project. (Commenter: 33, p. A-151)

Response: The proposed disposal methods are detailed in revised Appendix C, Sects. C.2.17 and C.3.7, and Sects. 2.2.1 and 2.3.2.1 of this FEIS.

- 3.10 Comment: Page xxvii. Alternative designs recommended for further evaluation. The evaluation concerning the use of alternatives should be concluded prior to making a decision on the least environmentally damaging alternative and the project as a whole. (Commenter: 33, p. A-151)

Response: Revised Appendix C, Sect. C.3, of this FEIS includes an evaluation of alternatives. The Record of Decision will select among the alternatives evaluated in the FEIS.

- 3.11 Comment: The Final EIS should include planned specifications for maximum permeabilities acceptable for the liners beneath the coal storage and solid waste disposal areas, in order to permit a more adequate evaluation of the potential for groundwater impacts. (Commenter: 33, p. A-152)

Response: Revised Sect. 2.2.1 and Appendix C, Sect. C.3.7.1, describe liner permeability for wastes and coal storage which is equal to or more stringent than proposed RCRA requirements. Geotechnical work is currently underway to verify that site soils can be compacted to this permeability. If the soils cannot be adequately compacted, suitable soils from off site or a liner material will be used.

- 3.12 Comment: Page C-36. Slag disposal area design. What is the life expectancy of this area? Was the area designed for the life of the project or just for the demonstration facility? If additional areas are needed, where will they be located? What alternative sites were considered? (Commenter: 33, p. A-153)

Response: The slag disposal area will be of sufficient size and capacity to dispose of the slag generated throughout the demonstration period plus 25 years of operation of an expanded commercial plant with a capacity of 30,000 tons of coal per day. Alternative disposal areas within the site boundary were considered.

- 3.13 Comment: Page 2-26. It is our understanding that the Texaco gasification process has been chosen. This paragraph should be modified accordingly. (Commenter: 31, p. A-147)

Response: Revised Appendix C, Sect. C.2.8, specifies use of Texaco gasification. The paragraph has been modified accordingly.

- 3.14 Comment: Page 2-9. Under the heading "Gasification" the statement is made that a variety of carbon sources including coal and oil can be used as gasifier feed. This is an extremely broad statement. (Commenter: 31, p. A-147)

Response: Flexibility of the Texaco partial oxidation process as regards feedstock (oil, gas, and coal) has been demonstrated in multiple installations. As discussed in Appendix C, Sect. C.2.8, consideration is being given to providing for alternative feeds for periods such as plant startups, when mineral-residue slurry feed is not available.

- 3.15 Comment: Page 2-32 and following. Throughout the entire report, the decision is reiterated to discharge no liquid streams. This means that the chemical dump becomes the repository for all waste chemicals which evolve from the process. Somewhere emphasis should be made that the solid wastes are an unknown mixture and are being treated very, very carefully. (Commenter: 31, p. A-147)

Response: Solid wastes were discussed in Appendix C, Sect. C.1.3, of the DEIS. The design now specifies selective discharge of treated wastewater, when river conditions permit (about 95% of the time) and zero-discharge operation when necessary. Zero-discharge operation would produce a brine. Brine disposal is described in revised Appendix C, Sect. C.3.7.2, and is highlighted in Sect. 2.3.2.1 as an area of uncertainty requiring further evaluation during the detailed design phase. Sludges or brines from the wastewater treatment system will be disposed of in accordance with RCRA requirements.

- 3.16 Comment: The EIS fails to mention any flexibility in operation for other than the 6000 tpsd, while in reality such alternative capacity is probably being designed in. In fact, flexibility in design capacity may serve to achieve a much better handle on environmental issues as well as operational parameters. (Commenter: 28, p. A-142)

Response: Capability of turndown to 25% of capacity (1500 tpsd) is discussed in revised Appendix C, Sect. C.2.18. See the response to comment 1.10 also.

- 3.17 Comment: Regarding the sulfur by-product, discuss the storage location relative to heat and water sources, and the location of the market. (Commenter: 28, p. A-142)

Response: Appendix C, Sect. C.2.16, described enclosed sulfur storage and rail shipment. This system comprises standard commercial equipment for by-product sulfur operations. The ultimate market location is not known at this time but would normally be a sulfuric acid plant.

- 3.18 Comment: Section 4.1.3.2, p. 4-5, paragraph 2, lines 5-6 — "routine process emissions can be reliably controlled with existing technology. . ." NIOSH states that coal liquefaction pilot plant technology has shown the need for improvement in materials of construction, piping and pressure vessels, rotating equipment, seals, valves, instrumentation, solid/liquid separation techniques. With the exception of seals, none of these design questions are addressed in the DEIS. (Commenter: 30, p. A-145)

Response: More detailed discussion of mechanical considerations is presented in revised Sect. C.3.9 of this FEIS. In addition, the Fort Lewis programs continue to generate operational experience, which will result in improved designs. Other DOE programs (EDS, METC, H-Coal, Wilsonville, etc.) also generate operational data of benefit to design and operation of the SRC-II demonstration plant. The proposed strategy for reducing fugitive emissions and leaks is also discussed in Sect. 4.1.3.3 and Appendix C, Sect. C.3.5.1.

- 3.19 Comment: Several areas where hydrocarbons may escape are either ignored or incompletely described regarding specific controls including (1) leaking equipment; (2) low pressure valves; (3) high pressure valves; (4) vents; (5) storage tank vent vapor; (6) piping leaks; (7) flange leaks; (8) safety relief valves; (9) control valves; and (10) pumps. These should receive attention. (Commenters: 18, p. A-71; 28, p. A-139)

Response: Section 4.1.3.3 and revised Appendix C, Sects. C.3.5.1, C.3.5.2, and C.3.9, describe fugitive emissions and mitigating measures.

- 3.20 Comment: Page 4-34. Why was the design of the demonstration plant carried to reduce fugitive hydrocarbon emissions to only 90 tons per year? (Commenter: 31, p. A-147)

Response: A detailed discussion of design considerations was presented in Appendix C, p. C-17, of the DEIS. The best available data (EPA's Radian study — EPA-600-2-79-044 — on fugitive emissions) was used to arrive at the 90-tons-per-year value. This is also discussed in revised Appendix C, Sect. C.4.1.8 of this FEIS. Future design work may arrive at a lower number. Additional information is contained in the PSD Permit Application and supplements thereto.

- 3.21 Comment: One extremely important question is the degree to which fugitive emissions can be captured and routed to the controlled combustor. The DEIS provides some indication that this will be done with some of the emission points, but it is not possible to appraise what untapped opportunities may exist, since no significant design information is available. (Commenter: 18, p. A-91)

Response: Appendix C, Sect. C.4.1.8, of this FEIS discusses sources of fugitive hydrocarbon emissions. Section 4.1.3.3 discusses engineering controls of fugitive hydrocarbon emissions. Also, Appendix C, Sect. C.3.5.4, of this FEIS discusses the controlled combustor/flare system.

- 3.22 Comment: Detailed design information on the controlled combustor and flare is needed to determine the adequacy of the system. (Commenter: 18, p. A-91)

Response: Revised Sect. C.3.5.4 provides expanded discussion of the controlled combustor/flare system. Detailed information is also contained in the PSD Permit Application and supplements submitted to EPA Region III.

- 3.23 Comment: Insufficient data is given to determine a "materials balance" for the potentially dangerous substances in the SRC-II process. Few design details have been offered. An inadequate basis has been given on which to judge the effectiveness and completeness of measures to contain or destroy toxic organic chemicals or trace metals that may escape into the workplace, the air, water, or groundwater, or the cost of alternatives. (Commenter: 18, p. A-81)

Response: Section 4.1.3 of this FEIS discusses sources of exposure and control plans for dangerous substances found in the SRC-II process. Appendix C has been revised and expanded to include additional information on the effectiveness of measures to contain or destroy materials of concern, including a discussion of nonmethane hydrocarbons with a boiling point above 600°F. This fraction is believed to be more biologically active than lower boiling point fractions. Detailed material balances will be prepared during the detail design phase of the project. See responses to comments 2.1 and 3.1.

- 3.24 Comment: Wet evaporative cooling is stated as "creating a potential pathway for process materials (including carcinogenic compounds) to be emitted to the atmosphere through the cooling system." Yet, it is also stated that alternative systems are presently available and commercially proven which could reduce or eliminate this potential. Why not use this proven system if it would reduce human and environmental exposure? (Commenters: 18, p. A-92; 30, p. A-144)

Response: Alternative design arrangements will continue to be considered to minimize the low potential for carcinogens to escape to the atmosphere through the cooling system. Revised Sects. C.3.5.5 and C.2.10 discuss cooling alternatives and the decision to use indirect cooling on process streams that contain appreciable concentration of materials with high boiling points. Circulating water contaminant monitoring systems will be used as discussed in Sect. 4.5.4 of this FEIS. Waste heat recovery and aerial coolers will be used for reduction of potential drift generation, icing, and fogging. Revised Sect. 4.2.3.1 includes a discussion of fogging/icing impacts. Cooling tower location selection is based on minimizing interaction with SRC plant operation and with commercial high-voltage transmission from Fort Martin power plant and Highway 53.

- 3.25 Comment: The chemical composition of the slag, the precise methods and locations for disposal, and plans for indefinitely monitoring the disposal sites if/when SRC-II is closed down are all left out of the EIS. (Commenters: 15, p. A-51; 30, p. A-146)

Response: The DEIS contained all available data, which have been retained in this FEIS, including (1) analysis of slag leachates (Appendix K); (2) location of the solid waste disposal area (Fig. 2.2); (3) cross-sectional diagrams of the disposal area (Fig. 2.5), and the liner (Fig. C.12, Appendix C); (4) the topography of the slag disposal area (Fig. C.11, Appendix C); (5) a discussion of soils and their attenuating capacity in the vicinity of the disposal area (Appendix L); (6) the analysis of groundwater quality impacts (Sect. 4.2.2.2); and (7) baseline geologic and soils information (Sect. 3.2.1.2). Monitoring is discussed in Sect. 4.5. If the disposal site is determined to be a hazardous waste management facility, ultimate monitoring and maintenance of the site will be accomplished through the Closure Plan required by State and Federal laws.

- 3.26 Comment: If the process heat boilers are to be built without the best available particulate emission controls, then DOE and the industrial partner must make a binding commitment to use only gaseous fuels. (Commenter: 18, p. A-74)

Response: The PSD Permit Application submitted to EPA region III and the West Virginia Air Pollution Control Commission (APCC) is based on the use of hydrotreated naphtha/desulfurized plant gas as fuel. Diversion of the naphtha to a plant product is being considered. If this occurs, plant fuel will be totally desulfurized plant gas.

- 3.27 Comment: Additional controls should be used in some cases. Where double or tandem mechanical seals with a flushing liquid cannot be used, a single seal with a flushing liquid should be used. Welded connections should be used as often as possible. Sealed bellows and diaphragm valves should be used as often as possible. Control of SO₂ and NO_x should be pursued with a goal of reducing these emissions to a minimum. Control of particulate matter should start with a level representative of the current state of the art and then be developed to provide information for possible future expansions. (Commenter: 5, p. A-21)

Response: Controls are discussed in revised Appendix C, Sect. C.3 of the FEIS and also in the PSD Permit Application and supplements submitted to EPA region III and the West Virginia APCC. Specifics regarding seals, valves, and connections are detail design considerations and will be developed at that time. All data from the demonstration plant will be used should future expansion of the facility occur.

- 3.28 Comment: The DES states that the question whether to buy electricity from elsewhere or to build a generator onsite has not yet been decided. This is major design decision that must be made before an adequate EIS can be prepared. (Commenter: 18, p. A-75)

Response: Onsite generation is proposed as the basis for worst-case air quality analysis for the FEIS. The final design decision is still pending (see revised Appendix C, Sect. C.2.14 and PSD Permit Application, supplement 4).

3.29 Comment: Page 4-28. No mention is made about disposal of incineration ash. (Commenter: 31, p. A-147)

Response: A wastewater sludge incinerator is part of the proposed design. Incineration ash disposal is discussed in revised Appendix C, Sect. C.3.7, of this FEIS.

3.30 Comment: Page 4-74. The storage area grade level appears to be much higher than necessary. (Commenter: 31, p. A-147)

Response: The grade level will raise the proposed storage area above the 500-year flood elevation to the same elevation as the existing railroad bed. Rail sidings will be added for product transport. (See Appendix D.)

3.31 Comment: Section 4.1.3.2, p. 4-8, paragraphs 2 and 3 — No mention is made of testing for hazardous adsorbed hydrocarbons or carbon particles during SRC combustion tests. (Commenter: 30, p. A-146)

Response: Combustion tests that were presented in Appendix C, Sect. C.4, of the DEIS did not include testing for hazardous adsorbed hydrocarbons during combustion but did measure polycyclic organic matter (see revised Appendix C, Sect. C.7). Tests for hazardous adsorbed hydrocarbons are planned and will be conducted prior to end-use application of the demonstration plant products.

4. SAFETY AND ACCIDENTS

- 4.1 Comment: DOE must perform a safety system analysis before preparation of the EIS. As DOE and P&M complete the plant design, they should perform a fault-tree system analysis and failure-mode evaluation of the proposed project. These techniques will provide sufficient safety data for inclusion in the new or supplemental EIS for the plant. (Commenters: 4, p. A-17; 18, p. A-96-97; 12, p. A-32; 30, p. A-145)

Response: It is difficult to perform a meaningful safety analysis without benefit of final design decisions. A safety system analysis is an integral part of the detail design and therefore cannot be completed at this time. Should the safety analysis disclose significant environmental impacts outside the scope of this FEIS, supplementary NEPA reviews will be performed as necessary. As discussed in Appendix AA of this FEIS, DOE will undertake a Hazards Evaluation Program for this project. The Safety Program Summary, a deliverable in the contract, will be completed by January 31, 1981. This report will describe the elements of the formalized Hazards Evaluation Program, including methods and procedures used for performing such evaluations at each stage of the program.

- 4.2 Comment: Several statements are made that chronic exposures are of greatest concern. While it is true that chronic low-level exposures are a major concern, acute life-threatening exposures to such gases as carbon monoxide, hydrogen sulfide, or hydrogen cyanide, from leaks and during maintenance, should be of greater concern. (Commenter: 30, p. A-144)

Response: The text has been revised to reflect this comment. See Sect. 4.1.3.7 and Appendix C, Sect. C.3.8 (Toxic Gases), of this FEIS.

- 4.3 Comment: If there is a fire at the SRC-II plant, will Gulf Oil depend on the volunteer fire department? (Commenter: 15, p. A-51)

Response: No. The plant will have fire fighting equipment on hand and trained personnel on duty during all shifts. It is expected that the plant would utilize supplemental support from the Morgantown Fire Department, which is not a volunteer group.

- 4.4 Comment: Section 2.3.1.1, p. 2-16 — How close will storage of materials be to residences? (Commenter: 30, p. A-144)

Response: Figures 2.2 and 2.3, Sect. 2.2, of this FEIS shows the plant layout map, and Fig. 3.2, Sect. 3.2.1.3 includes the location of nearby residences. As discussed in revised Appendix C, Sect. C.2.16, the nearest resident will be located 153 m (500 ft) from product truck storage, and the next closest resident would be located 763 m (2500 ft) from product rail storage.

- 4.5 Comment: The possibility of major explosions, as have occurred at other similar plants, or a prolonged release of toxic gases, is not mentioned, nor are potential impacts on the community addressed. (Commenter: 15, p. A-48)

Response: Appendix AA of this FEIS presents the Preliminary Hazards Identification and DOE's plans to conduct a Hazards Evaluation Program culminating in a formal Safety Analysis Report. Revised Sect. 4.1.3.2 also discusses the hazards associated with emergency events. See also responses to comments 4.1 and 3.1.

- 4.6 Comment: There is no mention of an evacuation plan for the area. How will we know when to leave and where to go? Who decides if there is an "emergency"? (Commenter: 15, p. A-48)

Response: As with any plant of this type, an emergency plan will be developed by DOE prior to start-up. It will include arrangements for assistance from local law enforcement, fire protection, hospital, ambulance and helicopter organizations in the event of an emergency such as fire or explosion. If a threat exists to the surrounding community, the same organizations would function to alleviate the effect and to carry out preventive, selected evacuations if such became desirable.

- 4.7 Comment: What is the legacy of accidents and hazards associated with technologies similar to SRC-II? What safety precautions will be taken? (Commenter: 15, p. A-51; 24, p. A-128)

Response: Many of the systems used in the plant are systems commonly used in other industries, such as fossil power plants, petrochemical refineries, and steel plants. These systems are identified in Table AA.2, Appendix AA of this FEIS. The design of the unique systems of the plant, for example, preheater, dissolver area, slurry area, and vacuum bottoms handling, is based on experience gained from pilot plant operation. A formalized Hazards Evaluation Program will be conducted to ensure that the SRC-II demonstration plant design meets the goal of achieving the safety level of the modern hydrocarbon process industry. This program is described in Appendix AA.

- 4.8 Comment: In the area of worker safety, the DEIS is virtually silent. Serious explosions have taken place at several SRC facilities. Spills are known to have occurred at Fort Lewis. None are mentioned here. An evaluation of previous accidents, spills, and explosions with plans for design modifications and community and worker contingency and evacuation programs are essential. (Commenters: 4, p. A-17; 15, p. A-48)

Response: No fires or explosions have occurred at SRC facilities. A spill did occur at the Fort Lewis pilot plant on December 19, 1979. Information on this spill is given in Sect. 4.1.3.1 and in Appendix Z, Sect. Z.5.2.2. See also response to comment 2.3. As discussed in the responses to comments 3.18 and 4.7, the experience and performance of the Fort Lewis, Wilsonville, Exxon Donor Solvent, and H-Coal pilot plants will be used to design the demonstration plant. Appendix AA includes the Preliminary Hazards Identification and DOE's plans for a Hazards Evaluation program. Also, as discussed in the response to comment 4.1, the Safety Analysis Report will be provided prior to operation. See also response to comment 2.3.

Worker protection programs to reduce any health risks are also discussed in Sects. 4.1.3.4, 4.1.3.6, and 4.1.3.7 and Appendix Y, Sect. Y.3.

- 4.9 Comment: The DEIS contains an inadequate discussion of emergencies and upsets. The proposed SRC-II process has never been commercially demonstrated. Since relatively little is known about the process it is likely that there will be unexpected occurrences at the plant. (Commenter: 18, p. A-93)

Response: As reflected throughout the revised Appendix C and the impact analyses in the revised Sect. 4.1.3, upsets and emergencies are expected and have been assessed to the degree possible based on the current design. Transportation accidents and resulting spills are discussed in Appendix Z of this FEIS. See also responses to comments 3.1 and 4.1.

- 4.10 Comment: The DEIS fails to adequately discuss the dangers of sudden venting of flammable and toxic materials. Many questions remain unanswered concerning the venting process. How often is it likely to occur? What will happen if the pilot in the flare isn't operating at the time of the venting? What emissions will result from the use of the flare? How will the flare affect those living nearby? All of these questions should have been treated in the DEIS. (Commenters: 18, p. A-96; 12, p. A-32; 28, p. A-138)

Response: An expanded discussion of the vent and flare system is provided in the revised Appendix C, Sect. C.3.5.4. Emissions from the flare, which is expected to be used infrequently, are discussed in revised Sects. C.4.1.4, C.4.1.5, and C.4.1.6 of this FEIS. Design and monitoring measures will be employed to ensure continuous pilot in the flare. The effect of the flare on the surrounding area is discussed in revised Sect. 4.1.3.2. See also the response to comment 3.1.

- 4.11 Comment: Despite the significant risk of fire or explosions, the DEIS contains no detailed analysis of the subject. In addition, the EIS should discuss design methods that will be employed to minimize the possibility of explosions and fires. (Commenter: 18, p. A-95-96)

Response: Major fires and explosions have occurred in related industries (e.g., petroleum, petrochemical, and refineries). DOE recognizes the potential for fires and explosions during operation of the proposed SRC-II demonstration plant and will minimize the possibility through the Preliminary Hazards Identification System and Hazards Evaluation Program as discussed in Appendix AA of this FEIS. See also Sect. 4.1.3.2 and responses to comments 4.1, 4.3, 4.5, 4.6, and 4.8.

- 4.12 Comment: One area where the DEIS is deficient is transportation incidents. It is inappropriate to dismiss spills during rail transportation by saying that more hazardous substances than this product are transported all the time. (Commenters: 4, p. A-17; 28, p. A-136; 15, p. A-48)

Response: A detailed discussion of transportation accidents has been added to the FEIS as Appendix Z. A summary of Appendix Z is contained in Sect. 4.1.3.8 of this FEIS.

- 4.13 Comment: Section 4.1.3.2, p. 4-6, paragraph 10 — Train accident statistics. Are two unit trains of 74 cars each sufficient to keep pace with the plant production? How is a train defined, when it is determined that in 1978 there were "15 accidents per million train miles?" Is a train 74 cars each? Is an accident defined by a dollar value? How much? Injuries or deaths were not discussed for the rail transport; are any expected? Increased traffic at railroad crossings may lead to an increased risk to the public. (Commenters: 30, p. A-145; 18, p. A-98)

Response: Two unit trains of 74 cars each will be sufficient when the demonstration plant is operating at full capacity. As discussed in Appendix C, Table C.2, the operating on-stream factor will be considerably less than 100% of capacity during much of the demonstration periods. This makes the accident analysis in Appendix Z a worst-case analysis. In Appendix Z, accident rates are presented in terms of shipment numbers as well as by train mile and by ton shipped. Accidents reported on the available data base are those involving a loss of \$2900 or more. As discussed in Appendix Z, Sect. Z.2.1.1, shipment of the SRC-II products will only add between 1.5 and 7.7% to the existing tonnage transported over the proposed rail lines. The capacity exists for accommodating this additional traffic.

- 4.14 Comment: The train accident analysis computing the likelihood that a spill will occur in the rail transport of the SRC-II product is misleading. The computation (p. 4-6) is based on a figure representing the number of accidents per million train miles on a national scale. This figure does not represent the likelihood of spills on the two transport routes being considered; hence, it ignores the effects of traffic congestion, population density and its associated intersecting with train routes, the type of car being used, and other factors that may influence accident rates along these routes. The accident data should be specific to the Northern and Southern transport rail lines. (Commenter: 18, p. A-97)

Response: Specific accident rates for the Northern and Southern lines were not available. See also responses to comments 4.12 and 4.13. The new transportation spill analysis determines the spill probability by four methods: per shipment, per volume, per ton-mile, and per car-mile.

- 4.15 Comment: Section 4.1.3.2, p. 4-7, Table — It is assumed that one-half of all accidents will involve empty trains; why? Train accident statistics in the recent past suggest that larger, heavier railroad cars coupled with deferred track and equipment maintenance have led to a higher incidence of accidents caused by equipment (wheel) and track failure. One would expect that loaded trains may be involved in more accidents. (Commenter: 30, p. A-146)

Response: In the DEIS, it was assumed that one-half of all accidents would involve empty trains. This was an error, however, because the "release per accident" statistic allows for accidents involving empty trains. Therefore, this assumption was not made in the FEIS. In addition, a more complete railroad accident data base was used in the FEIS, and predicted accident rates were produced using four different measures of rail shipment activity (see Appendix Z).

4.16 Comment: The DEIS fails to discuss the possibility of spills of hazardous materials.
(Commenters: 18, p. A-94-95; 28, p. A-136)

- effects on groundwater and surface water,
- mitigating measures, and
- discussion of Fort Lewis spill.

Response: Each of these issues is addressed in the added Appendix Z of this FEIS and in Sect. 4.1.3 (DEIS and FEIS).

5. HEALTH EFFECTS

5.1 Comment: The Draft EIS is insufficient, inaccurate, or misleading in seven areas of its treatment of the occupational impacts of the SRC-II plant planned for Fort Martin, West Virginia. (Commenter: 4, p. A-15)

1. The document underestimates and misleads the public as to the degree of hazard associated with the SRC-II.
2. It misinterprets the health experience of the Fort Lewis, Washington, pilot plant.
3. It is clearly lacking in its exposition of a worker protection program that will address not the plant design, but come into play after the plant is built.
4. It does not address the major impacts of unexpected events such as explosions or prolonged release of toxic gases.
5. It underestimates the hazard and does not deal with the public health hazards posed by the use of the fuels the SRC-II will produce.
6. In all, because of its own contradictions, its misinterpretations, and its omissions, the DES is not a credible document.
7. Finally, the DES makes clear the intent that SRC-II become a health experiment and that the residents and workers of this region are subjects for that experiment. (Commenter: 37, p. A-158)

Response: Specific areas noted in most of these comments are discussed in detail in the responses to specific comments in this section. General responses, in order, are

1. Section 4.1 of this FEIS has been extensively revised and expanded in response to comments with inputs and reviews by health effects experts. Appendix Y has also been added.
2. Sections 4.1.1 and 4.1.3 and Appendix Y address the health experience of the Fort Lewis pilot plant in a more clear and scientific manner.
3. Section 4.1.3.6 and Appendix Y, Sect. Y.3, discuss the worker protection program.
4. Section 4.1, Appendix AA, and Appendix C more thoroughly discuss upsets and emergency events. Appendix C, Sect. C.3.8, specifically discusses toxic gases. See also responses to comments 4.1, 4.3, 4.5, 4.6, 4.8, and 4.11.
5. End-use combustion is discussed in Sect. 4.1.3.10 and Appendix C, Sect. C.7. Transportation spills are discussed in Sect. 4.1.3.8 and Appendix Z. The way in which health effects affected market selection for SRC products is discussed in Appendix Z, Sect. Z.1.1.
6. As noted in items 1 through 4 above, revisions have been made.
7. Section 4.1 addresses this point (occupational and public health protection measures). See also response to comment 5.4.

5.2 Comment: The DES claims the plant will not cause an "undue risk" to either the work force, the public, or the environment. There is no scientific basis for this statement. "Undue" means inappropriate or unsuitable. How does DOE define appropriate and suitable risk or acceptable levels of exposure for substances whose danger is acknowledged by government, industry, and independent experts? (Commenters: 15, p. A-50; 30, p. A-145)

Response: This phrase has been deleted in the FEIS. The FEIS, in Sect. 1, outlines DOE's approach to synfuels risk assessments and the ongoing programs to obtain data in support of risk assessment. There appears to be, at this point, no single, accepted, scientifically valid way to quantify risk, as measured by mortalities and morbidities in occupationally and environmentally exposed populations or as measured by loss of habitat, ecological productivity, etc., for the SRC process or established technologies such as petroleum refining, petrochemical synthesis, or coal coking. As stated in the revised Sect. 4.1 of this FEIS, in recent years it has become apparent that there is a risk of cancer to workers associated with the coal coking and petroleum refining industries. Based on epidemiological data, changes in work-force practice and in industrial hygiene and personnel monitoring are continually being developed and upgraded in these industries. Regulation as to specific hazard is either in place or being considered by Federal and state agencies. In the case of SRC-II, a research program in progress is attempting to define elements of biomedical and ecological risk and will aid in assessing the magnitude of that risk and in developing controls to ameliorate the risk (Appendix Y). The SRC-II process, like all technologies involving chemical and physical agents, is not devoid of risk. Where it differs from established technologies is in the ongoing attempts to ameliorate risk before the SRC-II process becomes a large-scale supplier of energy needs.

- 5.3 Comment: The proposals in this document assume that proposed equipment and components will be able to withstand the harsh environmental conditions of the process. Recent published reports (*Chemical Engineering*, June 2, pp. 35-38) indicate severe material problems, which translate into increased fugitive emissions and more frequent maintenance and repairs, that is, increased worker exposure. (Commenter: 30, p. A-144)

Response: Fugitive emissions will be monitored as part of the industrial hygiene program (revised Sects. 4.1 and 4.5 and Appendix Y). Also, as described in revised Appendix C, Sect. C.3.5.1, a "directed maintenance program" will be used in which monitoring fugitive emissions will define when maintenance is required and when the maintenance is sufficient. See also the response to comment 3.18.

- 5.4 Comment: There is no mention of the health of community residents in the five-county area surrounding the SRC-II. Because there are no comprehensive health statistics for our area now, there will be no way to evaluate the relationship between changing health patterns as a result of the SRC-II. Without baseline health data, it would be nearly impossible to ever determine whether the SRC-II "experiment" was successful. (Commenter: 15, p. A-50)

Response: Process emissions will be monitored as discussed in Sects. 4.1 and 4.5 and Appendix Y of the FEIS. The plant design and monitoring of plant operations are aimed at reducing emissions to the lowest possible level to ensure minimal public exposure.

- 5.5 Comment: The DES gives little treatment to the toxicity of the SRC-II products. A recent report prepared for DOE indicates that most of these products are more heavily contaminated than the conventional oil-delivered products they would substitute for (Enviro Control, "Relative Health Effects of Gasoline and Heating Fuel Derived for Petroleum or Synthetic Sources," Draft, May 13, 1980). The DEIS should reflect consideration of this report and other available information that has been ignored. (Commenter: 18, p. A-92)

Response: It should be noted that the draft report cited in the comment has not undergone independent scientific review and may not be readily available to the general public. Furthermore, due to its preliminary nature, this material has not been used as a major resource in the EIS preparation. The FEIS now describes the data base available in published and reviewed documents, which may be used in the development of control procedures. Also, the new Appendix Z discusses how the health effects characteristics of the SRC-II product influenced the selection of markets and end users.

- 5.6 Comment: The draft EIS notes (p. 4-2) that the fuel tested (and found hazardous) from the Fort Lewis plant contained "significantly less" of the most toxic and cancer-causing chemicals (in the heavy distillates) than the fuel to be produced in Monongalia County. The Fort Martin fuel is likely to be even more hazardous to this community and work force. (Commenter: 4, p. A-16)

Response: The full-range SRC-II fuel oil from Fort Lewis and the proposed demonstration plant contains essentially the same amount of toxic materials. The main concern in the demonstration plant arises from the distillation of the full-range material into a middle and a heavy distillate. Indications are that the toxic materials are high boiling and therefore concentrate in the heavy distillate.

- 5.7 Comment: Perhaps the most serious omission from the discussion of health and environmental hazards in the DES is the lack of any mention at all of the only major epidemiological experience available. This is the study of skin cancer incidence among workers employed at the coal hydrogenation plant at Institute, West Virginia, in the 1950s. The DES's evasive attempt to distinguish this data away cannot possibly succeed without more data on the Fort Lewis experience yielding convincing reasons why the Institute experience should not be accorded great weight. (Commenter: 18, p. A-89)

Response: Data from the Institute plant and their applicability to the Fort Lewis experience have been included in the discussion in the revised Sect. 4.1 of the FEIS. See also response to comment 5.24.

- 5.8 Comment: The DES provides no details on the kinds of industrial hygiene measures that are followed at Fort Lewis, the kind of monitoring of exposure being done, and the kind of medical surveillance being performed. (Commenter: 18, p. A-89)

Response: Revised Sect. 4.1 and Appendix Y of the FEIS include a detailed discussion of the industrial hygiene measures and monitoring planned for the demonstration plant as well as their relationship to the Fort Lewis program.

- 5.9 Comment: In DOE's own literature on the medical program at Fort Lewis they reported "transient dermatitis from skin contact with the coal-derived material," photosensitization of the skin, and folliculitis. (Commenters: 4, p. A-16; 30, p. A-144)

Response: There have been some cases of eye irritation and photodermatitis at Fort Lewis. Folliculitis takes the form of a condition called "mechanic's acne"; a common condition in workers such as roofing workers, auto mechanics, etc., whose job requires contact with oils and greases. There is no known correlation between this condition, which is primarily of cosmetic concern, and more serious conditions such as skin cancer, tumors, etc. Further, the condition is ameliorated through the natural sloughing of skin when the worker stops contacting such materials.

- 5.10 Comment: The DES states (p. 4-1) that five years of operation at Fort Lewis "is well beyond the latency period of about 100 days for the appearance of skin tumors in experiments with laboratory animals." This statement is incorrect, based on the DOE's own research from the Battelle Memorial Institute. The cancer latency periods in all mice except those exposed to nearly lethal doses was considerably longer than 100 days; the researchers are still following many animals after 456 days. Further, it is invalid to relate the cancer latency period in experiments with laboratory mice to that in humans. It is widely recognized that most cancers of internal organs will not show up for 10 to 20 years after initial exposure. Five years of monitoring of the Fort Lewis workers is not enough time to say anything reassuring about the effects of these chemicals. (Commenters: 4, p. A-16; 18, p. A-88)

Response: The inference drawn from the DEIS is inaccurate; see Sect. 4.1.1 of the FEIS.

- 5.11 Comment: The Fort Lewis work force is too small a sample to warrant putting faith in the absence of observed effects. Effects occurring at very serious rates can escape detection in small studies. (Commenter: 18, p. A-88)

Response: Section 4.1 of the FEIS has been revised to reflect these concerns.

- 5.12 Comment: The DES states that most of the significant human exposure to SRC-II materials would be from acute rather than chronic episodes and would arise from occasional accidental emissions or spills. However, the PAH benzo(a)pyrene is known to be carcinogenic in single dose experiments; and, other polycyclic aromatic hydrocarbons present in coal, such as chrysene, methchrysenes, benzanthraces, benzacridines, aminoanthracenes, aminofluorenes, and naphthylamines, are also among the

most potent carcinogens known. This raises the very real possibility of significant carcinogenic risk arising from short-term leaks and spills, and this should be addressed in the DEIS. (Commenter: 18, p. A-82)

Response: PNL data (refs. 1 and 2 of revised Sect. 4.1 of the FEIS) demonstrate that long-term exposures to high concentrations of heavy coal liquids were required for tumor induction in mice. It is anticipated that risk of tumor induction will decrease at the single doses expected in human occupational or environmental exposure. Based on available data with mice, we cannot say whether there is a threshold for skin dose at which no effect occurs or whether there would be some skin cancer risk at any skin dose past zero. In other words, the data base for SRC materials does not allow one to say what the quantitative risk to humans would be for a single-dose exposure to SRC materials.

- 5.13 Comment: The deficiencies of the DES may well be due to the fact that the list of preparers in Sect. V includes no one with professional training and experience in toxicology, epidemiology, or other disciplines concerned with evaluation of chemical health hazards (e.g., biochemistry, biophysiology, pathology, pharmacology, or medicine). DOE will have to enlist the assistance of professionals with appropriate expertise to prepare an adequate analysis of the health and environmental hazards posed by this plant. (Commenters: 4, p. A-18; 18, p. A-81)

Response: Section 5 of the FEIS details the training and experience of preparers of the FEIS.

- 5.14 Comment: As pointed out by both Dr. George Pickett, State Health Director, and Mr. Carl Beard, State Air Pollution Control Director, far too much is unknown about the emissions from this process to assess its effects on the health and welfare of the citizens of the community. (Commenter: 37, p. A-158)

Response: See response to comment 5.4.

- 5.15 Comment: The DES fails to present a complete evaluation of the chemicals that are known and potential dangers to human health and the environment associated with the SRC-II process. It fails to discuss either the number of dangerous substances found in the process streams, wastes, and products, or the full range of adverse effects (range from cancer and mutation to neurological disorders) reported to be associated with them. The dangerous chemicals include benzene, aniline, indole, quinoline, phenol, and cresols, thiophene, hydrogen sulfide, carbon disulfide, arsenic, mercury, nickel, chromium, lead, and cadmium. (Commenter: 18, p. A-80 and A-82 to A-86)

Response: DOE recognizes that any complex hydrocarbon material such as petroleum or process and product streams from SRC will contain literally tens of thousands of compounds ranging from harmless to harmful as single entities. A definition of harm based on properties of single agents may not cover the actual and observed effects of a mixture of those agents because both positive and negative biochemical and biological synergistic interactions among agents may occur. Chemical entities of greatest concern are discussed in the assessment methodology sections (Sects. 1 and 4.1 and Appendix C) of the revised FEIS.

- 5.16 Comment: Occupational exposures within the plant will not be limited to skin contact. On p. 4-3, the EIS identifies aerosols of the heavy process materials as the likely source of inhalation exposures and ingestions. But it immediately dispenses with these hazards by stating that the materials are of low volatility (irrelevant to aerosol exposure) and that the exposures "would be insignificant in relation to dermal exposures." No justification for this is given. Industrial data from a similar facility has shown very high concentration of carcinogenic material within 200 ft of major process fugitive aerosol generators. (Commenter: 4, p. A-16)

Response: The FEIS has been revised regarding the significance of dermal and inhalation exposures. As defined in a series of status reports by PNL (refs. 1 and 2 of Sect. 4 of this FEIS and PNL, *Chemical, Biomedical and Ecological Studies of SRC-I Materials from the Ft. Lewis Pilot Plant: A Status Report*, Draft prepared for DOE under Contract DE-AC06-76RL0-1830, Richland, Wash.), materials known to cause biological effect (mutagenesis and perhaps, by extrapolation, carcinogenesis) are of low volatility and high boiling point. This does not mean that there would be no pulmonary exposure; it means that concerns relative to pulmonary exposure may be restricted to process streams containing high boiling point materials. It should be noted that this refers to hazards relative to carcinogenicity only. DOE is funding studies on inhalation toxicology. See also response to comment 5.3.

- 5.17 Comment: Section 4.1.1, p. 4-2, paragraph 2, line 7 — What does "marked reductions" mean? Many PAHs and aromatic amines do not have any established exposure standards. Although a 99.999% reduction may be achieved, the compounds may still be present at hazardous concentrations. (Commenter: 30, p. A-144)

Response: Many aromatic amines and PAHs do not have established standards. On the other hand, there are NIOSH standards for coal tar pitch volatiles, a mixture containing a variety of carcinogenic chemicals. As discussed in response to comments 5.2, 5.12, and 5.15, although these standards may not result in zero risk in industries presently using them, they will probably result in significant decrease in risk.

- 5.18 Comment: According to the DES, "the hydrogenation reaction produces complex organic materials which have the potential for serious adverse health effects (p. 4-3)." Although not proven by direct experiments, it is suspected that these materials are carcinogenic or toxic to man (p. 4-1). Because of these suspicions, we are assured that "DOE is actively engaged in a multi-million-dollar-per-year comprehensive program for characterizing, assessing, and controlling the health effects of SRC materials. Major long-term chemical and biological testing studies are underway..." (DEIS, p. 4-1)

The implication here is that little is known of the health effects of the materials produced in the SRC process, that what is known is not proven, and that much research is needed before anyone can say whether the SRC process is safe or dangerous. None of these implications is true. It is already known that SRC process materials, emissions inside and outside the plant, and the end product itself will all contain compounds capable of producing genetic mutation, birth defects, and cancer. (Commenter: 4, p. A-15)

Response: DOE has clarified these points in revised Sect. 4.1. However, it should be noted that many processes (petroleum refining, coal coking, petrochemical synthesis) involve the use and/or synthesis of materials known to cause cancer, mutations, etc. See also responses to comments 5.1, 5.2, 5.5, 5.6, and 5.15.

- 5.19 Comment: Section 4.1.3.1, p. 4-4, paragraph 2 — The use of engineering controls is the first line of defense for protecting the safety and health of workers. Respiratory protection for the worker should be used in a judicious manner after other means have been exhausted. (Commenter: 30, p. A-145)

Response: As discussed in revised Appendix C, Sect. C.3.9, safety and environment (including health) are the two highest design priorities for the demonstration plant. Engineering controls are discussed in revised Sect. 4.1.3 and Appendix C, Sect. C.3.5. See also the response to comment 4.1.

- 5.20 Comment: The DES states (p. 4-4) that "some skin contact will be inevitable for some members of the maintenance crew." This is followed by the statement that, "Effects of such exposure can be minimized by proper washing techniques." However, Gulf's operator of the Fort Lewis plant reports that some of the polynuclear aromatic materials cannot be washed off the skin. The DES ignores the fact that once SRC-II process material contaminates a worker's skin, "its complete and immediate removal is impossible." (Commenter: 4, p. A-16)

Response: The question is not whether washing removes PAH material completely and immediately; the question is whether or not washing ameliorates risk. The lack of skin tumors, at this time, in the Fort Lewis worker population versus their presence at much earlier times in the Institute, West Virginia, population would imply that washing, along with other industrial hygiene actions may ameliorate risk. It is recognized that the five years of operating experience at Fort Lewis is not conclusive.

- 5.21 Comment: Although it would be difficult to demonstrate in humans, such binding to tissues may occur in the lungs as well, converting a high level acute exposure to a long-term contact with the toxic materials. In laboratory experiments with animals, coal tar materials were administered into the lungs. The tumors produced were found to be closely associated with and contain brown or black coal tar spots, suggesting that the materials were bound to lung tissue and caused the tumors by their direct, local chemical action. (Commenter: 4, p. A-18)

Response: The method of exposure (insufflation in the referenced work) to lungs highly affects results in terms of tumorigenesis. Cigarette smoke is not carcinogenic to rodents. A pellet of tobacco smoke condensate is. The lung has mechanisms for removing small and large particles. It does not have mechanisms for removing surficially implanted pellets or for removing large clumps of material given by intratracheal instillation.

- 5.22 Comment: Section 4.1.3.1, p. 4-4, paragraph 2, line 5 — "such contact can be monitored by UV light examination." This is a controversial area. While some carcinogenic materials fluoresce, others do not. Conversely, many noncarcinogenic materials also fluoresce. There is also concern of the risk of skin sensitization and promotion of carcinogenic effects. Because of these potential risks, NIOSH is currently recommending the UV examination be conducted under medical supervision. (Commenter: 30, p. A-145)

Response: It is not clear what effects UV light might have on tumorigenesis, nor is it clear that it detects all carcinogens which might be present in complex hydrocarbon mixtures such as SRC. However, UV light is useful for detecting surface contamination due to spills and low-level UV may also be useful to monitor skin contamination. Revised Sect. 4.1.3.6 states that low-level UV monitoring will be assessed as a technique for improving worker hygiene. If this is concluded to be a safe and effective practice, it will be made available to workers as they pass through the change facility.

- 5.23 Comment: The DES implies that worker exposure to hazardous materials will be minimal (p. 4-4): "Exposure mechanisms for the plant work force will vary significantly, depending on job assignment; maintenance and operating personnel will receive the highest exposure during maintenance operations. Exposure mechanisms for the work force not directly involved in maintenance will be less." Enviro Control, in its study of the Fort Lewis operation gives a different picture of exposure. "Of the 184 workers at the Fort Lewis plant, 133 were identified by job assignment as having potential exposure to process contaminants." (Commenter: 4, p. A-18)

Response: All personnel working in the main process area at Fort Lewis may be exposed to some amount of SRC materials. However, extent of exposures is a function of job assignment, and indeed, maintenance people may have higher degrees of exposure.

- 5.24 Comment: In 1952, an experimental coal liquefaction pilot began operation at Institute, West Virginia. Before closing in 1963, the plant employed 359 workers. The incidence of skin cancer among these workers has been reported as between 16 and 37 times greater than would be expected in a similar nonexposed group. Since not enough time has passed for researchers to analyze cancers of other organs (lung, brain, stomach, and scrotum) in these workers, or the overall death rate, the ultimate result of this human experiment is still unknown. (Commenter: 4, p. A-16)

Response: The Institute workers, as of this time, do not appear to show a higher rate of systemic cancer than the general population (A. Palmer, "Mortality Experience of 50 Workers with Occupational Exposure to the Products of Coal Hydrogenation Processes," in *Symposium on Potential Health and Environmental Effects of Synthetic Fossil Fuel Technologies*, CONF-780903, ORNL, Oak Ridge, Tenn., 1979). It should be noted that the Institute work force was too small to make this observation statistically significant.

- 5.25 Comment: The DES is contradictory in its analysis of plans for toxic material control. The introduction (p. xix) states that existing regulations will not assure elimination of risks associated with the materials found in SRC-II. But what is the goal of the DOE control plan? The Project Environmental Plan states (p. T-4) that they will apply "pollution controls and mitigation procedures for compliance with existing regulations for the demonstration plant." While admitting the inadequacy of current environmental and occupational health standards for SRC-II materials, the DES makes clear that compliance with the inadequate standards is Gulf and DOE's goal. (Commenter: 4, p. A-18)

Response: DOE's approach to risk assessment for synfuels is outlined in Sect. 1 of the revised FEIS. Current requirements (EPA, NIOSH, etc.) require the SRC-II facility to meet existing regulations. The research program in place will aid in defining presently nonregulated chemicals of concern, both before plant operations begin and during plant operations. This action, anticipating regulation, should allow ongoing development of appropriate controls and procedures. The revised Summary and Sect. 2.1.1 state that, in the absence of specific regulatory guidelines, many mitigation measures will be used to minimize the release of harmful chemicals. [The PEP has been replaced by more detailed planning (see Sect. 4.5 and Appendix Y).]

- 5.26 Comment: The most shocking part of the DES is its clear implication that the demonstration plant is intended as a health experiment in which the workers and residents of the region are to be the guinea pigs (p. 4-59). According to the DES, DOE will develop a program to monitor plant emissions, monitor the region's environment, monitor the worker's environment, conduct medical examinations of the work force "to monitor the response of individuals to occupational exposures," and conduct research to discover how workers and the environment respond to chemicals in the SRC (pp. 4-59 to 4-62). This is exactly how experiments on guinea pigs are carried out. (Commenter: 4, p. A-18)

Response: See response to comment 5.4. The monitoring program will ensure that plant design meets the objective of minimal worker and population exposures.

- 5.27 Comment: Section 4.1.2, 4th line from bottom — "essentially free of mutagenic and carcinogenic activity . . ." One must not forget though that the light hydrocarbon fractions contain some potentially toxic materials. It is true that microbiological and animal tests have shown little if any mutagenic or carcinogenic activity in the samples tested to date. However, because coal composition may vary within the same coal seam and because the conditions under which previously tested pilot plant samples were taken may vary from those proposed for the demo plant, a statistically valid number of demo samples will be needed to provide assurances that the light hydrocarbon fractions are "essentially free of mutagenic and carcinogenic activity in microbiological and animal test systems." (Commenter: 30, p. A-145)

Response: Work with a number of light coal liquids derived from a variety of coals has shown such liquids to have little or no carcinogenic or mutagenic effects. For examples of this, see PNL reports referenced in response to comment 5.16, Weil and Condra ["The Hazards to Health in the Hydrogenation of Coal: II. Carcinogenic Effects of Materials on the Skin of Mice," *Arch. Environ. Health* 1: 187-193 (1960)] as well as W. C. Hueper ["Experimental Carcinogenic Studies on Hydrogenated Coal Oils: I. Bergius Oils," *Indust. Med. and Surg.*: 51-55 (1956)]. See also Sect. 4.1.2.

- 5.28 Comment: It has long been recognized that combustion and distillation products of coal cause cancer in humans. The carcinogenic potential of these products has been recognized since 1775 with the observation of high rates of scrotal cancer in chimney sweeps. As industrial processes have developed which heat coal at high temperature, producing gases, tars, and oils, the cancer incidence continues to be documented. Epidemiological evidence throughout the world and for various occupational groups shows conclusively that workers exposed to the products of combustion or distillation of coal have an increase in cancer of the lungs, skin, urinary organs, larynx, stomach, and intestines. (Commenters: 4, p. A-16; 18, p. A-88)

Response: The basis of occupational health concerns arising from studies of related coal utilization techniques is discussed in revised Sect. 4.1 of the FEIS.

- 5.29 Comment: The DES (p. 4-2) states that hydrotreating SRC-II products significantly reduces their mutagenicity in the Ames assay. This process reduces levels of polycyclic aromatic hydrocarbons and other genotoxic organic compounds, thus presumably lessening the carcinogenic and mutagenic risk to humans in the use of these products. At p. 4-3 the DES states that hydrotreating would be seriously considered "only if further studies indicate the health hazards of SRC fuel products to be much more serious than now anticipated." In view of the degree to which the DEIS has understated the health hazards associated with SRC-II chemicals, it is necessary that DOE completely reevaluate the advisability of hydrotreating. (Commenters: 18, p. A-93; 30, p. A-145)

Response: It should be noted that mutagenesis results may not totally correlate with carcinogenesis in animals. Thus, development of hydrotreating may be premature in terms of its use to ameliorate effects on humans. Second, control at the level of product composition/blend may be as or more effective than hydrotreatment. Treatment of only a small fraction of the total product may be effective. Engineering controls or design alterations to reduce worker exposure would be the preferred approach since hydrotreating would apply to only one aspect of the total worker exposure (i.e., it would not affect the risk of exposure to process materials within the plant). See also response to comment 3.6.

- 5.30 Comment: Section 4.1.3.2, p. 4-7, paragraph 1, lines 3-5 — The comparison between SRC distillate and chlorine, etc., is like comparing "apples and oranges." The chlorine, ammonia, etc., would not be used by the public to run some type of combustion engine. There have also been recent reports of coal liquefaction product instability in air, e.g., increasing viscosity and chemical changes. (Commenter: 30, p. A-146)

Response: The comparison between SRC distillate and other chemical products has been deleted. Continuing studies are discussed in Sect. 4.1 of the FEIS. Appendix Z discusses how the health risk of SRC products was used to eliminate the following markets for demonstration plant products: combustion engines, home heating, and commercial and industrial uses.

- 5.31 Comment: Section 4.1.1, p. 4-2, item 4 — What is considered representative SRC pilot materials? Is this a composite of various runs? Pilot plants generally do not operate for more than a few days continuously. Will the coal used at the Fort Lewis plant be used at the demonstration plant? Will the operating conditions be the same? Suggest at least deleting representative. (Commenter: 30, p. A-144)

Response: This section has been revised, and the term representative has been deleted.

6. WATER RESOURCES

- 6.1 Comment: Confusion exists within the DEIS itself as well as between it and the ORBC Water Assessment for Monongahela Synfuel Plant regarding the amount of water required for plant operation. (Commenter: 28, p. A-134)

Response: Total consumptive use for the proposed demonstration plant is estimated to be 226 liters/s (8.0 cfs). The WRC Assessment was based on an earlier design estimate of 246 liters/s (8.7 cfs) and thus constitutes a worst-case assessment.

- 6.2 Comment: The Corps of Engineers has, in the past, indicated that the Monongahela River would not support additional water consumption. This is in direct variance to the Corps' present assertion that the Monongahela River contains sufficient water for the proposed SRC-II plant. (Commenter: 19, p. A-108)

Response: The best current estimates regarding water availability are incorporated into the WRC Assessment and summarized in revised Sect. 4.2.2.1, "Water Use Impacts," of this FEIS. The U.S. Army Corps of Engineers participated in the preparation of the ORBC Assessment.

- 6.3 Comment: The EIS should consider alternative (supplemental) water sources for SRC-II and/or alternate plant designs, in the event that Monongahela River water might have to be shared to permit the operation of other synfuel plants downstream. (Commenter: 38, p. A-159)

Response: The revised Sect. 4.2.2.1 of the FEIS indicates that the SRC-II project will consider both alternative (supplemental) water sources (Sect. 4.2.2.1, "Discussion of Water Use Impacts") and alternative designs (Appendix C). In addition, DOE accepts the possibility that severe drought conditions in the Monongahela Basin will necessitate plant turndown or complete shutdown.

- 6.4 Comment: The EIS admits there might be a problem with water availability from the Monongahela River. It does not mention the possibility of serious water shortages downriver in Pennsylvania. (Commenter: 15, p. A-49)

Response: Discussion of impacts on water availability, including streamflow deficits at several locks and dams in Pennsylvania, has been expanded in revised Sect. 4.2.2.1. The FEIS indicates that, during severe droughts, consumptive water use by the SRC-II plant could be curtailed by plant turndown or complete shutdown.

- 6.5 Comment: The use or potential use of water from Stonewall Jackson Dam should not be considered for the SRC-II project. (Commenters: 14, p. A-44; 18, p. A-79; 21, p. A-125; 28, p. A-141; 33, p. A-150)

Response: The impacts of the SRC-II demonstration project have been assessed assuming that there will be no increase in low-flow augmentation due to the completion of the Stonewall Jackson Reservoir. DOE endorses comprehensive water planning for the basin, as called for by the WRC assessment.

- 6.6 Comment: Pages xxii, 4-20, and 4-21 — The statement that water consumption of the commercial facility is not expected to increase in proportion to the increase in capacity is not substantiated in the text. If this cannot be substantiated, a worst-case situation should be evaluated. (Commenters: 33, p. A-151; 18, p. A-79)

Response: As discussed in Appendix C, Sect. C.8.3, the consumptive water use by the commercial facility is expected to increase by a factor of 3.5 with a five-fold scale-up in the size of the commercial plant. This is primarily because of the increased thermal efficiency of the commercial facility.

- 6.7 Comment: Page 2-19, paragraph 2 — The statement is made that a detailed evaluation of water resource impacts cannot be made until the Water Resources Council study is completed. We agree and suggest that preparation and release of the DEIS was premature without the information. (Commenters: 33, p. A-151; 18, p. A-67; 16, p. A-52)

Response: The final report from the WRC was issued on Jan. 9, 1981.

- 6.8 Comment: A thorough, realistic analysis of the prospects of achieving zero discharge and an adequate facility for removing toxic pollutants from the wastewater before discharge must be a part of the DEIS. (Commenter: 18, p. A-77)

Response: The design of the SRC-II facility has been revised to include a tertiary wastewater treatment system, wastewater discharge, and zero-discharge capability when it is required to maintain river water quality. This is discussed in revised Appendix C, Sect. C.3.6, of the FEIS, and the impacts on surface water quality and aquatic ecology are discussed in revised Sects. 4.2.2.3 and 4.2.2.4.

- 6.9 Comment: Flow reductions caused by the plant's consumption of water could contribute to increases in the ambient levels (by reducing dilution) and exacerbate what appears to be an existing problem. The DEIS should at least address the potential for this effect. (Commenter: 18, p. A-78)

Response: Section 4.2.2.1 has been revised to address this concern. With the 7-d, 10-year low flow, the consumptive use for the demonstration plant could cause pollutants (after dilution) to be 2.5% more concentrated. With the commercial plant, pollutants would be 8.5% more concentrated.

- 6.10 Comment: An NPDES permit will be necessary. (Commenter: 28, p. A-133)

Response: An NPDES permit application will be submitted to EPA.

- 6.11 Comment: The water quality analysis contained in the DEIS and the Ohio River Basin Commission Water Assessment for Monongahela Synfuel Plant (ORBC) sketch a comforting image of the plant's impact upon water quality and quantity, concluding, in essence, that the SRC-II plant will have minimal adverse effects on the aquatic environment. However, both documents are premised on unsupported assertions, questionable assumptions, and doubtful predictions of future conditions. (Commenter: 18, p. A-77)

Response: Due to the change in strategy for handling wastewater, the water quality analyses have been substantially revised in this FEIS. See following responses to comments (6.12 through 6.18).

- 6.12 Comment: The DEIS and ORBC make two important assumptions with respect to the yardsticks by which water quality impacts will be measured: (1) the parameters to be assessed and (2) the ambient levels for those parameters. There is no basis to suppose these parameters will remain unchanged. The DEIS should evaluate possible changes between now and 2020. (Commenter: 18, p. A-77)

Response: Section 4.2.2.3 has been revised to reflect design changes. A wide spectrum of water quality constituents are considered, and worst-case ambient levels are assumed.

- 6.13 Comment: Page 2-39, surface water quality — This argument for use of the Fort Martin site is invalid. Water quality impacts from construction and operation at any site would be the same if all other factors are equal. If this discussion is to remain in the FES, soil type, slopes, annual rainfall, and other factors should be used to determine at which site construction and operation impacts would be the least. (Commenter: 33, p. A-151)

Response: Section 2.3.2.2 has been revised to reflect this comment.

- 6.14 Comment: An item left out is that Pennsylvania has more stringent water quality standards than either West Virginia or the Federal government. Because the SRC-II site is in West Virginia, will it be permitted to violate Pennsylvania's law — even though it is right on the state line? (Commenter: 15, p. A-49)

Response: Table S.1 in Appendix S has been revised to include Pennsylvania's water quality standards. At times when the SRC-II discharge could cause water quality violations of the laws of either state, the wastewater treatment will be shifted to zero-discharge operation.

- 6.15 Comment: EPA has issued criteria for a number of pollutants that are not yet incorporated into West Virginia standards (see DEIS, Table S.1, pp. S-2 through S-3). This situation could change as the states revise their standards over the years, resulting in new state standards for which violations are likely (compare Table S.1 with Table 3.3, for example, with respect to phenol and sulfates). If SRC-II causes flow reductions that decrease dilution, these parameters would become relevant. (Commenter: 18, p. A-78)

Response: The FEIS (Table S.1 in Appendix S) considers relevant EPA standards and criteria, including those West Virginia has not adopted.

- 6.16 Comment: As a result of upcoming EPA proposals, additional water quality criteria and standards may be in the offing, particularly for toxics. EPA will publish final criteria for 65 toxics this fall and expects to implement at least some of those through state water quality standards. Preliminary criteria are available now. Thus, it seems likely that, during the life of the plant, quite a few new standards will be adopted. DOE should address these to the extent permitted before the FES must be completed. (Commenter: 18, p. A-78)

Response: Table S.3 in Appendix S has been added to this FEIS to reflect the draft water quality criteria promulgated by EPA. These are considered where applicable.

- 6.17 Comment: The DEIS and ORBC report also seem to assume that the regulatory ambient levels (water quality standards) will not change over the life of the project. The Monongahela and its tributaries are classified for all uses, including water supply, contact recreation, and fish propagation (DEIS, p. 3-18). So, the "use classifications" for these water bodies cannot get more stringent. But the ambient levels needed to support those uses can change whenever better knowledge of pollutant effects is developed. This is particularly true for toxic pollutants. Note, for example, the DEIS discussion of toxics at p. 4-29. (Commenter: 18, p. A-78)

Response: Draft criteria for toxic pollutants and estimated permissible concentrations are listed in Tables S.3 and S.4 of Appendix S. These are discussed in revised Sect. 4.2.2.4 of the FEIS. See also response to comment 6.12.

- 6.18 Comment: Regulations are under review, and they probably will not be as restrictive as has been assumed (ORBC, p. 20). Yet, neither the DEIS nor the ORBC report assesses the impact of such less restrictive controls on the plant's water quality effects. (Commenter: 18, p. A-79)

Response: Revised Sect. 4.2.2.1 and Table 4.5 reflect this comment.

- 6.19 Comment: The Pennsylvania Department of Environmental Resources points out (ORBC, p. 42), BAT technologies (especially for thermal discharges) may result in consumptive uses "several times higher than that projected by the Pa. State Water Plan." Apparently, ORBC relied on these Pennsylvania projections (p. 13). Most important, the predictions of future consumptive use assume no increase for electric power generation through 2020 (p. 25). And, even at present capacity, the use of cooling towers at generating plants and other industrial facilities (under new BAT regulations) would cause a "major increase in consumptive use projections" (p. 25). (Commenter: 18, p. A-79)

Response: Section 3.2.2.1 notes that installation of cooling towers at power stations on the Monongahela could increase consumptive water use by 1530 liters/s. However, the WRC and ORBC assessments did rely on Pennsylvania's estimates of consumptive use in Pennsylvania in the Monongahela River Basin. Currently, Pennsylvania does not anticipate that these power stations will increase their consumptive use.

- 6.20 Comment: ORBC assumes that "major leakage problems" at some lock-and-dam sites will be corrected before 1985 (p. 22). DOE should spell this situation out in some detail. (Commenter: 18, p. A-79)

Response: Whether or not the Corps corrects leakage problems at its locks and dams will have very little influence on water use impacts of the SRC-II demonstration facility. Water use impacts of the commercial facility are discussed in Sect. 4.2.2.1.

- 6.21 Comment: Regarding low-flow water availability, this problem should have been evaluated thoroughly before selecting an alternative and/or issuing a DEIS. (Commenter: 33, p. A-151)

Response: Water availability was a selection criterion. The EIS provides an assessment of water availability and preliminary plant design, as well as alternative plant designs. This provides DOE and the public with a more comprehensive basis for decision-making than that which was available previously. Water availability will influence the final design of the facility. The water assessment can also influence the facility's final design. It should also be noted that Sect. 2.3.2.1 identifies several alternatives being evaluated during detailed design that will influence water consumption. These include waste heat rejection, wastewater treatment, and onsite water storage.

7. AIR QUALITY

- 7.1 Comment: There is insufficient information on the project design to review the DES for the accuracy of its stated conclusions and its potential to fulfill the regulatory requirements for construction of a major industrial source of air pollution. (Commenter: 28, p. A-137)

Response: A lack of detailed design is an acknowledged limitation and the FEIS has been updated to reflect the designs supporting the PSD Permit Application which EPA Region III and the West Virginia Air Pollution Control Commission have determined to be substantially completed. Where information is still unavailable, studies and designs are currently underway. Revisions consistent with the PSD Application appear throughout revised Appendix C of this FEIS.

- 7.2 Comment: There is no discussion presented regarding the possibility of designing appropriate equipment to meet or even exceed controls recommended by regulatory agencies. In other words, this project represents such new technology that it deserves innovative technology for controls. (Commenter: 28, p. A-140)

Response: Appropriate equipment will be designed to control the new technology. Discussion is included in revised Appendix C, Sects. C.3 and C.4.1 of this FEIS. Environmental control technologies to be employed are current state-of-the-art control equipment utilized in petroleum, petrochemical, and other industries and will meet regulatory requirements.

- 7.3 Comment: The absence of documentation on the modeling study does not allow an evaluation of its conclusions. Too little information on modeling is included due to the inconclusive stage of the design. Further information is needed for emissions of sulfur, hydrocarbons, NO_x, etc., as described on pp. 2-28 and 2-29. (Commenters: 28, p. A-137; 18, p. A-73)

Response: EPA has been provided information on modeling procedures in Supplements 1 and 2 to the PSD Permit Application. (This is also available in public reading rooms.) The results of an independent modeling effort are given in revised Appendix Q. This Appendix also provides the results of an earlier "VALLEY" modeling performed for the PSD Permit Application and a more recent effort using CRSTER and I.S.C. models. See also the revised Sect. 4.2.3.1 for documentation of the models and Appendix C, Sect. C.4.1 for updated emission estimates.

- 7.4 Comment: All emission information should be made available to regulatory agencies and the potential effects evaluated. (Commenter: 13, p. A-33)

Response: Emission information has been provided to EPA and the West Virginia APCC (see comment 7.1). The potential effects were discussed in Sects. 4.2.1.3 and 4.2.3.1 of the DEIS and have been revised in this FEIS, based on new emission estimates and a modeling effort conducted independent of the modeling used to support the PSD Permit Application.

- 7.5 Comment: Cumulative effects on air quality have not been determined; sufficient emissions information is not available. (Commenter: 18, p. A-69)

Response: A discussion of the cumulative effects on air quality was provided in Sect. 4.2.3.1 of the DEIS. The most recent emission information is contained in revised Appendix C, Table C.12, and cumulative air quality impacts are discussed in revised Sect. 4.2.3.1 of the FEIS. It should also be noted that the air quality background measured in the baseline monitoring program (Sect. 3.2.3.1) included existing sources in the area.

- 7.6 Comment: The table C.1 (DES, p. C-9) should include the allowable standards for the named pollutants. (Commenter: 31, p. A-147)

Response: Table C.12 (footnotes g and h) of the FEIS identify applicable standards for NO_x and TSP.

- 7.7 Comment: With regard to particulates, the DES fails to discuss many points in coal storage, preparation, and handling. Where control is discussed, some control measures specified are demonstrably not the best available. (Commenters: 12, p. A-32; 18, p. A-73; 28, p. A-139)

- no control methods for conveyor loading transfer points
- prefer flue gas heat to flash drying
- coal pile fires

Response: An expanded discussion of the environmental controls proposed for coal storage and handling has been included in new Sect. C.3.1.1, Appendix C, of this FEIS. Also, see the response to comment 3.2.

- 7.8 Comment: Diesel fuels from SRC-II product will also elevate carcinogenic fine particulate emissions from diesel vehicles. This results from the higher aromaticity of SRC-derived fuel as compared with conventional diesel fuel. This problem must also be considered. (Commenter: 18, p. A-93)

Response: As discussed in the new Appendix Z, Sect. Z.1.1, the health effects characteristics of SRC products have been used in selection of markets and end uses. There are currently no plans to use SRC products from the demonstration plant as fuel for diesel vehicles (see Sect. 1.3). Future studies will define whether SRC products are suitable for use as transportation fuels or blending stocks.

- 7.9 Comment: The air quality analysis assumes that on-site generation will be chosen and appears to assume that such a facility would be fueled by SRC-II product, and therefore that extensive technological emission controls will not be needed (DES, p. 2-33). If on-site generation is chosen, a binding commitment to use only gaseous fuels is essential here. (Commenter: 18, p. A-75)

Response: See Sect. C.2.14 of this FEIS and response to comment 3.26.

- 7.10 Comment: Full analysis of the controlled combustor/flare system requires design details and additional information on the following: (Commenter: 28, p. A-138)

- composition and flow rates of hydrocarbon feeds;
- identification of all contributing sources of hydrocarbons;
- NO_x , particulates, and hydrocarbon emissions during startup and upsets; and
- monitoring.

Response: The design of the controlled-combustor/flare system will be finalized during the detailed design phase of the project. (See response to comment 3.1.) The combustor-flare system is described in greater detail in revised Appendix C, Sect. C.3.5.4. EPA and the West Virginia APCC have also been provided currently available design information in Supplement No. 4 to the PSD Permit Application. The monitoring of controlled combustor emissions is included in revised Sect. 4.5.4.

- 7.11 Comment: More information is necessary regarding the wastewater treatment sludge incinerators. (Commenter: 28, p. A-139)

Response: Sludge incineration is described in revised Appendix C and Sects. C.3.6.2 and C.3.7.3. EPA and the West Virginia APCC have been provided currently available design information in Supplements 4 and 5 to the PSD Permit Application. See also response to comment 3.1.

- 7.12 Comment: Regarding cooling tower emissions, the DES does not indicate that, according to some experience with the double-effect evaporators proposed for wastewater treatment, lighter hydrocarbons (such as phenols) may volatilize in the evaporators and

build up in the circulating water (rather than appearing in the evaporator concentrate). Such hydrocarbons could then add to the emissions from the wet cooling tower. Understandably, the DES cannot quantify such emissions from the wet cooling tower, and little is said about the control of these emissions, other than that alternative cooling systems (e.g., dry cooling towers) are being further assessed. Pending further review and the availability of further information, it would appear that a double-effect evaporator/zero-liquid discharge system, in conjunction with wet cooling towers, may not be BACT; if evaporation is employed for wastewater treatment, dry cooling may be preferred unless data can be provided indicating that the concern about organics buildup is unfounded. (Commenters: 12, p. A-32; 28, p. A-139)

Response: The strategy for waste heat rejection has changed since the DEIS, and additional discussion is included in new Sects. C.3.5.5 and C.3.6.2 of Appendix C of the FEIS. Complete information on cooling tower operation and emissions is dependent on a later stage of design. The selection of all dry cooling may be technically viable for waste heat rejection, but without evaporative water loss from wet cooling towers, the plant could not achieve zero wastewater discharge (revised Appendix C, Sects. C.2.11 and C.3.6). Also, dry aerial coolers could pose a fugitive emission problem, which could be eliminated with the use of indirect cooling systems. Monitoring of the recirculating water and the cooling tower makeup water from treated wastewater is discussed in revised Sect. 4.5.4. See also response to comment 3.1.

- 7.13 Comment: For sulfur recovery/Claus tail-gas cleanup, it would be useful to have additional information, including the composition and conditions of the streams entering the units (with special attention to the nature of the sulfur species present in the gas, and the nature of any other species in the gas to which the processes might be sensitive); any pertinent design/operating information which can be provided, such as flow rate of solvent relative to the feed rate of gaseous sulfur species, and other important design details; and performance specifications for the units, including data supporting the performance estimates. It would be useful to provide further information concerning inlet streams; design/operation details and performance specifications. More detailed information supporting the selection of Super-SCOT (demonstrating that its higher reliability offsets the reduced removals) is necessary. Also, information should be presented justifying the level of H₂S removal that the proposed Super-SCOT unit is designed to obtain, since other evidence indicates that Super-SCOT might be designed to obtain higher removals than those proposed. Again, stream compositions, design/operating details and performance specs are of interest. (Commenter: 28, p. A-138)

Response: Further information on the sulfur recovery/Claus tail-gas cleanup is presented in revised Appendix C, Sect. C.3.2.1. See also the response to comment 3.1.

- 7.14 Comment: Inadequate data is supplied for the acid gas scrubbing system. The concentration of hydrogen sulfide in the stream to be sent to the primary recovery system and the variability of the components of this stream are not given. Potential for fugitive emissions of toxic sulfur control compounds is not discussed. (Commenter: 18, p. A-73)

Response: Further information on the sulfur recovery system is given in revised Appendix C, Sect. C.3.2.1. A discussion of toxic gases has been included in new Sect. C.3.8 of Appendix C.

- 7.15 Comment: As for sulfur dioxide, the DES appeals to the prospect that unspecified SO₂ removal technologies, which the document apparently concludes are not available for the demonstration plant, will in fact be available by the time the commercial plant is built (DES, p. 4-38). No details are offered as to what technologies fall into that "in-between" state now, why they are not available for use at the demonstration plant, and why they can be relied on to be available in time for commercialization. (Commenter: 18, p. A-75)

Response: Commercially available sulfur recovery alternatives are discussed in revised Appendix C, Sect. C.3.2.1. Sulfur recovery for the commercial plant is discussed in Appendix C, Sect. C.8.2.2.

- 7.16 Comment: The DES reveals that the demonstration plant probably will cause violations of the ozone standards and that the commercial plant probably will cause violations of the ozone, SO₂, and TSP standards. Despite these likely violations of major requirements of Federal law, the DES contains inadequate discussion of means available to prevent them. (Commenter: 18, p. A-70)

Response: The control of hydrocarbons from point sources and fugitive sources is discussed in revised Appendix C, Sect. C.3.5. The demonstration plant may exacerbate the existing local ozone problem. It is not expected that the commercial plant will violate the SO₂ or TSP standards (revised Sect. 4.2.3.1). The ozone standard may be violated during commercialization. See revised Appendix C, Sect. C.8.2.

- 7.17 Comment: The DES states, "SO₂ and particulate emissions from a commercial facility could not increase in proportion to the increase in capacity" (DES, p. 4-38). Absolutely no support is given for this statement. (Commenter: 18, p. A-75)

Response: Support for this statement is given in revised Appendix C, Sect. C.8.2.

- 7.18 Comment: Fugitives are the major source of gaseous hydrocarbon emissions. It would be helpful to show estimates of the approximate number of pumps, valves, and other fugitive sources in the plant; the approximate number of pumps which will have double mechanical seals; the approximate number of pumps, valves, etc. which will be enclosed; etc. Both the demonstration plant and the commercial plant will need greater hydrocarbon emission reduction to comply with standards. (Commenters: 28, p. A-138; 18, p. A-70-71)

Response: Further details on control of fugitive hydrocarbons are given in Appendix C, Sect. 3.5. The proposed "directed maintenance" program is also discussed in this section. Appendix C, Sect. C.4.1.8 discusses the various sources that are expected to contribute to the fugitive hydrocarbon emission rate and an estimate of the degree of reduction which can be achieved by the proposed controls. An estimate of hydrocarbon concentrations using the "VALLEY" model is given in revised Sect. 4.2.3.1. Additional information is provided specifically in Supplement No. 3 of the the PSD Permit Application. Fugitive hydrocarbon emissions from the commercial plant are discussed in Appendix C, Sect. C.8.2.3.

- 7.19 Comment: Emissions of NO_x from the three 308 MM Btu/h "power boilers" are 0.53 lb/MM Btu above the applicable NSPS of 0.2 to 0.3 lb/MM Btu for gas and oil-fired units. The source of the emission factors which DOE used in estimating these NO_x (and other) emissions would be of interest. No controls are proposed for NO_x or particulates (or for HC's); this lack of controls should be acceptable so long as the sulfur content of the naphtha (0.1%) and plant gas (100 ppm) remain at those levels. DOE should further support the estimate that sulfur contents will be at those levels. (Commenter: 28, p. A-138)

Response: Additional information on the Heaters/Boilers emissions and the sulfur content of the process-derived fuels is given in revised Appendix C, Sects. C.3.1.4, C.3.2.2, and C.4.1. EPA and the West Virginia APCC have also been provided detailed information in Supplement 2 of the PSD Permit Application.

- 7.20 Comment: The extent of controls applied to the storage tanks and loading facilities is unspecified. Compliance with applicable standards is not discussed nor are the tanks even identified as emissions sources. Identification of any emissions must be supplied as well as calculations of such emissions. (Commenter: 28, p. A-139)

Response: Storage tank emission control procedures are given in Appendix C, Sect. C.3.5.2.

- 7.21 Comment: The goal of the project is to expand to a 30,000 TPSD facility. Since the initial facility is projected to consume 94% of the TSP-PSD increment and 41% of the SO increment, a 5-fold increase in size will violate these PSD increments. (Commenters: 18, p. A-75; 16, p. A-52)

Response: The air quality impact analysis for the demonstration- and commercial-scale plants has been revised to reflect updated emission estimates (as presented in Sect. 4.2.3.1 and Appendix C, Sects. C.4.1 and C.8.2). Expansion to a commercial plant is not expected to violate the PSD increments (see revised Sect. 4.2.3.1).

- 7.22 Comment: The DES states: "PSD increments were established to allow for carefully planned growth and restrictions on development due to consumption of an increment must be weighed against benefit to the area." Yet, though this is a correct statement of the problem, the DES reveals no meaningful effort to explore or answer it. There is not even any indication that State and local governments, whose developmental choices may be severely limited by the plant as designed, have been involved in these critical choices. (Commenter: 18, p. A-76)

Response: PSD increments are considered on a first-come-first-serve basis. DOE submitted a PSD application to EPA and the West Virginia APCC in May 1980. Subsequently, meetings have been held and supplementary permit information supplied. The consumption of PSD increments and the limitations this consumption may impose on other industries is discussed in the revised Sect. 4.2.3.1 for the demonstration and commercial plants. From this analysis it appears that the SRC-II demonstration and commercial plants will not limit further industrial growth in the area.

- 7.23 Comment: The DES identifies one other planned industrial facility that would be precluded by the demonstration plant's consumption of so much of the PSD increments, the Alla Ohio Coke Plant (DES, p. 4-39). There may well be others. A more thorough investigation of the region's economic development plans and needs seems to be called for before a major step of limiting future options is taken. (Commenters: 18, p. A-76; 15, p. A-51)

Response: The proposed coke plant was not identified as being precluded by the demonstration plant's consumption of PSD increment. It was identified as a contributor to the consumption of the increment assuming it becomes operational (DEIS, p. 4-39). The impact of the coke plant was considered in the SRC-II PSD application and the combined emissions were found not to exceed PSD increment standards. Short-term increment consumption is fairly localized in its effect. Other plants could be built in the regional area. Revised Sect. 4.2.3.1 discusses the interaction of the demonstration plant with other emission sources including the coke plant. See also the response to Comment 7.22.

- 7.24 Comment: The PSD regulations require Best Available Control Technology (BACT) which, at a minimum, will be the standards of performance for new stationary sources (NSPS). The absence of identifying the actual control technology which will be used in the demonstration plant will not allow a determination of the adequacy of the design. The PSD application has been determined incomplete based upon substantial deficiencies in specific design data. (Commenter: 28, p. A-137)

Response: Determination of BACT is a regulatory decision based on a PSD Permit Application and is beyond the scope of an environmental impact statement. The PSD application has been submitted and has been judged by EPA Region III to be substantially complete, subject to submittal of select detailed information. See also responses to comments 3.1 and 7.1.

- 7.25 Comment: EPA raises the following questions:

1. What data can be provided to assure the claims that sulfur content of naphtha and plant gas will be 0.1% and 100 ppm, respectively?
2. Is there a possibility that power boilers will be coal fired rather than fired with naphtha or plant gas? What controls would be installed if coal were used?
3. What controls will be employed to control emissions from the gasifier slag dewatering systems?
4. Would it be possible to include emissions inventories of all sources, analytical results, source interactions, and operating schedules? This could be a step-by-step map for the entire system along with any possible aberrations or upsets and could appear as a supplemental environmental report preceding the FEIS.

(Commenter: 28, p. A-139)

Response: The answers to EPA questions are as follows:

1. Sulfur content data is given in new Sect. C.3.2.2 of Appendix C.
2. See the response to comment 7.9.

3. Suitable gas-treating devices will be installed on the slag dewatering system to prevent releases of toxic or explosive gases. As discussed in Appendix C, Sect. C.2.8, all gases evolved during slag quenching and depressurization will be routed to the controlled combustor/elevated flare system.
4. There is insufficient information to include a final emission inventory of all sources and an operating schedule at this time, and it will not be available for many months. Worst-case emission estimates were used. Also see the response to comment 3.1.

7.26 Comment: A decision is expected shortly that may require EPA to reinstate the prior, more protective standards, for ozone. In this light, it also cannot be assumed (as in Table 4-2, p. 4-35 of the DES) that West Virginia's standards, which still reflect the prior Federal standards, will be changed. (Commenter: 18, p. A-71)

Response: Pending a decision to the contrary, West Virginia's ozone standard will be changed to the newer Federal standard.

7.27 Comment: Page 3-24, paragraph 8: The DES states that snowfall can be expected from September through May. Although normals for the area may indicate a "Trace" (T) in those two months, the occurrence of snow then is rare and insignificant. If a trace occurs once in 100 years, it statistically is recorded as a trace in the normals, misleading the reader. Thus, the DES would be more accurate if it stated that snowfall can be expected from October through April. (Commenter: 27, p. A-132)

Response: The text has been revised to more realistically reflect expectations of snowfall in the period from October to April.

7.28 Comment: The DES does not discuss the contribution of SRC-II to "acid rain." (Commenters: 18, p. A-76; 23, p. A-127; 27, p. A-132)

Response: "Acid rain" is formed when sulfur and nitrogen oxides from industrial and automotive emissions combine with atmospheric moisture. This combination forms a dilute acid that falls as precipitation. Studies are currently underway to determine the causal relationship, but "acid rain" is believed to cause acidified lakes (in which fish cannot survive), reduced crop yields, and structural damage to buildings.

Because the proposed demonstration plant emits sulfur and nitrogen oxides, it follows that the plant may contribute to the problem. "Acid rain" is a long-range transport problem. The effect of the plant is regional in nature and as such contributes only a small fraction to the amounts of sulfur and nitrogen oxides emitted over a large region.

7.29 Comment: The DEIS does not discuss odors from the plant. Potential emissions (NMHC) from reactors, pumps, valves, flanges, fuel gas handling, sulfur removal and recovery, waste water treatment, heat rejection system leaks, maintenance, upsets, and incomplete combustion in the flare. (Commenter: 15, p. A-32)

Response: Hydrogen sulfide and ammonia produced by reaction of hydrogen with sulfur and nitrogen present in the feed coal present the major potential for odor problems. These materials are undesirable contaminants in further processing steps, and process streams are treated to reduce concentrations to acceptable levels. The treatment facilities produce concentrated ammonia and hydrogen sulfide streams from which liquid ammonia and elemental sulfur are recovered for sale as by-products. This recovery provides the primary means of odor control. No problems are anticipated as a result of emission of the small concentrations of ammonia remaining after recovery; however, to preclude any odor problems associated with hydrogen sulfide, the tail gas from the sulfur recovery unit is incinerated to convert the remaining hydrogen sulfide to sulfur dioxide which does not present a significant odor potential. (This does, however, constitute the major sulfur dioxide emission source and is considered in determining compliance with ambient air quality standards.) Only in the unlikely event of a failure in the incinerator would there be any significant potential for these odors outside the process area. Various hydrocarbon compounds will be emitted from fugitive sources within the plant. Each compound will have a unique odor and each person will have a unique threshold of odor detection for each compound. It is likely that hydrocarbon odors will be detectable at some locations within the plant boundary and occasionally at some offsite locations. The occurrence of the odor will depend on the operating condition of the plant (e.g., shutdown, startup, amount of fugitive emissions, rate of operation), meteorological conditions, threshold of odor detection, etc.

8. SOCIOECONOMIC

- 8.1 Comment: The EIS did not consider any development effects upon neighboring Greene County, Pennsylvania. This largely rural county will absorb considerable scattered development. (Commenter: 32, p. A-149)

Response: Estimates of the number of demonstration-phase construction workers and dependents likely to locate in Greene County, Pennsylvania, are set forth in revised Sect. 4.2.4.1, Tables 4.19 and 4.21. Indirect employment is estimated in Tables 4.23 and 4.24. Neither suggests any significant impact. Tables 4.25 and 4.26 estimate income likely to be received by Greene County residents during peak construction activity.

- 8.2 Comment: The DES does mention, in passing, that property taxes could be "substantially" increased by raising property assessments and rates. The DES does not address why our local communities should subsidize Gulf Oil. (Commenter: 15, p. A-49)

Response: Property tax rates in Monongalia County are at the maximum, under West Virginia law, at the present time. The county, through local political processes, determines the assessment rate for property taxes. Virtually all of the revenues generated through the property tax remain within the county. Property tax revenues will in no way subsidize Gulf Oil.

- 8.3 Comment: The DES does not appear to offer a projection of the total increase in population likely to be induced by construction of the full-size commercial plant. At one point, the DES states that 2000 workers might have to move into the area and, "based on current family size, this would imply a population increase of 3850" (DES, p. 4-46). However, the figure of 3850 does not appear to include any secondary employment induced by the project economic activity. At another point, the DES indicates that construction of the commercial plant would create 500 secondary jobs while plant operation would create approximately 465 secondary jobs, 90% of which are, according to the DES, expected to be filled by people living in the area (DES, p. 2-20). There is no indication given of how these figures relate to the population projection of 3850. (Commenter: 18, p. A-103)

Response: See the revised analysis of the major impacts likely to result from the commercialization phase in Sect. 4.2.4.3 of the FEIS.

- 8.4 Comment: The age distribution of in-migrants is not mentioned. No doubt, a considerable number of children can be expected, but because too little is known about where the families will live some of the local systems may be overwhelmed. In an attempt to accommodate this sudden crunch, which may disappear as suddenly as it appears, what can be expected in the long run to happen to the teachers and facilities? (Commenters: 15, p. A-51; 28, p. A-141)

Response: Revised Sect. 4.2.4.1 estimates the numbers of in-migrant workers with families and the expected number of children by broad age groups relating to educational level. The expected distribution by county of in-migrants is set forth in Tables 4.19, 4.21, 4.23, and 4.24.

The anticipated school enrollment changes as well as potential impacts resulting from the SRC-II demonstration facility are addressed in Sects. 3.2.4.5 and 4.2.4.1 of the FEIS. Because of the projected number of in-migrating students to Monongalia County, it is not anticipated that a large number of additional teachers or physical facilities will have to be added to the existing system (Sect. 3.2.4.5).

- 8.5 Comment: The DES projects an increase of only 1620 persons in the county (Sect. 4.2.4.1). This figure is highly suspect and appears to be a low estimate. However, even if it is correct in relation to the SRC-II work force, it fails to consider the substantial workforce which will also be necessary to construct the proposed coke plant to be located in Monongalia County or the expansion and addition of other businesses which will result from the "boom economy" that the SRC-II and coke plant will create. (Commenter: 10, p. A-29)

Response: Revised population increase estimates for Monongalia County in revised Sect. 4.2.4.1 indicate an expected population rise of between 1575 and 1925 persons due to SRC-II construction at its peak. Section 3.2.4.3 indicates that no other construction project will add substantially to this impact. More specifically the most recent (November 1, 1980) information on other projects planned for the Morgantown area reveals little significant competition for labor beyond baseline activity.

The proposed Fairmont Energy Corporation Coke Plant is about one year away from start of construction, a delay from the original schedule. A PSD permit has been applied for but has not yet been granted. The U.S. Army Corps of Engineers will be responsible for preparing an environmental assessment but has not done so as of this time. No further information is currently available.

Other facilities to be constructed include the NIOSH facility at the West Virginia University stadium, and the industrial park at Core.

1. NIOSH is planning an expansion of their present facility to handle an increase in employment from 420 to approximately 800. The expansion is not definite and no information is available on the construction schedule.
2. The industrial park at Core project is extremely indefinite as to a construction schedule.

The implications of SRC-II construction for a "boom economy" are addressed in response to Comment 8.37. No "boom-town" effects are likely.

- 8.6 Comment: The draft statement does not provide an analysis or discussion of the social, psychological, or economic problems that may be caused by living under conditions which may be actually or potentially hazardous.

The draft statement does not indicate the existing resources available in the community to address these needs, nor does it include plans the project might take to make these and additional resources available.

We would also suggest that the final EIS include a provision explicitly addressing the present need and possible future demand for human service programs for the people living in the vicinity of the SRC project site. We will appreciate your cooperation in providing us with this information. (Commenter: 29, p. A-143)

Response: Revision of Sects. 3 and 4 of the DEIS includes additional information regarding the availability of public services (Sects. 3.2.4 and 4.2.4.1). It is not anticipated that construction and operation of the SRC-II facility will significantly affect existing public utilities and service.

Concerning the effects to the local community that may result from living under the potential hazards which result from proximity to the SRC-II facility (as with any plant of this type) an emergency plan will be developed prior to start-up. No information exists that would suggest that living in proximity to the project would cause or result in psychological damages simply because of the presence of the proposed plant.

- 8.7 Comment: The DES estimates that construction of the demonstration project will increase the population by 1620 people. Although it is not entirely clear from the text of the DES, it appears that this figure was arrived at by multiplying the total number of workers expected to be needed to build the plant by 25% — the percentage of workers who are expected to have to move into the area. In turn, this number was apparently multiplied by two in order to account for what the DES terms "dependents, administrative personnel, and part of the increased secondary employment induced by the project economic activity" (DES, p. 4-40). (Commenters: 18, p. A-103; 10, p. A-29)

Response: Revised Tables 4.19 and 4.21 in Sect. 4.2.4.1 estimate the total in-migration of workers at peak construction at between 1420 and 1835 for the 90-min zone around the site. This estimate is based upon extensive analysis of TVA experience with construction labor migration in the eastern United States in recent years. Further analysis of TVA experience indicates that the total population increase in the 90-min zone will be between 2400 and 3100 persons, and between 1600 and 2700 secondary jobs will be created during peak construction activity. Of these in-migrants, Monongalia County is estimated to have an increase of between 1575 and 1925 persons, with the remainder locating elsewhere within 60 min of the plant site (see Tables 4.19 and 4.21 and response to comment 8.5).

- 8.8 Comment: The second major flaw in the DES population increase projections is in the "multiplier" used to account for the secondary population increases likely to be induced by project economic activity including families joining workers, the need for increased public services, and expanded wholesale and retail industry plus new growth in construction of housing, roads, sewers, etc. The DES apparently uses a multiplier of less than two. See DES, pp. 4-40, 2-20, and 4-46. This figure is in sharp contrast to those used in DOE's recent study of the environmental impacts of synthetic fuel production. That study concluded that multipliers can vary from "over 4.5 to 7" (DOE Synthetic Fuels Study, p. 5-146). The use of a low multiplier in the DES results in a significant underestimation of the population increase likely to result from the project. (Commenter: 18, p. A-104)

Response: The SRC-II project is not expected to produce boom town conditions in the area. Consequently, the population multipliers calculated from boom town experiences are not appropriate for estimating population increases in the SRC-II area.

In general, population multipliers should not be compared to economic multipliers. The population multiplier includes new construction workers, new manufacturing and trade workers, and their nonworking family members. The population multiplier will always exceed the employment multiplier if family members are included. Consequently, population multipliers may seriously overestimate economic impacts, such as employment, income, and expenditure in an area.

Finally, in some areas, population multipliers based on boom town assumptions may not be appropriate for planning needed public and social infrastructure expansion. These multipliers are sensitive to assumptions about in-migrating worker responses. Population multipliers based on boom town assumptions presume workers will in-migrate to fill new trade and service jobs. In most areas of the eastern United States this in-migration does not occur and population multipliers are overestimated.

- 8.9 Comment: Specifically, there are three major flaws with the DES's treatment of socioeconomic impacts:
1. The DES's population estimates are highly questionable.
 2. The DES contains no discussion of the classic "boom town" effects that are known to accompany energy development projects.
 3. The DES contains no serious discussion of the many possible approaches for mitigating "boom town" and other socioeconomic impacts. (Commenter: 18, p. A-102)

Response: Each of these points is dealt with separately in some detail in Appendix A. See response to comments 8.7, 8.5, 8.3, and 8.37. In general, these points are also treated in revised FEIS Sects. 3.2.4.1 and 4.2.4.1.

- 8.10 Comment: The DES recognizes that there will be a strain on our social services — sewers, roads, schools — both during the demonstration and commercial phases of the SRC-II. Relieving this increased burden will require planning and funds for expanding social services. Yet, the DES does not take into account Monongalia County's peculiar attitude toward planning. The only county planning professional quit recently because he said the planning commission did not have sufficient funds to do effective work. Evidently, the county places a low priority on the long-range planning DOE and Gulf are calling for. (Commenter: 15, p. A-49)

Response: Potential strains on local social services are discussed in Sect. 4.2.4.1 of the revised FEIS. In addition, the Region VI housing analysis (Appendix V.4) discusses potential problem areas at the county level. While recognition of potential problems and possible mitigation measures is only a first step in the planning process, it is a beginning. Planning can only be successful with input from concerned citizens moving through the political process to influence local decision makers. Local decision makers have recognized and applied for state and Federal monies which are designed to mitigate potential impacts. DOE and the local governments will work together to mitigate potential impacts to this end (see Sects. 4.2.4.1 and 4.6.2 and Appendix V, Sect. V.4).

- 8.11 Comment: It appears certain that the SRC-II induced influx of so many people will precipitate local disruptions beyond those addressed in the DES. Housing is mentioned on p. 4-46: The in-migration of about 5000 people over eight years will place pressures on housing, but too little analyses are done on how and where these pressures will be absorbed. On p. 3-3, for example, the statement is made that development costs for permanent housing may be too high. If this is true, and certainly using the word "may" does not clarify things, what is the alternative? Presumably temporary housing is the answer, but too little information is presented to assess the impact of this alternative. (Commenter: 28, p. A-141)

Response: For current estimates of in-migration during commercialization phase construction see response to comment 8.3 and revised FEIS Sect. 4.2.4.3. Based on the in-migration estimates and the Region VI housing analysis, it appears that the housing market in Monongalia County may have problems accommodating the influx of workers, especially regarding mobile homes. A Region VI task force is presently evaluating alternative housing options. The recommendations of this task force, including a locational analysis of potential housing sites, are available in Appendix V.4. See revised Sect. 4.2.4.3 for commercial-phase aspects of housing development.

- 8.12 Comment: The DES does not mention the specific impact on particular populations -- such as the elderly. (Commenters: 1, p. A-12; 15, p. A-51)

Response: Principal potential sources of adverse impacts on the elderly population, which are inflation and housing, are dealt with in revised Sect. 4.2.4.1. Briefly, no particular adverse impacts on this particular population are anticipated at peak construction activity, with the possible exception of inflation of rents due to increased competition for rental properties (Sect. 4.2.4.1).

There may be some displacements of persons because of a tight rental market for both single and multi-unit housing. The extent of this displacement will depend in part on the response of the private market to increased housing demand and use of Federal assistance monies by city and county governments. Monongalia County has applied for and received funds from HUD under their Community Development Block Grant program to finance low-income housing with appropriate water and sewer system facilities. Region VI Planning and Development Council is also studying alternatives to deal with the potential problem (Sect. 4.2.4.1).

Taxes on property owned by elderly or low-income groups are not likely to increase as the rate for property taxes are already at the legal maximum in Monongalia County (Sect. 4.2.4.1).

Services such as subsidized medical care or free county clinics, lower fees for transportation, social security, and other welfare projects specifically oriented toward elderly or low-income groups are denied highly paid construction workers. Therefore, any fluctuations in supply will not be due to the SRC-II project (Sect. 4.2.4.1).

- 8.13 Comment: Develop a diversification strategy; although the preparers are confused and contradictory about the nature and extent of the existing system's degree of specialization-diversity (see p. 3-30), we need a diversification plan that assures that we experience growth with development. (Commenter: 1, p. A-12)

Response: Because of the secondary or indirect impacts of the SRC-II project it is assumed that additional growth will take place in the region. This section of West Virginia is becoming a leader in the development of new coal technologies, of which the SRC-II project is a significant contributor. Should the SRC-II become a large commercial operation, additional-complementary industries as well as indirect employment will develop. From an economic development standpoint the Morgantown area should, over the next decades, experience additional growth. The development of a diversification strategy is a local responsibility.

- 8.14 Comment: Assess the synergistic, additive effects of other major projects slated for development in the immediately impacted area and its region-wide context; it makes no sense to do forecasting in a vacuum, ignoring everything else in the environment. (Commenter: 1, p. A-12)

Response: Revised labor-availability estimates supported by two independent studies are summarized in revised Sects. 3.2.4.3, 4.2.4.1, and 4.2.4.3. Both conclude in brief that extensive examination does not reveal any other major construction project that is likely to represent any significant competing demand for construction labor in the five-state area surrounding the SRC-II site. See comment 8.5 for response regarding specific construction projects in the immediate Morgantown area.

- 8.15 Comment: If the SRC-II project is approved for construction, we stand to lose more than our history, but our future as well. We have been told that the church building will be preserved but for us this isn't enough. What is a church with no people? Slowly the Fort Martin Community is being dissolved with grim statements of what the SRC-II project will do to the environment and that of the surrounding area. (Commenter: 7, p. A-24)

Response: As noted, the Fort Martin Church and surrounding property will be preserved for continued use by the community should they so desire. Those Fort Martin residents whose property will be acquired for this proposed action will be compensated for their property and provided ample time to relocate to areas of their choosing. Effects of the project on property acquisition, relocation, socioeconomic impacts assistance, and plant design and operation have an objective of minimizing the impacts to surrounding communities.

- 8.16 Comment: The DES considers the possibility of the demonstration plant never making it to commercial operation. It considers the effect of "mothballing" on elimination of pollution. But it does not consider what would happen to the local economy and the unemployment rate (currently the lowest in West Virginia) once all the workers who have come here to work at the SRC-II plant are laid-off — the "bust" part of the boom/bust syndrome. (Commenters: 15, p. A-50; 10, p. A-30)

Response: Section 4.2.4.4 sets out the principal impacts of decommissioning and mothballing; most notably, a loss of a majority of the 460 direct jobs and an indeterminate number of indirect jobs and concomitant loss of income of about \$12 million a year. The ability of the market to absorb that future unemployment is not now known and cannot be accurately predicted. See also comment 8.37, which concerns boom-town effects.

- 8.17 Comment: A sound analysis of socioeconomic impacts likely to be induced by an energy facility must begin with an accurate projection of the population increases likely to result from construction and operation of that facility. (Commenter: 18, p. A-103)

Response: See response to comment 8.7 and revised FEIS Sect. 4.2.4.1.

- 8.18 Comment: Many social services are not discussed or are inadequately addressed, including medical services, fire protection, garbage collection, nursing homes, and utilities. Thus, as with health status, there is inadequate baseline data on social services. (Commenters: 18, p. A-102; 15, p. A-51)

Response: Revised baseline data is found in Sect. 3.2.4 and in Appendix V.4.

- 8.19 Comment: When the DES described the additional strain on social services, it incorrectly assumed that the current level of services is adequate. (Commenters: 15, p. A-49; 28, p. A-141)

Response: Additional information is provided in Sects. 3.2.4 and 4.2.4.1 and in Appendix V.4. It is not assumed that the existing levels of services are adequate in the analyses that have been made.

- 8.20 Comment: Figure 2.2, p. 2-7 — What is the location of Fort Martin's school to the facility? Also, is the school presently being used? (Commenter: 30, p. A-144)

Response: Fort Martin School is located within the site boundary as was shown in Fig. 2.2. The school is presently used as a community center.

- 8.21 Comment: Make use of the known and available methodologies from the fields of technology assessment, impact analysis, and the environmental design arts; the consultants obviously did not approach the "best state of the arts" mandate when they failed to even make full use of the impact model selected for their analysis or when they do not even refer to such obviously relevant materials as the Murphy Williams Urban Planning and Housing Consultants, "Socioeconomic Impact Assessment: A Methodology Applied to Synthetic Fuels" (Washington, D.C.: Government Printing Office, April, 1978). (Commenter: 1, p. A-12)

Response: After review of the document cited in the above comment, it is concluded that the revised sections 3 and 4 of the FEIS are substantially in agreement with the suggestions given in the document. Additionally, work relating to labor availability and predicted location of in-moving workers represents an advanced state-of-the-art assessment as compared to methodologies available in 1978.

- 8.22 Comment: Because of the vagaries of population shifts, economic needs and opportunity pressures on local political entities, socioeconomic impact is one of the most difficult areas to assess and in which to make sound predictions. We believe a fairly good job has been done in pinpointing where problems may be expected, but solutions and effects are lacking. (Commenters: 28, p. A-141; 8, p. A-24)

Response: Because of the relatively small number of construction workers which will in-migrate to Monongalia County, it is not anticipated that any major socioeconomic impacts will occur. The largest impact will be in the housing market. This is discussed in Sect. 4, and in the Region VI housing analysis (Appendix V.4). Region VI is preparing recommendations concerning the location of housing. These recommendations are available in Appendix V.4.

- 8.23 Comment: The DES does not address the likelihood or impact of increased inflation due to the SRC-II, which will hit hardest at those on fixed incomes and working people. And once prices go up, it is unlikely they will go down after construction is completed. (Commenters: 15, p. A-49; 10, p. A-29)

Response: No major long-term price increases beyond normal levels of inflation are anticipated to occur in the SRC-II area due to demonstration or commercial plant construction or operation. Short-term pressures on housing costs, mainly in the rental market, may occur. However, it is not known if this will result in a price increase. See revised Sect. 4.2.4 of the FEIS.

- 8.24 Comment: The community profile, needs assessment, and carrying capacity, as well as the baseline projections should be integrated into the final report, not simply referred to in some inaccessible, probably wholly inadequate, prior report. (Commenter: 1, p. A-12)

Response: Virtually all baseline data and projected impacts are contained in Sects. 3 and 4 with supporting documents in Appendixes V.3, V.2, and V.1. The single major outside reference source is the *Environmental Report*, Vol. 2, which is available in the public reading rooms.

- 8.25 Comment: The pollution in this narrow valley will become greater as the number of people and university students with their many automobiles increase without any added emissions into the atmosphere and water. As this pollution becomes greater the health of the students, faculty and other persons living in this area will be affected. Also, there will be faster deterioration of buildings and equipment, and the house cleaning burdens will increase. Difficulty recruiting university faculty and skilled workers will become greater. (Commenter: 23, p. A-127)

Response: This FEIS addresses environmental impacts of the proposed SRC-II demonstration plant on the surrounding area. Included are the primary and secondary impacts of construction and operations labor influxes to the Monongalia County and other counties in the region. These impacts, noted in the FEIS, Sect. 4.2.4, are within established State or Federal standards and should not have a significant deleterious effect on the region's environment or on the health of individuals in the surrounding area. See also response to comment 5.4.

- 8.26 Comment: In the absence of any land use controls in Monongalia and Greene counties, the role of planning (a) new housing sites, (b) public facility extensions, and (c) other community development concerns, must fall (in West Virginia) to the Regional Planning and Development Council, Region VI. Currently, it is conducting a housing needs analysis of the County; the Region will be able to best assess locations for temporary and permanent housing. At this time, the West Virginia county totally lacks the technical capacity to provide such feasibility information.

HUD Suggestion: DOE should fund Region VI to perform SRC-II "secondary growth" public-action alternatives.

Overemphasis on the SRC-II plant itself and the assumption that other parties will address the "outside of the plant" problems is dangerous, and can lead to serious local problems which in turn will affect the plant's efficiency. We believe carefully-tailored, advance implementation planning by Region VI would be a prudent investment action by DOE. (Commenters: 13, p. A-33; 32, p. A-148-149)

Response: The Region VI baseline study is finished and is included in this FEIS as Appendix V.4. County plans to address these issues have been filed with Region VI. See Sect. 4.6.2 for recommended mitigation measures.

- 8.27 Comment: The EIS does not mention the fact that there is significant and widespread local opposition to the SRC-II. List of all public meetings, attendance, and statements should be made available in this DES. Information should be supplied as to (1) the names of property owners from whom land was acquired, (2) the amount paid for the purchase and whether the land was acquired through condemnation proceeding or not. (Commenters: 10, p. A-25; 15, p. A-51)

Response: Support or opposition has no effect on the impact analysis performed for this EIS. Transcripts of the public hearings are available from DOE and are also available at locations identified in Sect. 5 of the Summary of the FEIS. Information on property owners, land acquired, amount paid for purchases of property, and acquisition procedures are not germane to the EIS process. Actions to acquire options on the land for this proposed action have been undertaken by the industrial partner through the Monongalia Development Authority. To date no property has been acquired through condemnation. Should the proposed action be approved, DOE would obtain ownership of the site.

- 8.28 Comment: Problems exist with roads, sewers, water, etc. There is insufficient lead time to address the anticipated problems. Road congestion is already a problem when the University is in session. While the Department of Highways may be studying road construction possibilities, it appears that the roads will be constructed after SRC-II is already under way. Moreover, as with housing, the discussion of roads and services in the Environmental Impact Statement ignores the intersection of SRC-II and the coke plant. (Commenters: 10, p. A-30; 34, p. A-154; 36, p. A-157; 10, p. A-30)

Response: The State of West Virginia is completing the transportation analysis (Sect. 4.2.4.1 and Appendix V.4 of the FEIS).

- 8.29 Comment: The speed with which SRC-II will be constructed probably renders any significant local adjustment in the housing market impossible. The housing study proposed by Region VI will not be completed until September of this year. Any action will occur much later. Yet, construction will begin next year. By December 1981, the Environmental Impact Statement projects a workforce of 1175. By December 1982, the workforce will increase to 3154 (Table 4.4). Again, this presupposes no workforce will be involved in the coke plant and no additional demand on the rental market will result from other sources. Even so, when the workers arrive, the housing will not yet have been built. (Commenter: 10, p. A-30)

Response: A revised housing availability and impact analysis is provided in Sects. 3.2.4.5 and 4.2.4.1. The new Region VI housing analysis is found in Appendix V.4.

- 8.30 Comment: Page 4-43 — No reference is made to an increase in alcoholism and crime which a large influx of construction workers would cause, based on the experience of similar projects elsewhere. These and other important social factors need to be analyzed. (Commenter: 16, p. A-52)

Response: It is estimated in Table 4.2 that only 1005 construction workers will in-migrate to the five-county study area. The rest of the migrant labor will locate outside of the five-county area. It is further estimated that more than 60% of the construction labor will be available from the five-county region surrounding the site. These factors will tend to reduce the potential for increased crime and alcoholism rates. It is not anticipated, therefore, that the in-migration of SRC-II workers to the area will significantly alter the preexisting crime and alcoholism rates. These problems are more applicable to "boom-town" effects which will not occur with this project (see the discussion of the applicability of "boom-town" analysis contained in the response to comment 8.37). Furthermore, problems of crime and alcohol abuse are often perceived problems. Groups such as construction workers are stereotyped incorrectly; studies do not support such allegations or perceptions (see Sect. 4.2.4.1).

- 8.31 Comment: In order to effectively assess the impact, the part this plant will play in the local tax structure needs to be addressed. What projected taxes will this plant pay locally? More emphasis should be put on the inevitable increased cost of living to surrounding communities, also increased taxes. All of which will result from the increased demands that will be put on all commodities including public services. In short, spell out in dollars and cents what the monetary cost will be to surrounding communities. (Commenter: 8, p. A-25)

Response: See revised Sect. 4.2.4 of the FEIS for anticipated SRC-II impacts on local taxes as well as local inflation. In short, however, no major price increases are anticipated beyond the level of inflation that would occur in the absence of SRC-II.

- 8.32 Comment: On p. 4-44, the DES states: As soon as the final plant layout is selected, all archaeological sites that may be disturbed by plant construction will be further evaluated to assess their potential significance. (Commenter: 18, p. A-69)

Response: Archaeological sites have been evaluated by the DOE, the State of West Virginia, and the Department of the Interior. See revised Sects. 3.2.4.7 and 4.2.4.1 for detailed discussion.

- 8.33 Comment: A comparative socioeconomic cost-benefit analysis of alternative sites, according to NEPA Guidelines, this is the heart of the environmental assessment process. (Commenter: 1, p. A-11)

Response: A cost-benefit analysis of alternative sites is not specifically required under CEQ regulations. It was not made because of the difficulty of quantifying the wide variety of benefits and costs at each site and because cost/benefit analyses often obscure significant social issues.

- 8.34 Comment: Anticipating trends and working now to mitigate them is what a DES is supposed to do. Unfortunately, the "Socioeconomic Impact Analysis" drafted by CONSAD Research Corporation does not do what it is supposed to do. It does not meet the legal requirements for preparing such a document, it does a very poor job of anticipating the multiple impacts of the proposed project, and it provides no plan for mitigating its adverse consequences. (Commenter: 1, p. A-11)

Response: Revised Sects. 4.2.4.1, 4.5.3.5, and 4.6.2 contain the mitigation and monitoring program. The CONSAD Report was only one of the documents used in preparing the revised socioeconomic sections of the FEIS.

- 8.35 Comment: Page 4-42 — On what basis was the man-power estimate made? It appears to be low if a reasonable wage rate is applied to total man-hours and related to total estimated plant cost. (Commenter: 31, p. A-147)

Response: Construction man-power estimates are based upon engineering specifications of size and type of plant and the nature of installed equipment. Total man-hours is a parameter used along with others to estimate total plant cost, not the reverse. Wage rates are those commonly paid in the area for specific crafts. See revised Sects. 3.2.4.3 and 4.2.4.1 and Appendix V.3.

- 8.36 Comment: The DES mentions the loss of the land tax base without being specific on the magnitude. It also mentions that several million dollars in sales taxes will be realized by the State. Will this sales tax revenue adequately cover the services required from local political bodies? In addition, is it assumed that the State will turn any of this revenue over to the local governmental units to help defray these additional costs of services? (Commenter: 28, p. A-141)

Response: Current land use is primarily agricultural, with some residential (Sect. 4.2.4). Therefore, the loss of the land tax base will be minimal. Baseline tax information is provided in revised Sect. 3.2.4.5 of the FEIS. Additional tax revenues resulting from the project are discussed in revised Sect. 4.2.4. The local governments will not benefit from property tax revenues until such time as the facility is transferred to the industrial partner. It is generally recognized that single family units normally do not contribute through various taxes a sufficient amount of revenue to compensate local and state governments for local services provided those family units. The shortfall in revenues is typically made up through tax revenues paid by commercial and industrial enterprises. In the case of the SRC-II facility, which will be federally owned and untaxable in the demonstration stage, this source of revenue will be unavailable. (For a detailed analysis of a similar situation, see Robert B. Braid, Jr., and Stephen D. Kyles, *The Clinch River Breeder Reactor Plant: An Analysis of the Impacts of Its Immigrant Construction Workers on Local Public Services*, May, 1977, prepared for the Appalachian Regional Commission under Contract No. TQ-10 TN-5105-76-1-302-0401.) Consequently, a per capita deficit in community services caused by SRC-II-generated in-migrants should be anticipated. Identification during the monitoring program of any such deficits for each jurisdiction in the five-county impact region should be accomplished annually on the basis of a per capita cost/benefit analysis of each jurisdiction's aggregated expenditures. DOE may, however, elect to pay in lieu of taxes prior to the commercial phase. This has not yet been determined.

- 8.37 Comment: The DES Contains No Discussion of "Boom Town" Effects. It is well established that rapid increases in population induced by construction of energy projects tend to produce significant social and economic dislocations. The dislocations are generally known as "boom town" effects. Surprisingly, the DES contains no discussion of the boom town effects.

The boom town effects that may result from the SRC-II project, but which are not discussed in the DES, include:

- front-end financing problems,
- fiscal uncertainties,
- fiscal disparities,
- social problems,
- inefficient regional settlement patterns,
- local community development problems,
- resource depletion or community contraction problems, and
- community development management problems.

(Commenter: 18, p. A-104-105)

Response: Critical to anticipating a "boom-bust" potential is the anticipated annual population growth relative to the existing population. The DOE study, *Synthetic Fuels and the Environment: An Environment and Regulations Impacts Analysis* (June, 1980), suggests that an annual growth of less than 10% is unlikely to result in absorption problems. Further, energy impact assistance legislation recently passed by the U.S. Senate (S.2332 July 31, 1980, 96th Congress, 2D Session) specifies a minimum of 8% growth per year in employment/population (or 24% in three years) before an area is considered "impacted" and thereby eligible for Federal assistance under the above cited legislation. The best estimate of the total population growth in the area of Monongalia County, West Virginia, due to peak demonstration-phase construction activity at SRC-II is between 2 and 2.5% of projected 1985 county population. Clearly this anticipated growth in other characteristics set forth above falls far short of the conventional criteria for an anticipated "boom-town" impact. Consequently, it is expected that the effects of "boom town" simply will not occur. See Sect. 4.2.4 of the FEIS.

- 8.38 Comment: The housing impacts, as presented, appear underestimated in the light of informed first-hand knowledge of Monongalia County and recent experience of the Pittsburgh Area Office. The Morgantown-Monongalia County area has few standard vacant units. Transient construction workers, with Davis-Bacon wages, will be able to pay higher prices for the few available standard units, and will in turn cause considerable displacement among low- to moderate-income households, including students. The

housing shortage will be further increased by a lack of available sewer and water facilities for proposed mobile home developments. The latter park or "pad" shortage is probably underestimated in the DES.

HUD Suggestion: At this time, there is sufficient lead-time to avoid what could otherwise become a serious low- and moderate-income rental housing shortage. This office suggests, first, that a cooperative effort be established immediately between the Department of Energy and HUD to utilize DOE (or construction contractor's) funds to develop new mobile home parks for the workers in Monongalia and Greene Counties, on a well-planned and well-sited basis, with package water and sewer systems, if public facilities are not accessible. After the construction phase, such market-rate parks could be continued or be converted (if well planned) to single-family housing subdivisions.

Second, we urge DOE to consider funding 100 to 300 units of permanent rental housing for the workers, to further minimize, we believe, inevitable competition for available private rental units in the Morgantown/Mt. Morris/Waynesburg area. Created rental pressures on the elderly tenants and low/moderate income tenants of existing private facilities may cause inadvertent displacement. DOE-assisted new units could ease such inflationary, competitive market pressures. After the construction employment declined, the units could be sold, by prearrangement, to an owner for market-rate or Section 8 low/moderate income tenants. Again we stress, however, that careful, small-housing project planning, design, and siting should be followed to meet local small-town/semi-rural area needs. (Commenters: 32, p. A-148; 10, p. A-29-30; 15, p. A-51)

Response: Revised Sect. 4.2.4.1 deals with the comment on a housing shortage. Revised Sect. 4.6.2 lists mitigation measures. Federal assistance programs are presented in Appendix V.5.

- 8.39 Comment: In addition to neglecting potential water and air pollution from other proposed industrial developments and their possible cumulative or "synergistic" effects, the DES also ignores whatever social impacts will result from expanded development. (Commenter: 15, p. A-49)

Response: Revised Sects. 3.2.4.3 and 4.2.4.3 deal with the cumulative impact issue and commercialization at expanded capacity respectively. Cumulative impacts during construction of the demonstration plant are found not to be significant. A revised analysis of commercialization impacts is presented based upon presently available information.

- 8.40 Comment: The DES does not address the potential adverse impacts that may be experienced by communities faced with rapid growth due to energy development which are described in DOE's Report to the President on Energy Impact Assistance, published in March 1978 (DOE/I-R-009, UC-13). (Commenter: 9, p. A-26)

Response: See response to comment 8.37.

- 8.41 Comment: The DES does not reflect consideration of all the categories around which adverse socioenvironmental impacts could occur. (Commenter: 9, p. A-26)

Response: Revised Sect. 4.2.4 considers an expanded number of factors upon which SRC-II impacts may be felt including population change by county, detailed secondary employment impacts, income effects, and inflationary effects as well as schooling, housing, public services and finance, and other categories deemed significant.

- 8.42 Comment: Information available indicates the navigation system for the Monongahela will not be able to handle feedstock transportation after 1988. What alternatives are available to fill this need after that date? If rail is used, what will the increased traffic needs be in the face of using up the excess or added capacity for product shipments? These are important considerations in site location that are ignored in the DES. (Commenter: 28, p. A-140)

Response: See Appendix C, Sect. C.8.5 (River and Rail Impacts). Compared with the total rail mileage, additional mileage for the transportation of coal to the SRC-II commercial plant will be minor. Consequently, injuries or deaths from this additional mileage should be minimal.

9. FLOODPLAIN/WETLANDS

- 9.1 Comment: Floodplain and wetland areas should not be filled. One of the alternatives, given on pp. 4-75 or D-8, should be used. (Commenters: 28, p. A-137; 33, p. A-150; 33, p. A-152)

- Drainage of toxic materials into wetland systems should be precluded.
- Significant damage to species uncommon to the area may result and experts should be contacted.
- Alternatives to floodplain utilization and wetland fill should be provided (p. 4-16, paragraphs 1, 2, and 3).

Response: A modified site plan developed since publication of the DEIS indicates that the amount of filling necessary has been minimized by the location of most of the storage tank facilities above the 500-year flood elevation, but still within the bottomlands of the Monongahela River. The modified plans and their impacts are discussed in detail in revised Appendix D.

A small amount of filling in wetlands (0.2 to 1.0 ha in forested wetlands) will be required under the revised plans for the storage facilities (Appendix D). Prevention of spills of toxic materials into wetlands systems is discussed in Appendix D and revised Appendix C, Sects. C.3.5.3 and C.2.16.

Wetlands concerns have been discussed in Sects. 4.2.1.3 and 4.8 and in Appendix D. This is considered adequate. As a result of coordination with the U.S. Fish and Wildlife Service and the West Virginia Department of Natural Resources, several mitigative actions are being considered, including development of public access to the river, wildlife habitat improvement on land to be idle on the site, and creation of wetland areas. These mitigation measures are summarized in revised Sects. 4.6.6 and 4.6.7. Alternatives to floodplain utilization and wetland fill are discussed in Appendix D.

- 9.2 Comment: Page 2-25, paragraph 2 — This paragraph includes this statement, "The feasibility of alternatives that avoid or reduce encroachment on the floodplain are currently being evaluated." The U.S. Department of Interior cannot evaluate the effects or make recommendation on alternatives without this information. (Commenter: 33, p. A-151)

Response: Additional information and the current plans for facilities in the floodplain are presented in Appendix D. This information is being reviewed by the U.S. Fish and Wildlife Service. See also revised Appendix E.

- 9.3 Comment: From the discussions on p. 4-20, Sect. 2.2.1, and Appendixes D and J, it is obvious that floodplain issues are covered; however, analyses of alternatives to floodplain locations, for example, a pipeline to the rail area from storage facilities near the plant, are incomplete. (Commenter: 28, p. A-136)

Response: Analyses of alternatives to location of storage facilities in the floodplain are presented in Appendix D.

- 9.4 Comment: Page 4-20. Why is the facility designed to raise elevation above the 500-year flood level? What is the justification? (Commenter: 31, p. A-147).

Response: The facility is designed to raise the storage tank base elevation above the 500-year flood level to minimize impacts of possible floods on the facilities and to minimize the potential for contamination of floodwaters. From a processing standpoint, the proposed elevation places the storage area at the same elevation as the railroad siding. Such mitigatory measures are in keeping with Executive Orders 11988 and 11990 and Water Resources Council and DOE floodplain/wetlands regulations (see Appendix D).

- 9.5 Comment: Knowledge of the impacts on forested areas and wetlands is ambiguous. On p. 4-16, the DEIS notes, "The significance of the loss of the forested wetland is unclear, because the abundance of such wetlands near the site is unknown." (Commenters: 18, p. A-100; 28, p. A-137)

Response: Section 4.2.1.3 has been revised to reflect further information on the abundance of wetlands in the site vicinity.

- 9.6 Comment: Page B-5, Table B-4 and B-5 — These tables should be revised to show adverse wetland impacts at the selected site. (Commenter: 33, p. A-153)

Response: Tables B.4 and B.5 show a comparison of alternative sites by the use of matrix values; wetlands are included as a screening criterion.

- 9.7 Comment: Page 4-72 — Where is the plant located in relation to the floodplain elevation? (Commenter: 33, p. A-153)

Response: The plant location and layout was shown in Fig. 2.2 of the DEIS and compared with the floodplain area in Fig. 4.2. Elevation of the plant and the floodplain are given in revised Appendix D of the FEIS (see Fig. D.2 and Sect. D.3.1).

- 9.8 Comment: Page B-4, Table B-2 — No adverse impact is recorded for the wetlands category for the selected site (assuming Ben's Run is the Fort Martin site). A definite adverse impact will occur to the 2.5-acre forested wetland from filling; additionally, the 60-acre emergent wetland on Crooked Run would be affected by construction of the plant site and disposal area as well as by their continued use. (These impacts are clearly identified in Appendix D.) (Commenter: 33, p. A-153)

Response: Ben's Run is an alternative site located on the Ohio River. The analysis of impacts on Crooked Run are discussed in this FEIS, Sects. 4.2.2.3 and 4.2.2.4.

- 9.9 Comment: Sect. 4.8, p. 4-72, floodplain-wetlands assessment — Paragraph 4 of this section says that the floodplain and forested wetland areas along the river are not valuable ecological resources. We strongly disagree; the values of floodplains and wetlands were well documented; Executive Orders 11988 and 11990 point out these values. In mountainous regions, such as where the proposed site is, the values of the resources are often greater than in other areas. These resources are generally of limited areal extent and thus more unique in mountainous areas. (Commenters: 33, p. A-152; 18, p. A-100)

Response: Section 4.2.1.3 has been revised to clarify the basis of the assessment (Sect. 4.2.1.3).

- 9.10 Comment: If the demonstration plant product facilities are stored in the floodplain, what will be stored and what are the potential hazards to surface water and groundwater if flooding does occur? (Commenter: 30, p. A-144)

Response: Products stored at the floodplain storage area are discussed in Sect. 2.2.1.2 of the FEIS. As noted in Appendix D, Sect. D.2.3, of the DEIS, the potential hazard resulting from flooding is expected to be minimal since the storage area is located above the 500-year elevation. It should be noted that the base of the product storage area is 11.5 ft above the 500-year flood elevation. In addition, design of the storage facilities includes a containment dike and lining with impervious materials that will both contain spills and protect against floods of greater magnitude than the 500-year flood.

- 9.11 Comment: In addition, removal of wetlands from other stream systems within the site may influence runoff adversely, thus augmenting the flooding potential of the Monongahela River. This too should receive attention. (Commenter: 28, p. A-137)

Response: DOE recognizes this concern. However, the removal of about 1 ha of wetlands may augment flooding while runoff containment structures will reduce the site contribution to flooding. The magnitude of these opposing factors is not considered significant. See also Appendix J.

- 9.12 Comment: A rather good description and analysis of the effects of the facility upon flooding is presented but without apparent reference to the wetlands contribution to flood control. (Commenter: 28, p. A-136)

Response: Appendix D and Sect. 4.2.1.3 have been revised to indicate the values of floodplains and wetlands for flood control.

- 9.13 Comment: The DES states that wetlands impacts cannot be assessed because their abundance near the site is unknown (DES, p. 4-16). The abundance or relative number of wetlands does not affect the significance of any single wetland as this statement implies. This statement does indicate, however, that DOE has much to do in nature of a site analysis. (Commenter: 18, p. A-100)

Response: The abundance or relative number of wetlands does affect the significance of the loss of any single wetland. The amount of wetland to be lost is given in Appendix D and Sect. 4.2.1.3, and effects on biota are addressed in Sect. 4.2.1.3. Information on the abundance of wetlands along the Monongahela River in the site vicinity is also included in Sect. 4.2.1.3.

- 9.14 Comment: DOE has not complied with environmental review laws and executive orders. It has not conducted the required fish and wildlife surveys. Nor has it prepared the Floodplain/Wetland Assessment. These studies must be completed and integrated into the new draft or supplemental DES. (Commenter: 18, p. A-100)

Response: DOE has consulted with the U.S. Fish and Wildlife Service in connection with the Fish and Wildlife Coordination Act, and DOE has conducted the necessary fish and wildlife surveys. A floodplain/wetland assessment was presented in Appendix D of the DEIS and is updated in the FEIS, Appendix D. DOE has also prepared a preliminary floodplain/wetland determination in compliance with Executive Orders 11988 and 11990. A preliminary determination is included in Appendix D.

- 9.15 Comment: Page 4-72 — Paragraph 5 of this section states that the floodplain will be filled to approximately 20 ft above the 500 year storm. We are not convinced that this is the most practical alternative for coal storage. (Commenter: 33, p. A-153)

Response: The coal storage area has been relocated. Revised plans for floodplain development that minimize effects on the floodplain and alternatives to this development are addressed in revised Appendix D of the FEIS.

- 9.16 Comment: Page 2-20, increased encroachment in the floodplain — Since the volume and location of product storage depends on the method of shipment and cannot be determined at this time, the impacts of such storage cannot be determined. (Commenter: 33, p. A-151)

Response: The amount of encroachment onto the floodplain was addressed in Appendix D of the DEIS. The mode of product transport is discussed in Appendix Z and Appendix C, Sect. C.2.16.

10. ECOLOGY

- 10.1 Comment: The lack of a detailed site construction plan (DES, p. 4-14), of the siting of hazardous waste containment (Ibid., p. xxvii), and of product storage facilities (Ibid., p. 2-20) prevent an analysis of the quantity or quality of site disturbance of fish and wildlife resources. (Commenter: 18, p. A-99)

Response: The ecological analysis in the DEIS showed that the proposed site was an acceptable site ecologically and addressed impacts on terrestrial biota primarily in terms of habitat loss. Although changes in specific site plans or site layouts may change the quality and quantity of the impacts, these changes are unlikely to be great enough to change the ecological suitability of the site for the SRC-II facility. However, any significant design changes will be reviewed as discussed in the response to comment 2.1. Ecological impacts of the current plans for design and layout are addressed in revised Sects. 4.2.1.3 and 4.2.2.4.

- 10.2 Comment: The statement inadequately assesses the effect of air and water discharges from synfuel production as well as streamflow diversion and solid waste disposal on fish and wildlife and their habitats. This inadequacy can be attributed in part to the fact that the Department of Energy did not consult with the Department's Fish and Wildlife Service (FWS) as required under the Fish and Wildlife Coordination Act. It, therefore, appears that fish and wildlife resources were not equally considered with other project objectives. (Commenters: 33, p. A-150, A-152; 18, p. A-98-99)

Response: The effects of air emissions on wildlife and their habitats are addressed in Sect. 4.2.1.3 and Appendix G. Effects of solid waste storage on terrestrial wildlife are assessed in terms of habitat loss. DOE has consulted with the Fish and Wildlife Service, and several mitigative actions are being considered, including development of public access to the river, wildlife habitat improvement on land to be idle on the site, and creation of wetland areas (see Sects. 4.6.6, 4.6.7, and Appendix E).

- 10.3 Comment: The deficiencies in the DES's treatment of fish and wildlife resources fall into two broad categories: (1) inadequate analysis of impacts and (2) failure to address important mitigation measures. (Commenter: 18, p. A-98)

Response: DOE agrees that the facility layout should minimize impacts on fish and wildlife resources to the extent feasible. Impacts of the current facility layout plans on fish and wildlife are addressed in revised Sects. 4.2.1.3 and 4.2.2.4. A section on terrestrial ecology mitigation measures has been added (Sect. 4.6.7). Many of the mitigation measures listed in Sect. 4.6 under process controls, geology and soils, water, and air quality will also serve to minimize impacts on fish and wildlife resources. DOE is considering the following as mitigation measures for fish and wildlife resources: wetland creation, fishery development, wildlife habitat improvement, and public access. The U.S. Fish and Wildlife Service has been contacted relative to these proposals (see Appendix E).

- 10.4 Comment: Page xx, paragraph 8 — The statement "...the consumptive use of water is not expected to have a significant impact on the river's biological resources..." is not substantiated in the text of this statement. (Commenters: 18, p. A-99; 33, p. A-150)

Response: Section 4.2.2.1, which has been revised to assess water use impacts, indicates that with the 7-d, 10-year low flow, water consumption of the SRC-II demonstration plant will reduce flow by 2.4%. Thus, as a worst case, pollutants introduced downstream could cause in-stream concentrations to be up to 2.5% greater. This may cause a small but barely detectable adverse impact on fish and wildlife.

- 10.5 Comment: Page 4-31. Operational impacts — What will the approach velocity at the intake structure be? If the approach velocity is similar to or the same as the "intake velocity" (10 m/s) it is extremely high and could have severe effects on entrainment and impingement rates. How does this relate to the commercial plant? (Commenters: 18, p. A-99; 26, p. A-130; 33, p. A-152)

Response: The 10 m/s was a typographical error, and the text has been revised to show the correct design intake velocity of 10 cm/s (Sect. 4.2.2.4). The intake structure has been designed to accommodate the requirements of a commercial plant. The approach velocity during operation of the demonstration plant will be considerably less than 10 cm/s.

- 10.6 Comment: Page 3-20 to 3-24, Aquatic Biology — This section and Appendix F appear to be rather inadequate to assess the potential effects of the plant on the aquatic environment. More information on downstream aquatic biology is needed before construction begins in order to have baseline information from which future impacts can be evaluated. This should include water chemistry and benthic invertebrate studies as well as adequate fish sampling. (Commenter: 22, p. A-126)

Response: Additional information has been provided in revised Sect. 3.2.2.3 and Appendix F of the FEIS. Section 4.5.3.3 details additional aquatic ecology monitoring recommended for construction and operation.

- 10.7 Comment: Page 2-16, paragraph 5 — The awareness of the possible, very serious adverse impact of an accidental release of process material to the surface water should demand design criteria that will minimize such an accident to the maximum degree possible even if this increases costs. (Commenter: 22, p. A-126)

Response: All areas where process materials could be accidentally released to surface waters will be designed for maximum containment. The design for process storage areas is in Appendix D, Sect. D.2.3, of the DEIS and in revised Appendix C, Sect. C.3.5.3 of the FEIS. Also, Appendix Z has been added to address the likelihood and impacts of product spills during transit. Section Z.5.2.1 specifically addresses the impacts on water resources.

- 10.8 Comment: Different quantities of plant water consumption are given. Along with these discrepancies are mutually exclusive remarks regarding fish and wildlife impacts. The ORBC study appears to indicate further study on these effects is necessary while the DES seems to lay any such questions to rest. Such discrepancies should be resolved prior to the FES. (Commenter: 28, p. A-134)

Response: As noted in revised Sect. 4.2.2.4 and in the response to Comment 10.4, the SRC-II demonstration plant may cause a small but barely detectable adverse impact on fish and wildlife. Based on the ORBC study, the WRC Water Assessment calls for further study of the fish and wildlife in-stream flow needs and the impacts resulting from consumptive water use by SRC-II and other users. Further study of fish and wildlife impacts, together with consideration of water quality and availability issues, would occur as part of comprehensive basin-wide water planning. See also response to comment 2.1.

- 10.9 Comment: A discussion of aquatic life and their biological and recreational values in the ponds and streams in the project area should be provided. Mitigation for the loss of fresh water pond fishery habitat should be included. (Commenter: 33, p. A-152)

Response: Discussion of aquatic life of onsite ponds is found in revised Sect. 3.2.2.3 and Table F.2 (Appendix F) of the FEIS. Construction of freshwater pond habitat is indicated as a potential mitigation measure in revised Sect. 4.6.7.

- 10.10 Comment: Page 4-14, Sect. 4.2.1.3, Terrestrial ecology — Impacts cannot be quantified nor can decisions on alternative selections be made without the benefit of more detailed construction plans. We cannot assess impacts without knowing how much land will be disturbed. (Commenters: 33, p. A-152; 18, p. A-99)

Response: The FEIS has been revised to reflect the most current layout plans. See response to comment 10.1.

- 10.11 Comment: Page 4-17, paragraph 1 — The statement that shrub and tree grasslands are not high-quality wildlife habitats is not correct. These areas provide habitat for a wide diversity of wildlife species as the bird list included in that paragraph shows. Was a breeding bird census conducted on the project area? If not, what fish and wildlife expertise was consulted regarding breeding bird populations? (Commenters: 33, p. A-152; 18, p. A-101)

Response: In comparison with several other habitat types on the site, the grassland and shrub and tree grasslands on the site are not high-quality wildlife habitats. These grassland habitats support a significantly lower wildlife diversity than the other habitats. Contrary to the comment, these grasslands do not provide habitat for all of the species listed in the paragraph (i.e., not all of the species listed occur in these habitats on the site), although they do provide potential habitat (i.e., habitat that might be suitable for these species). Surveys of breeding birds were made by the industrial partner and its consultants. Information concerning breeding birds on the site was presented in the DEIS, Sect. 3.2.1.2 and Table 3.1 and in the FEIS, Sect. 3.2.1.3.

- 10.12 Comment: Page 1-18, paragraph 1 — We do not agree that the proposed barge facilities are in an area of low impact. Floodplains and wetlands are extremely valuable to fish and wildlife and are very limited in mountainous areas. (Commenter: 33, p. A-151).

Response: See the Floodplain/Wetlands Assessment of the FEIS (Sect. D.3 and revised Sects. 4.2.1.3 and 4.6.6).

- 10.13 Comment: Page xxix, paragraph 2 — What fish and wildlife resource values were considered in the selection of alternatives? Impacts to fish and wildlife resources should be identified and included. (Commenters: 33, p. A-151; 18, p. A-99).

Response: The presence of wetlands and endangered species was considered in the evaluation of alternative sites (see Table B.3 in Appendix B). Impacts to fish and wildlife are considered in Sects. 4.3.1.3, 4.3.2.3, 4.4.1.3, and 4.4.2.3 for alternative sites to the extent necessary to determine if alternative sites offered potential for appreciably reduced impacts.

11. MONITORING AND MITIGATION

- 11.1 Comment: The DEIS fails to present any detailed information on the monitoring scheme that will produce the necessary data. Instead the monitoring section is full of references to plans that will be developed (see, e.g., Sect. 4.5.3.2 and approaches that may be followed; also see, e.g., Sect. 4.5.4). (Commenter: 18, p. A-106)

Response: A primary purpose of the proposed demonstration plant is to establish the environmental acceptability of the SRC-II process, and this will require extensive monitoring as outlined in revised Sect. 4.5. As discussed in revised Sect. 4.5, compliance monitoring will be carried out to establish that the proposed facility is being constructed and operated within existing standards and regulations. Specific details for compliance monitoring will require approval of the appropriate regulatory agency. Additional monitoring to meet the goals of DOE's environmental program for the SRC-II process will be detailed as the project develops. The monitoring program presented in revised Sect. 4.5 was developed with the flexibility to adapt to changes in the plant design and the site layout. The program identifies sources of pollutants to be monitored, parameters to be sampled, and the sampling frequency. See also Appendix Y.

- 11.2 Comment: After construction, monitoring should be systematically carried out, especially at and around the slag area so that any failure in the containment system will be known. Monitoring will also help to identify any problems associated with anaerobically produced groundwater contaminants. Anaerobic studies should also be carried out for products and any by-products that could cause contamination of groundwaters and benthos. (Commenter: 28, p. A-134)

Response: DOE concurs. Monitoring for the slag disposal area is discussed in Sects. 4.5.3.1 and 4.5.3.2. See also response to comment 11.1. Regarding anaerobic contaminants, preliminary laboratory tests indicate that anaerobic microbial activity should not occur in leachate from the slag. Attempts to have bacteria survive in the leachate have been unsuccessful. Both sulfate (62 ppm) and BOD (33 mg/liter) levels are low and unable to support biologic activity. The by-products from anaerobic activity are hydrogen sulfide, methane, and organic acids. These materials will be detected by the slag disposal monitoring program.

- 11.3 Comment: The leak detection and repair program must be described in much more detail. (Commenter: 18, p. A-90)

Response: Current design plans for the solid waste disposal areas are presented in revised Sect. 2.2.1 and Appendix C (Sect. C.3.7). These plans include underdrains to collect any leachate for analysis and treatment. Specific details of the program will not be available until the completion of the final design. The leak detection and repair program must have the approval of EPA and the state of West Virginia.

- 11.4 Comment: If waste characterization and groundwater monitoring have to be evaluated during the demonstration stage, how can it be stated that "...no significant additional impacts are expected?" (Commenter: 33, p. A-151)

Response: Based on available information and the use of conservative disposal designs, no significant additional impacts are expected. However, evaluation of data from monitoring during the demonstration stage will confirm this impact analysis, determine the effectiveness of the mitigation measures, and identify any unexpected problem areas. The use of monitoring for these purposes is a primary focus of DOE's program to ensure the environmental acceptability of coal liquefaction facilities.

- 11.5 Comment: Groundwater monitoring should include a thorough assessment of the geohydrology prior to construction of the plant and slag disposal area; this should not coincide with the initial construction phase. This should be designed to present a picture of the aquifers, the recharge capacity at the site, and flows as well as flow rates. (Commenter: 28, p. A-134)

Response: Ongoing detailed groundwater monitoring includes an assessment of geohydrological characteristics beneath the plant process area and the waste disposal site. This is a part of the expanded baseline monitoring discussed in revised Sect. 4.5.3.1.

- 11.6 Comment: With regard for the river monitoring, information must be gathered several times annually for ichthyoplankton so that a species balance is known and a baseline can be established. Coordination with State officials may suffice, depending upon their program for fish population assessments. (Commenters: 28, p. A-134; 33, p. A-152)

Response: Results of ichthyoplankton sampling are presented in Table F.5 and F.6 of the FEIS. Supplemental monitoring for ichthyoplankton is discussed in revised Sect. 4.5.3.3.

- 11.7 Comment: The list of measures for mitigating fish and wildlife impacts is insufficient. Here as elsewhere the major obstacle is the lack of an adequate design. (Commenter: 18, p. A-101)

Response: Sects. 4.6.5, 4.6.6, and 4.6.7 have been expanded to reflect mitigation measures. See also Appendix E and the responses to comments 10.2 and 10.3.

- 11.8 Comment: The erosion control techniques and housekeeping practices discussed on p. 4-28 do not compensate for the loss of fish, wildlife, and riparian and aquatic resources. (Commenter: 18, p. A-101)

Response: See responses to comments 10.2, 10.3, and 11.7.

- 11.9 Comment: The DES should include information on location of mitigating areas and their management and utilization plans. Alternatives to floodplain fill (DEIS, p. 4-75) should be developed as mitigative methods. (Commenters: 18, p. A-102; 33, p. A-150)

Response: Filling of floodplains and alternatives are discussed in revised Appendix D and Sects. 4.8 and 2.3.2.1 of the FEIS. Location of mitigating areas and their management plans are being developed by DOE in consultation with the U.S. Fish and Wildlife Service and the West Virginia Department of Natural Resources. Also see Appendix E and response to comment 11.7.

- 11.10 Comment: The only mitigative measures given for entrainment and impingement losses is the construction of Stonewall Jackson Reservoir. This is not acceptable mitigation. Many techniques are available to reduce entrainment and impingement losses and these should be thoroughly evaluated and the best technique utilized. (Commenters: 33, p. A-152; 18, p. A-101)

Response: Section 4.2.2.4 indicates that impingement losses will be minimized by intake structure design which keeps intake velocity below 10 cm/s. Entrainment losses can be further reduced by siting the intake structure in areas of minimum ichthyoplankton densities. DOE is currently evaluating the location of the proposed intake and the possible relocation to a site closer to midstream to avoid areas of high ichthyoplankton density (see revised Sect. 2.3.2.1). See also response to comment 6.5.

- 11.11 Comment: Air Quality Monitoring: On p. 4-7, words appear to the effect that the end products will depend to a large extent upon the quality of coal used as feedstock. Does this have any implications for the end use at power plants? That is, will the product represent large enough changes to warrant special monitoring at the site and in its surroundings? If so, a program should be undertaken to this end or if not, reassuring statements should be included to allay fears. (Commenter: 28, p. A-139)

Response: The results of combustion tests are discussed in revised Appendix C, Sect. C.7.1. These tests indicate that a large number of boilers could utilize SRC-II fuel and maintain compliance with emission standards. The need for special monitoring is not anticipated; it is not expected that the different feedstocks that could be used will have significant effect on the properties of the plant's products.

- 11.12 Comment: EPA believes a thorough socioeconomic monitoring program should be established to allow for quick resolution of problems. The socioeconomic monitoring should be carried out beyond the first quarter of the demonstration operation. (Commenter: 28, p. A-141-142)

Response: Socioeconomic monitoring is discussed in revised Sect. 4.5.3.5 of this FEIS. Population increases and associated socioeconomic problems will result from construction activities over a three- to four-year period. Monitoring throughout this period as well as the first quarter of operation should be sufficient to identify and mitigate any problems.

- 11.13 Comment: The DEIS provides no indication of the information, training, or financial assistance options available to the company, Federal government, or local community. There are dozens of possible approaches for mitigating the socioeconomic impacts of the SRC-II plant. (Commenter: 18, p. A-105)

Response: Appendix V.5 has been added to the FEIS. This Appendix includes a summary of available Federal assistance programs for which Monongalia County and the city of Morgantown are judged to be eligible.

12. ALTERNATIVES

- 12.1 Comment: Section 2.1.3, p. 2-2 — Summary comparison of alternatives. Water quality and supply, fish and wildlife resources, and floodplain and wetland values should have been considered in this evaluation. (Commenter: 33, p. A-151)

Response: A summary comparison of impacts on water, fish and wildlife resources, and floodplain and wetland values is included in revised Sect. 2.3.2.2 of the FEIS.

- 12.2 Comment: Page B-4, Table B-3 — Water supply, floodplains, and fish and wildlife resources should be used as additional environmental variables during site selection. (Commenter: 33, p. A-153)

Response: The procedures used for site-selection analyses are discussed in revised Appendix B, Sect. B.2, of the FEIS.

- 12.3 Comment: As part of the site alternative assessment no mention is made of the possibility of choosing a site closer to the point of final product use. (Commenter: 28, p. A-140)

Response: Revised Appendix B.2 includes a list of factors that influenced site selection. Proximity to market was considered, along with other locational factors.

- 12.4 Comment: Page 2-38, comparison of impacts at proposed and alternative sites — It is stated that if process design remains the same, the significance of these impacts depends on site-specific considerations. It is stated in the third paragraph of that section and other places in the draft that no plant layouts have been proposed for the alternative sites. It is not possible to select the best environmental alternative without this information. (Commenter: 33, p. A-151)

Response: The purpose of this alternative site analysis is not to select the environmentally preferable site but rather, in response to NEPA, to identify reasonable alternative sites.

- 12.5 Comment: If offsite electrical generation is selected, then the DES must include analysis of the environmental impacts attributable to the additional generating capacity elsewhere needed to supply the plant. (Commenter: 18, p. A-75)

Response: The current design includes onsite conventional steam turbogenerators to provide the proposed plant's electricity needs. See revised Appendix C, Sect. C.2.14. The air emission estimates in Sect. C.4.1 include analysis of the implications of onsite steam generation. The air quality impact analysis in Sect. 4.2.3.1 is also based on onsite electrical generation.

- 12.6 Comment: Page 4-47 — Proposed pipeline routes must be identified and their impacts reviewed in this EIS. (Commenter: 16, p. A-52)

Response: Only gaseous products would be shipped by pipeline, and the existing pipeline that traverses the site would be used. No impacts would be expected.

- 12.7 Comment: Alternate means of shipping coal to the commercial facility should be studied, as current lock capacities along the existing river system might be inadequate to accommodate the volume of coal required for the commercial plant without causing delays to other users of the river system. (Commenter: 18, p. A-69)

Response: This issue is discussed in the revised Sect. 4.2.2.1 and C.8.5 of this FEIS. See also response to comment 8.42.

- 12.8 Comment: The DES itself identifies more effective technology for sulfur recovery, but simply states that more study of alternatives is needed (DES, p. 2-27). This discussion is far too incomplete to illuminate choices with regard to sulfur recovery tail gas clean-up. (Commenter: 18, p. A-74)

Response: Additional discussion on sulfur removal and recovery alternatives has been provided in revised Appendix C, Sect. C.3.2.1, of this FEIS.

13. SOLID WASTE

- 13.1 Comment: The solid waste discussions within the DES incompletely address several problems, ranging from potential hazards of the materials through location of the disposal site. The summary, for example, should mention hazards that might be associated with waste components from the various processes. The document is deficient in pinpointing disposal measures other than for the gasifier options, which are to be delayed, according to p. 4-22, until the demonstration phase has started. (Commenter: 28, p. A-140)

Response: Additional information on solid wastes has been included in revised Sect. 2.2.1.2 and revised Appendix C, Sect. C.3.7. Proposed disposal sites and methods are discussed in these sections. Revised Sect. 2.3.2.1 identifies the areas of incomplete design.

- 13.2 Comment: Further details on the landfill design/operation would be necessary in order to confirm that the landfill would be "secure." For example, is the proposed liner (3 feet of clay compacted to a permeability of 10^{-8} cm/sec) equivalent to RCRA requirements? Is the liner slope and the leachate collection system designed in accordance with RCRA requirements in order to prevent moisture buildup at the bottom of the disposal basin? What data are available demonstrating that available soils/clays can be compacted to 10^{-8} cm/sec? (Commenters: 28, p. A-140; 18, p. A-67)

Response: The design of the plant will fully comply with the requirements of RCRA regarding waste generation, handling and storage. Specific design details for the proposed landfill will be provided to EPA and the state of West Virginia during the Solid Waste Disposal Permit process. The information required by regulatory agencies will be obtained as final design proceeds. DOE will conduct additional geotechnical studies to determine whether onsite soils can in fact be compacted to a permeability of 10^{-8} cm/s. If onsite soils are unsuitable, offsite soils will be used.

- 13.3 Comment: On 4-24, anaerobic conditions are mentioned for the second time. It would be a good idea to ascertain the results of anaerobic conditions on the waste since such conditions could exist in a variety of environments from the river to the disposal site. It also seems feasible to carry out laboratory studies to answer the following questions. First, what could be expected in low lying areas where incidental and small spills might occur? Second, presumably a range of compounds could be produced anaerobically that might become mobile, and monitoring systems could conceivably miss them. What are the implications for groundwater and for surface waters, as well as natural areas? (In conjunction with any new products or by-products formed as either solid or liquid waste, bioassay tests should be performed so that a clear picture of toxicity is presented for all SRC-II products and by-products, as part of the plans referred to in Appendix I.) (Commenter: 28, p. A-140)

Response: Preliminary tests on anaerobic conditions are discussed in response to comment 11.2. Additional tests will be conducted to better characterize the waste streams associated with the demonstration facility (see Sect. 4.5 of this FEIS).

- 13.4 Comment: Is it possible that the amount of wastes will be far larger than anticipated, based upon the experimental nature of the project? The solid products of numerous upsets may make for greater disposal plans than cited for requirements with highly reactive intermediate wastes. (Commenter: 28, p. A-140)

Response: The proposed slag disposal area will be of sufficient size and capacity to handle the waste from the demonstration plant and 25 years of commercial operation. This should be more than adequate to handle waste from unexpected upsets. In addition, the disposal areas for slag and other wastes will be designed on the assumption that all wastes are "hazardous," even though preliminary laboratory work (Appendix K) suggests that slag (the greatest volume of solid waste) will be "nonhazardous."

13.5 Comment: Slag Tests — Some questions have been raised regarding use of the term "slag." Is this really slag in the same sense that the term is used for related industries? Its chemical composition is such that it may deserve treatment wholly different from slag produced in other industrial operations. (Commenter: 28, p. A-140)

Response: The gasified mineral-ash residue is considered to be a type of slag since it is produced by water quenching a molten mineral substance. Preliminary studies indicate that the slag is nonhazardous (see revised Appendix C, Sect. 3.7.1, and Appendix K).

14. LAND USE

- 14.1 Comment: Page xvi, paragraph 2 — The purchase of land for the demonstration project prior to approval of the Final Environmental Statement appears to conflict with Section 1502.2(f) of the CEQ regulations. (Commenter: 33, p. A-150)

Response: DOE will obtain ownership to the site only after a Record of Decision approving the project is issued. Prior to that time any land acquired will belong to the industrial partner or the Monongalia County Development Authority.

- 14.2 Comment: Section 5, p. xviii — Current status of the proposed action. This section should state that land purchases for the project have already been initiated. (Commenter: 33, p. A-150)

Response: The text has been revised to reflect this comment.

- 14.3 Comment: EPA is concerned about the amount of land to be taken out of current production trends. The inordinately large amount of land dedicated to the project may imply greater ambitions for the site than described in this DEIS. If this is true, it is suggested that DOE describe future land uses to the fullest extent possible. (Commenter: 28, p. A-141)

Response: As was noted on p. xvi of the DEIS, the large amount of land comprising the proposed site is a result of topography and land ownership patterns. All plans for the site are described in the FEIS and now include the possibility of onsite water storage for use during droughts and improvement of wildlife habitat on the western portion of the site to offset the loss of wetland areas. In addition, the land surrounding the site will serve as a buffer against future growth adjacent to the proposed site. Also see the response to comment 14.6.

- 14.4 Comment: It is possible that, because the facility's land is not owned by DOE on a fee-simple basis, future mining could be undertaken at the whim of the mining companies in mineral ownership. With the techniques of mine sealing being as primitive as they are, two obvious possibilities come to mind: (1) subsidence could develop such that aquifers may be intersected; (2) large-scale subsidence could occur that would disrupt the plant as well as disposal sites and other essential operations. Even though informal discussions have laid this concern to rest, statements should be made to the effect that no operations will be located over such areas and that no mining will ever take place in the deep geological formations at the site. (Commenter: 28, p. A-141)

Response: The active site areas for both the demonstration and commercial facilities are not located above major coal reserves. In addition, subsurface mineral rights will be obtained for those areas beneath the active site areas and conveyed to DOE as part of the industrial partner's land contribution to the project. Should the demonstration plant be transferred to a private firm after completion of the demonstration, the mineral rights would be transferred with the plant and land.

- 14.5 Comment: Impacts on the Proposed Site — Impacts on the site cannot be quantified as the site boundaries have not yet been secured (p. 2-14). Due to a revision in the plant layout to avoid commercial slag disposal in areas subject to possible subsidence, the site boundaries may change significantly because acquisition of the western portion of the site may no longer be necessary (but may be acquired as a result of the pattern of land ownership), and additional buffer area may be acquired along Highway 53. (Commenter: 18, p. A-24)

Response: The impact assessment is based on the site shown in Fig. 2.2 of the FEIS. Should any significant changes occur as design is finalized, the potential impacts will be assessed according to the procedure described in the response to comments 2.1 and 3.1.

- 14.6 Comment: Appendix B, p. B-2, paragraph 3 — Why is the site selection criteria 1300 acres, when less than 300 acres are needed for the project? Use of 1300 acres rather than 300 acres extremely limits available alternatives and seems to be very arbitrary. According to Table B.1 on p. B-3, this criteria eliminated 13 of the 27 alternatives sites identified. Would these sites have been eliminated if 300 acres was the size criteria? (Commenter: 33, p. A-153)

Response: During the site selection process (described in Appendix B, Sect. B.2), the industrial partner specified the minimum land requirement as 1300 acres. Permanent plant facilities will occupy about 373 acres (Sect. 4.2.1.3); however, the topography of the site does not allow each of the permanent facility areas to adjoin one another, so additional land is required. During construction, additional land will be required as laydown areas for equipment and construction materials. As is customary with industrial facilities, a buffer zone will be provided between the plant facilities and surrounding land in public or private ownership, which adds to the amount of land required. Finally, the size of the site was selected to enable plant expansion. These factors, plus the possible need for onsite water storage, combined to produce the 1300-acre criterion. The DOE alternative site selection for comparative impact analysis (Appendix B, Sect. B.3) also used the 1300-acre criterion.

15. GEOLOGY AND SOILS

- 15.1 Comment: Geological surveys described on pp. 3-5 and 4-13 mention deep mine voids that have been encountered on the site. It is not clear that any of the solid waste operations will be located over these areas. Subsidence is definitely a possibility in areas overlying such abandoned workings and should be considered. (Commenters: 28, p. A-140; 33, p. A-152)

Response: Solid waste operations will not be located over areas in which mine voids have been located. See revised Sect. 4.2.1.2, "Operational Impacts."

- 15.2 Comment: The DES calculated soil loss to the area using the Universal Soil Loss Equation (DES, p. 4-12). Use of this method is not particularly appropriate as it was not modeled from data on construction sites. The Universal Soil Loss Equation is designated for predicting agricultural soil losses during a single storm and on a specific site. It cannot be used for averaging soil losses, either temporally or spatially, as was done in the DES. This is due to the extreme variations in vegetation, soil physics, and slope, unique to each site. The soil losses presented, therefore, cannot be accepted. (Commenter: 18, p. A-101)

Response: This comment has been considered in the revised Appendix H, Sect. L.5, and revised Sect. 4.2.1.2, "Construction Impacts."

- 15.3 Comment: The soils descriptions in Appendix I is commendably exhaustive except that it lacks site specificity. The possibility also exists that the parent material and bedding may contain pyritic minerals, as briefly discussed on p. 4-13. Disturbance of these during construction could produce acid mine drainage that should be controlled during construction and mitigated so that soil pH remains at an acceptable level for operation. This goes a little beyond the controls mentioned in the DES. Statements are made that soils will be depended upon for attenuation of spilled products so that they will not percolate into aquifers. We hope any spills will be controlled much more thoroughly through means other than depending upon the clay fraction.

What are the attenuation properties of the soil underneath the proposed disposal site? (Appendix L is not site-specific). (Commenter: 28, p. A-141)

Response: The characteristics of the site soils are described in Appendix L, Sect. L.3. Control measures, such as paving the process area, lining product storage areas, and lining the slag disposal site, are described in Sect. 4.2.2.2 and revised Appendix C, Sects. C.3.5.3 and C.3.7.

Pyritic material exposed during construction will be segregated and placed in disposal sites to prevent acid contamination of soils.

- 15.4 Comment: The DES has overlooked the extent to which haul roads contribute to sedimentation and erosion rates (DES, pp. 4-12 and 4-13). (Commenter: 18, p. A-101)

Response: This has been included in revised Sect. 4.2.1.2, "Construction Impacts."

- 15.5 Comment: The schedule for gathering baseline geohydrological data is needed. (Commenter: 28, p. A-134)

Response: See response to comment 11.5.

15.6 Comment: Effects of geotechnical properties on operation and the impacts on geologic characteristics are dependent on later design. (Commenter: 18, p. A-67)

Response: The procedure for determining the effects of geotechnical characteristics on final design are discussed in Sect. 4.2.1.2.

Appendix A.4

SUMMARY OF ISSUES RAISED AT PUBLIC HEARINGS

SUMMARY OF ISSUES RAISED AT PUBLIC HEARINGS
June 30 and July 1, 1980
Morgantown, West Virginia

This section presents the major issues raised at the public hearings in Morgantown, West Virginia, on June 30 and July 1, 1980, concerning the SRC-II demonstration project. The issues were extracted from the hearing transcripts and grouped in the same manner as written comments in Sect. A.3. Because most issues are similar to those contained in the written comments, which have been addressed in Sect. A.3, they are referenced by number to the appropriate comment in Sect. A.3. Each comment includes a number corresponding to the list of speakers in Sect. A.1 and the page number from the transcript of the public hearings [e.g., (Speaker 18, p. 213)]. The responses to other issues are cross-referenced to the appropriate sections of this FEIS. The few issues raised at the public hearings but not previously considered or accommodated are responded to in this section. If speakers submitted written comments similar to their oral remarks, the comments are addressed in Sect. A.3.

1. PROGRAMMATIC AND POLICY ISSUES

- 1.1 Comment: How do policy changes regarding U.S. fuel emphasis affect the SRC-II plant?
(Speaker: 18, p. 213)

Response: During the demonstration phase the facility involves government participation. Consequently, major policy changes by the government could affect the demonstration plant. The commercial operation will be owned solely by the industrial partner and, therefore, be subject to existing market conditions for the products.

- 1.2 Comment: Address the impacts of a commercial size SRC-II plant. (Speaker: 13, p. 137)

Response: See response to comment 1.3, Appendix A.3 of this FEIS.

- 1.3 Comment: Alternative energy sources are not adequately addressed. (Speaker: 3, p. 15; 7, p. 40; 10, p. 147)

Response: See response to comment 1.2, Appendix A.3.

- 1.4 Comment: A programmatic statement should be prepared for both demonstration and commercial plants. (Speaker: 7, p. 42)

Response: See responses to comments 1.1, 1.4, and 2.1, Appendix A.3.

2. GENERAL COMMENTS

- 2.1 Comment: Identify other uses for SRC-II other than boiler fuel. (Speaker: 3, p. 14)

Response: Products from the plant are shown in Table 2.1 of this FEIS. In addition to boiler fuel, these products include naphtha, methane, ethane, propane, and butane.

- 2.2 Comment: Discuss the suitability of local coal. (Speaker: 13, p. 142-143)

Response: See response to comment 2.11, Appendix A.3.

- 2.3 Comment: Revise site map to show correct boundaries and indicate commercial expansion. (Speaker: 11, p. 202)

Response: See Fig. 2.2 of this FEIS.

2.4 Comment: Edit to ensure consistent use of metric units. (Speaker: 14, p. 32)

Response: See response to comment 2.4, Appendix A.3.

2.5 Comment: Locate the plant at the source of coal (Speaker: 4, p. 20)

Response: See response to comment 2.11, Appendix A.3.

3. PLANT DESIGN AND ENGINEERING

3.1 Comment: More information is needed on waste disposal and disposal sites. (Speakers: 16, p. 119; 22, p. 166)

Response: See Appendix C, Sect. C.3.7, of this FEIS.

3.2 Comment: Identify impacts of water soluble solid wastes. (Speaker: 14, p. 36)

Response: See Sect. 4.2.2.2 and Appendix C, Sect. C.3.7.2.

3.3 Comment: Identify impacts of alternative wastewater treatment systems. (Speaker: 2, p. 226)

Response: This is discussed in Appendix C, Sect. C.3.6.2.2, and responses to comments 3.4 and 6.8, Appendix A.3.

3.4 Comment: The final plant design is needed. (Speakers: 16, p. 123; 18, p. 215; 22, p. 104)

Response: See response to comment 3.1, Appendix A.3.

4. SAFETY AND ACCIDENTS

4.1 Comment: Discuss the need for a community evacuation plan. (Speaker: 18, p. 209)

Response: See response to comment 4.6, Appendix A.3.

4.2 Comment: Clarify the PEP statement focusing only on compliance with existing standards. (Speaker: 1, p. 84)

Response: The PEP has been replaced by more detailed planning (see Sect. 4.5 and Appendix Y). See also response to comment 5.25, Appendix A.3.

4.3 Comment: Discuss accidents and fatalities as a result of mining coal for demo and commercial plants. (Speaker: 13, p. 139)

Response: See response to comment 2.11, Appendix A.3.

4.4 Comment: Discuss suitability of enclosing the process area and using double piping. (Speaker: 22, p. 165)

Response: This is discussed in Appendix C, Sect. C.3.9.

4.5 Comment: Include a Safety Analysis Report or a commitment to prepare one and a discussion of its contents — fault-tree analysis. (Speakers: 1, p. 79; 13, p. 139; 20, p. 185; 22, p. 166)

Response: See response to comment 4.1, Appendix A.3, and FEIS Appendix AA.

5. HEALTH RISKS

- 5.1 Comment: Include a discussion of CO, H₂O, SO₂, and thermal risks. (Speaker: 13, p. 137)

Response: Control of common industrial hazards including those mentioned are discussed in Sect. 4.1.3.7 of this FEIS.

- 5.2 Comment: Include a detailed discussion of control plans and mitigation measures to alleviate health risks, including a discussion of the hygiene program. (Speakers: 7, p. 44; 14, p. 33; 31, p. 219)

Response: See Sect. 4.1.3 and Appendix Y.3.

6. WATER RESOURCES

- 6.1 Comment: Discuss the effects of SRC-II product spills on water bodies. (Speakers: 16, p. 119; 18, p. 208)

Response: This is discussed in Appendix Z and Sect. 4.1.3.8.

- 6.2 Comment: Definitive finding is needed regarding the dependence of the demo and commercial plants on the Stonewall Jackson Dam. Will water be available to the SRC plant? If it is available, will it be adequate to offset the SRC-II consumption? What will the impacts be in Pennsylvania? If SRC-II does depend on the dam, what are the impacts of the dam project? (Speakers: 7, p. 41; 4, p. 21; 10, p. 150; 13, p. 144; 30, p. 26-28)

Response: See response to comment 6.5, Appendix A.3.

- 6.3 Comment: Discuss alternative water supply strategies. (Speakers: 30, p. 28; 10, p. 150)

Response: See response to comment 6.3, Appendix A.3.

- 6.4 Comment: Obtain WRC water resource assessment. (Speakers: 10, p. 151; 7, p. 41; 30, p. 26)

Response: See response to comment 6.7 in Appendix A.3.

- 6.5 Comment: Discuss administrative alternatives to reduce water consumption during critical drought periods. (Speakers: 7, p. 41; 34, p. 30)

Response: See responses to comments 6.3 and 6.4 in Appendix A.3.

- 6.6 Comment: Clear up conflicting reports from COE regarding the adequacy of the lock and dam system for meeting navigation needs through commercial operation. Discuss impacts of upgrading locks to accommodate SRC-II. (Speakers: 7, p. 44; 4, p. 20; 13, p. 144)

Response: See response to comment 8.42 in Appendix A.3.

- 6.7 Comment: Since Pennsylvania has more stringent water quality standards than West Virginia or the United States, will SRC-II be allowed to cause violations in Pennsylvania? (Speaker: 18, p. 212)

Response: See response to comment 6.14 in Apperidix A.3.

7. AIR AND NOISE

- 7.1 Comment: Include results of PSD application into air quality impacts. Include Alla Coke Plant. (Speakers: 4, p. 17-18; 12, p. 113; 20, p. 186; 18, p. 212; 6, p. 241)

Response: This is provided in Sect. 4.2.3.1 of the FEIS. See also response to comment 7.23.

- 7.2 Comment: Elaborate on location and type of industry restrictions in the future with respect to PSD increments and increment consumption. (Speakers: 6, p. 241; 12, p. 114; 18, p. 208)

Response: See responses to comments 7.22 and 7.23 in Appendix A.3. This is also discussed in Sect. 4.2.3.

- 7.3 Comment: Discuss the effect of atmospheric inversions on air quality. (Speaker: 18, p. 208)

Response: The air quality dispersion modeling includes the effect of atmospheric inversions on air quality. See revised Sect. 4.2.3.1 and Appendix Q.

- 7.4 Comment: What are the noise impacts during construction and operation? (Speaker: 22, p. 105)

Response: Noise effects are discussed in Sect. 4.2.3.2 and Appendix W.

8. SOCIOECONOMIC

- 8.1 Comment: Obtain Region VI Planning Commissions's housing availability study. (Speaker: 20, p. 182)

Response: This is included as Appendix V.4 of the FEIS.

- 8.2 Comment: Revise the estimate of available housing. The estimate is based on CONSAD's report to the Region VI Planning Commission and is out of date. (Speaker: 20, p. 181)

Response: See response to comment 8.29, Appendix A.3.

- 8.3 Comment: Discuss the schedule for plant construction and increased housing demand in relation to the availability of housing. Discuss possible mitigation strategies and whether they could be implemented in time. (Speakers: 10, p. 151; 13, p. 140; 20, p. 182; 24, p. 48)

Response: See response to comment 8.11, Appendix A.3.

- 8.4 Comment: Identify whether all residents to be affected by property acquisition have been notified. (Speaker: 11, p. 202-203)

Response: See response to comment 8.15, Appendix A.3. All affected residents have been notified.

- 8.5 Comment: Determine the capacity and available space in individual schools. Presently, only a county-wide estimate is available. This estimate will be linked to the settlement pattern for immigrating families for a determination of the adequacy of affected schools. (Speaker: 16, p. 118)

Response: See response to comment 8.4, Appendix A.3.

- 8.6 Comment: Determine the cost per capita to educate the additional school children. (Speaker: 12, p. 114)

Response: This is provided in Sect. 4.2.4.1 of this FEIS.

- 8.7 Comment: Discuss the effects on the University of West Virginia and on the university community. (Speakers: 16, p. 119; 11, p. 207; 2, p. 224)

Response: See responses to comments 8.5 and 8.25.

- 8.8 Comment: Elaborate on the need to upgrade sewer and water supply facilities. Determine the effect of the project on these facilities and vice versa. If upgrading is necessary, what is the cost and who will pay for it. (Speakers: 12, p. 114; 20, p. 183; 24, p. 48)

Response: This is discussed in Sect. 4.2.4.1 of the FEIS.

- 8.9 Comment: Determine the adequacy of and effects on hospitals, nursing homes, professional services, and other health care services. (Speakers: 16, p. 118; 24, p. 48)

Response: See response to comment 8.18, Appendix A.3.

- 8.10 Comment: Discuss taxation of the site and the facility, or payments in lieu of taxes. (Speakers: 12, p. 114; 20, p. 184)

Response: See response to comment 8.36, Appendix A.3.

- 8.11 Comment: A finance analysis is needed to compare the demands of the project (especially the in-migrating population during construction) to the adequacy and capacity of community services. The analysis should discuss the potential increase in the costs of these services and the effects on citizen taxes. Discuss who will pay for mitigation: P&M, DOE, citizens. (Speakers: 10, p. 151; 24, p. 184)

Response: See responses to comments 8.31 and 8.35, Appendix A.3.

- 8.12 Comment: Will union or nonunion personnel be used during construction? If nonunion, revise in-migrating labor size and all socioeconomic issues. (Speaker: 13, p. 142 and 144)

Response: No final decision has been made. See also response to comment 8.35, Appendix A.3.

- 8.13 Comment: Integrate the CONSAD labor availability study and the ORAU construction labor assessment. (Speakers: 16, p. 119; 10, p. 152)

Response: See response to comment 8.14, Appendix A.3.

- 8.14 Comment: Identify the exact transportation route for products, especially the fuel oil. (Speaker: 7, p. 44)

Response: A possible transportation route is discussed in Appendix Z.

- 8.15 Comment: Determine environmental and economic effects of road upgrading — also the schedule of the upgrading relative to construction schedule. (Speakers: 12, p. 114; 13, p. 140)

Response: See response to comment 8.28, Appendix A.3.

- 8.16 Comment: Can mitigation of transportation impacts occur in time? Discuss mitigation measures. (Speakers: 18, p. 208; 20, p. 183; 24, p. 48)

Response: See Sect. 4.2.4.1 ("Transportation").

- 8.17 Comment: Discuss and evaluate the socioeconomic impacts of decommissioning. (Speaker: 18, p. 214)

Response: See response to comment 8.16, Appendix A.3.

- 8.18 Comment: Discuss fate of the Fort Martin Church and its importance. (Speaker: 11, p. 200-201)

Response: See response to comment 8.15, Appendix A.3.

8.19 Comment: More discussion of regional socioeconomic impacts, not just Morgantown and Monongalia County is needed. (Speakers: 10, p. 152; 24, p. 51)

Response: See response to comment 8.1, Appendix A.3, and Sect. 4.2.4.1 of this FEIS.

8.20 Comment: Discuss the potential for a boom & bust cycle. (Speakers: 16, p. 119; 18, p. 214)

Response: See response to comment 8.37, Appendix A.3.

8.21 Comment: Identify the economic and social effects on special populations such as the elderly and low-income groups. (Speakers: 20, p. 179; 24, p. 50)

Response: See response to comment 8.12, Appendix A.3.

8.22 Comment: In general, identify which people and areas will benefit and which will suffer. (Speakers: 18, p. 214; 13, p. 140)

Response: This is discussed throughout Sect. 4.2 of this FEIS.

8.23 Comment: Assess the cumulative impacts of SRC-II, Alla Ohio Coke Plant, the industrial plant at Core, and other planned projects in the study area. (Speakers: 18, p. 213; 20, p. 178; 24, p. 151)

Response: See responses to comments 8.5 and 8.14, Appendix A.3.

9. FLOODPLAIN/WETLANDS

9.1 Comment: Complete a floodplain/wetland practicability determination.

Response: A preliminary determination is provided in Appendix D.