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Final Environmental Impact Statement

Remedial Actions at the Former Vitro Rare Metals Plant Site,

Canonsburg, Washington County, Pennsylvania

United States Department of Energy

July 1983

Volume I

DISCLAIMER

Cover Sheet

Final Environmental Impact Statement

Remedial Actions at the

Former Vitro Rare Metals Plant Site,

Canonsburg, Washington County,

Pennsylvania

(a) Lead Agency: U.S. Department of Energy (DOE)
Cooperating Agency: U.S. Nuclear Regulatory Commission (NRC)

(b) Proposed Action: Long-term stabilization and control of residual radioactive materials at an industrial park in Canonsburg, Pennsylvania designated a processing site for remedial action under the Uranium Mill Tailings Radiation Control Act of 1978 (Public Law 95-604).

(c) For Further Information Contact: (1) Mr. James A. Morley, Manager, Uranium Mill Tailings Remedial Action Project, U.S. Department of Energy, Albuquerque Operations Office, 5301 Central Avenue, N.E., Suite 1700, Albuquerque, New Mexico 87108, Ph: (505) 844-3941; (2) Dr. Robert J. Stern, Director, Office of Environmental Compliance, U.S. Department of Energy, Office of the Assistant Secretary for Environmental Protection, Safety, and Emergency Preparedness, Room 4G-064, Forrestal Building, 1000 Independence Avenue, S.W., Washington, D.C. 20585, Ph: (202) 252-4600; (3) Mr. Henry Garson, Esq., Assistant General Counsel for Environment, U.S. Department of Energy, Room 6D-033, Forrestal Building, 1000 Independence Avenue, S.W., Washington, DC 20585, Ph: (202) 252-6947.

For Copies of the FEIS, Contact: Mr. Morley at the above address.

(d) Designation: Final Environmental Impact Statement (FEIS).

(e) Abstract: This Canonsburg FEIS evaluates the environmental impacts associated with remedial actions in connection with residual radioactive materials remaining at the inactive uranium processing site located in Canonsburg, Washington County, Pennsylvania. The Canonsburg site is an 18.5-acre property that was formerly owned by the Vitro Rare Metals Company. The expanded Canonsburg site would be an approximately 30-acre property that would include the Canonsburg site (the former Vitro Rare Metals plant), seven adjacent private houses, and the former Georges

Pottery property. The processing plant located on the Canonsburg site was owned and operated by the Vitro Rare Metals Company and its successors in interest. During the period 1942 through 1957 the Vitro Manufacturing Company and its successor, the Vitro Corporation of America, processed onsite (contractor-owned) residues and ores, and government-owned ores, concentrates, and scraps to extract uranium and other rare metals. The Canonsburg site is now the Canon Industrial Park. In addition to storing the residual radioactive materials of this process at the Canonsburg site, approximately 12,000 tons of radioactively contaminated materials were transferred to a railroad landfill in Burrell Township, Indiana County, Pennsylvania (the Burrell site). This Canonsburg FEIS evaluates five alternatives for removing the potential public health hazard associated with the radioactively contaminated materials. In addition to "no action," these alternatives involve various combinations of stabilization of the radioactively contaminated materials in place or decontamination of the Canonsburg and Burrell sites by removing the radioactively contaminated materials to another location. In addition to the two sites mentioned, a third site located in Hanover Township, Washington County, Pennsylvania (the Hanover site) has been considered as a disposal site to which the radioactively contaminated materials presently located at either of the other two sites might be moved.

The five alternatives are: (1) no action; (2) decontamination of the Burrell site, transfer of the Burrell site's radioactively contaminated materials to the Canonsburg site, and stabilization of both the Canonsburg and Burrell sites' radioactively contaminated materials at the expanded Canonsburg site; (3) stabilization of the Canonsburg site's radioactively contaminated materials at the expanded Canonsburg site and the Burrell site's radioactively contaminated materials at the Burrell site; (4) decontamination of both the Canonsburg and Burrell sites, and disposal of all of the radioactively contaminated materials at the Hanover site; (5) decontamination of the Canonsburg site, disposal of its radioactively contaminated materials at the Hanover site, and stabilization of the Burrell site's radioactively contaminated materials at the Burrell site.

Alternative 3 is the DOE's preferred alternative.

Impacts associated with the proposed cleanup were assessed in terms of radiation, air quality, surface- and ground-water quality, soils, geology, mineral resources, aquatic and terrestrial ecology, noise, land use, socioeconomics, demography, and transportation networks. Under Alternative 1 the present situation would remain (i.e., the presence of radioactively contaminated materials at the Canonsburg and Burrell sites). The main impact of this alternative is that there would be 0.011 and 0.001 additional lung cancer deaths per year among the 68,488 people living near the Canonsburg and Burrell sites, respectively, due to the radioactively contaminated materials present. After any of the other alternatives are completed, the incremental chance for any individual living near any of the three sites dying from lung cancer arising from the radioactively contaminated materials would be approximately 1 in 20,000,000 per year. This is extremely small when compared with the normally expected annual lung cancer death rate of 1 in 33. Aside from the radiological impacts, the impacts arising from the transportation of the radioactively contaminated materials and clean fill would be the most significant. If Alternative 3 is selected as the recommended action, the majority of the hauling would be for clean fill. This clean fill material would come from borrow pits located near each site. The use of 20-ton dump trucks to haul this clean fill material would create traffic, noise, and road deterioration problems, particularly on the narrow streets giving access to the Canonsburg site. The timing of the trips would be scheduled so that peak traffic hours and heavily traveled routes would be used as little as possible. Under all of the remedial-action alternatives, excavation of radioactively contaminated materials, addition of clean fill, and grading, would occur in the flood plain of Chartiers Creek. Alternative 2 or 3 would involve filling part of the flood plain to provide a base for the encapsulation cell.

Other potential impacts that could not be avoided include the possible local exceedance of the total suspended-particulate air-quality standard at the Hanover site under Alternatives 4 and 5, the disruption of the terrestrial ecosystems at each site, the disruption of local businesses, the inconvenience of the local residents through noise, travel, and aesthetic impacts, and the potential loss of land for future development. If Alternative 2 or 3 is chosen, at the expanded Canonsburg site there would be the loss of the former Georges Pottery buildings and the seven residences currently located on Wilson Avenue (also called Ward Street) and George Street adjacent to the Canon Industrial Park. The owners of the buildings and residences, and the businesses located on the expanded Canonsburg site would receive relocation assistance from the U.S. Department of Energy.

Local businesses and local government agencies could receive additional revenues from supplying the goods and services needed by the workers conducting the remedial action.

Several mitigation measures have been identified which, if implemented, would reduce or eliminate any remaining impacts. These measures could include emission controls on vehicles, stoppage of work during adverse weather conditions, covering exposed piles at the end of each day, placement of erosion-control berms, use of protective equipment, treatment of all waste water leaving the site, decontamination of all vehicles leaving the site, and personnel radiation protection measures. A monitoring program would be implemented during the remedial action to ensure that no significant releases of radiation, dust, soil, or other pollutants occur. After the project is completed, a long-term surveillance and maintenance program would be implemented to further ensure that the program accomplished its primary goal, i.e., remove the potential public health hazard associated with the radioactively contaminated materials.

This Canonsburg FEIS contains several changes from the Canonsburg Draft Environmental Impact Statement (DEIS) issued by the DOE in November 1982. These changes include the following:

1. Use of the final U.S. Environmental Protection Agency (EPA) standards (40 CFR 192) in place of the proposed EPA standards (40 CFR 192 (proposed)).

2. Revision of the radiological discussions for the "no action" alternative to more accurately reflect the existing site conditions.

3. Increase of the radiological impact evaluation area at the Canonsburg site from 1.24 miles (2 kilometers) to 6.2 miles (10 kilometers).

4. Revision of the ground-water discussions to include new data and current modeling results.

5. Revision of Appendices A.1 and A.2 to reflect the most recent engineering designs.

6. Addition of a new appendix that assesses potential flood-plain impacts.

7. Addition of a new chapter containing public comments on the Canonsburg DEIS and the DOE's responses to these comments.

These changes are more fully described in Chapters 1 and 5. The changes respond to public comments, and provide the most current information available but do not represent substantial changes in the proposed action or significant new circumstances or information.

Additional information on the remedial-action activities at the three sites will be presented in several future documents as described in Section 1.6.

Final Environmental Impact Statement

Remedial Actions at the Former Vitro Rare Metals Plant Site

Canonsburg, Washington County, Pennsylvania

United States Department of Energy

July 1983

Volume I

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1 Summary

In response to public concern over the potential public health hazards associated with uranium mill tailings and associated residual radioactive material left abandoned or otherwise uncontrolled at several inactive processing sites throughout the United States, Congress passed the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA), Public Law 95-604, which was enacted into law on November 8, 1978. In UMTRCA, the Congress acknowledged the potential health hazards associated with uranium-mill tailings. Title I of UMTRCA authorizes the U.S. Department of Energy (DOE) to enter into cooperative agreements with affected states and Indian tribes to clean up those inactive sites contaminated with uranium-mill tailings, requires the Secretary of the DOE to designate sites to be cleaned up, and charges the EPA to promulgate standards for these sites. The U.S. Environmental Protection Agency (EPA) has promulgated final standards (40 CFR 192) for remedial actions at inactive uranium-processing sites (40 FR 590-604, January 5, 1983). The EPA published an Environmental Impact Statement (EIS) (U.S. EPA, 1982) on the development and impacts of the standards (40 CFR 192). All remedial actions performed under the UMTRCA must be done in accordance with the EPA standards (40 CFR 192) and with the concurrence of the U.S. Nuclear Regulatory Commission (NRC), which will issue a license for the maintenance and monitoring of the disposal site after the cleanup work is complete.

The Canonsburg, Pennsylvania site is one of the sites identified in the UMTRCA as requiring remedial action. On November 8, 1979 it was designated as a high priority site by the Secretary of the DOE, and on September 5, 1980 the DOE and the Commonwealth of Pennsylvania (Commonwealth) entered into a cooperative agreement to perform remedial work at this site. As required by the National Environmental Policy Act of 1969 (NEPA, Public Law 91-190), this EIS has been prepared to discuss the potential environmental impacts of the proposed and alternative remedial-action strategies that could be performed at this site. The Canonsburg Draft EIS (DEIS) (U.S. DOE, 1982a) was issued in November 1982. Public and government comments on the Canonsburg DEIS (U.S. DOE, 1982a) were solicited through a notice in the Federal Register (47 FR 55305, December 8, 1982) and through a series of local public hearings held in January 1983 (see Chapter 6).

The Canonsburg FEIS includes several changes from the Canonsburg DEIS (U.S. DOE, 1982a). These changes are summarized in the paragraphs that follow, and are discussed in subsequent chapters of the Canonsburg FEIS.

1. The EPA published final standards (40 CFR 192) for remedial actions at inactive uranium processing sites (48 FR 590-606, January 5, 1983; effective March 7, 1983). These final standards contain several less stringent standards compared to the proposed standards (40 CFR 192 (proposed)) (45 FR 27370-27375, April 22, 1980 and 46 FR 2556-2563, January 9, 1981). The promulgation of these standards (40 CFR 192) resulted in design changes for the remedial-action program, such as a reduction in the overall cover thickness at the expanded Canonsburg site. One of the main differences between the proposed EPA standards (40 CFR 192 (proposed)) and the final EPA standards (40 CFR 192) is

that the amount of radon-222 that may be released from the surface of a disposal site has been increased by a factor of 10 (i.e., from 2 to 20 picocuries per square meter per second).

2. The description of the present (no action) radiological conditions was revised to more accurately reflect the existing situation at the Canonsburg site. The Canonsburg DEIS (U.S. DOE, 1982a) took a worst-case approach and considered the radioactively contaminated materials present on the Canonsburg site to be essentially uncovered and directly exposed to the biosphere. The Canonsburg FEIS considers the existing soil cover over these radioactively contaminated materials. This revision results in a reduction by a factor of 15 in the estimated level of radiological impacts resulting from the current condition (no action) of the Canonsburg site compared with that given in the Canonsburg DEIS (U.S. DOE, 1982a). This revision does not change the actual amounts of radioactively contaminated materials present on the Canonsburg site nor the actual radiological impacts either during or after the remedial action. The revision results only in a revised estimate of the present radiological situation on the Canonsburg site against which the potential radiological impacts during and after remedial action are compared. In other words, the physical impacts do not change, but the estimates of these impacts are more accurate.

   The Canonsburg DEIS (U.S. DOE, 1982a) estimated that Alternative 2 or 3 would reduce the potential radiological impacts at the Canonsburg site by a factor of 700, compared with the no action alternative. Because of the changes described in these first two items, the Canonsburg FEIS estimates that Alternative 2 or 3 would reduce the potential radiological impacts at the Canonsburg site by a factor of 4, compared with no action.

   The Canonsburg DEIS (U.S. DOE, 1982a) estimated a slight increase in the level of potential radiological impacts during the 96-week remedial-action period at the expanded Canonsburg site, compared with no action. Because the estimate of the potential radiological impacts under no action has been reduced, as described in this item, the Canonsburg FEIS estimates that the potential radiological impacts under Alternative 2 or 3 would be about twice those of the no action alternative during the 96-week remedial-action period.

3. The geographical area considered in the radiological impact evaluation for the Canonsburg site was increased from 1.24 miles (2 kilometers) to 6.2 miles (10 kilometers). This change permitted a more extensive assessment of the potential environmental impacts resulting from any of the alternative remedial actions.

4. Additional ground-water data were obtained. These data were collected at both onsite wells on the expanded Canonsburg site and at offsite wells both upgradient and downgradient of the expanded Canonsburg site. These data provide a more complete characterization of the

hydrological and geological conditions of the expanded Canonsburg site. A computer modeling study of the ground-water regime at the expanded Canonsburg site has also been completed. This more current information is included in the Canonsburg FEIS.

5. A new appendix (Appendix J) covering flood-plain impacts has been added. This appendix summarizes the project's potential environmental impacts on the flood plains of both Chartiers Creek and the Conemaugh River. This new appendix constitutes a flood-plain assessment in accordance with the DOE regulations (10 CFR 1022).

6. Appendices A.1 and A.2 (which in the Canonsburg DEIS (U.S. DOE, 1982a) were executive summaries of the engineering feasibility studies for in-situ stabilization of the Canonsburg and Burrell sites' radioactively contaminated materials, respectively) have been replaced in the Canonsburg FEIS by the executive summaries of the conceptual designs for in-situ stabilization of the radioactively contaminated materials at the expanded Canonsburg site and the Burrell site. These appendices provide a more current description of what the expected remedial actions would be at each site if the proposed alternative (Alternative 3) is accomplished.

7. A new chapter (Chapter 6) has been added to this Canonsburg FEIS to accommodate the comments on the Canonsburg DEIS (U.S. DOE, 1982a) received from the public and government agencies both at the public hearings and by letter. Chapter 6 also includes the DOE's response to each comment. Changes, corrections, and new information generated as a result of these comments have also been incorporated into the body of the Canonsburg FEIS.

These changes are more fully described in Chapters 1 and 5. The changes respond to public comments, and provide the most current information available but do not represent substantial changes in the proposed action or significant new circumstances or information.

The remedial actions described and evaluated in this Canonsburg FEIS would be conducted to accomplish one major goal: removing a potential public health hazard, i.e., that potential hazard associated with radioactively contaminated materials. The tasks performed in achieving this goal are as follows:

1. Establish the project background.
2. Collect the baseline data.
3. Identify the engineering alternatives.
4. Characterize the affected environment.
5. Evaluate the environmental impacts.
6. Conduct the remedial action.
7. Perform maintenance and monitoring activities.

1.1 PROJECT BACKGROUND

The Canonsburg site is located within the Borough of Canonsburg, Washington County, in southwestern Pennsylvania. It lies approximately 20 miles southwest of downtown Pittsburgh (Figure 1-1). The former Vitro Rare Metals Plant property (18.5 acres), now the Canon Industrial Park, is the area designated by the UMTRCA as containing the residual radioactive materials and is the area implied in this Canonsburg FEIS when discussing the Canonsburg site. The Canonsburg site is divided by Strabane Avenue and Ward Street into three separate areas: A, B, and C (Figure 1-2). Area A is the only developed area and contains the existing Canon Industrial Park buildings. Areas B and C are open areas along Chartiers Creek. Two other areas adjacent to the Canonsburg site, i.e., the former Georges Pottery property (6.1 acres) and the seven residences situated on Wilson Avenue and George Street (5.4 acres), are needed to complete the remedial-action alternatives involving onsite stabilization (Alternatives 2 and 3). The expanded Canonsburg site is approximately 30 acres in size, bounded by Chartiers Creek to the north, west, and east, and by the ConRail right-of-way to the south (Figure 1-3). The expanded Canonsburg site contains the Canonsburg site, the adjacent residential area, and the former Georges Pottery property. The expanded Canonsburg site is located in an urban area; e.g., across the ConRail tracks to the south, residences are as close as 250 feet to the expanded Canonsburg site.

In the early 1900's, the Standard Chemical Company initiated the development of a method to extract and concentrate radium from carnotite ore. The company established its radium-processing facilities at Canonsburg, Pennsylvania, and produced the first salable quantities of radium in 1913 (Standard Chemical Co., 1919). The company ceased processing operations in the early 1920's (probably around 1922), but continued to act as a marketing agent for some foreign radium producers.

Vitro purchased the Canonsburg facility in 1933 and utilized it for the extraction of uranium, vanadium, and radium from various residues, ores, and concentrates. From 1942 until the facility's closing in 1957, Vitro and its successor, the Vitro Corporation of America, owned and operated the plant on the Canonsburg site. The operations were directed toward the production of uranium concentrates. The only customer from 1942 to 1957 was the United States Government. The uranium, and other rare metals, were extracted from both onsite (contractor-owned) residues and ores and government-owned ores, concentrates, and scrap. During this time various ores, concentrates, and scrap materials were brought from different Atomic Energy Commission (AEC) installations to the Canonsburg site for uranium recovery. The end products of these processes were delivered to the AEC in accordance with terms of government procurement contracts. All solid process wastes were stored temporarily on the Canonsburg site. The liquid wastes were discharged through a drainage system beneath Strabane Avenue into the former swamp in Area C that discharged through a drainage ditch into Chartiers Creek. This swamp has since been filled in.

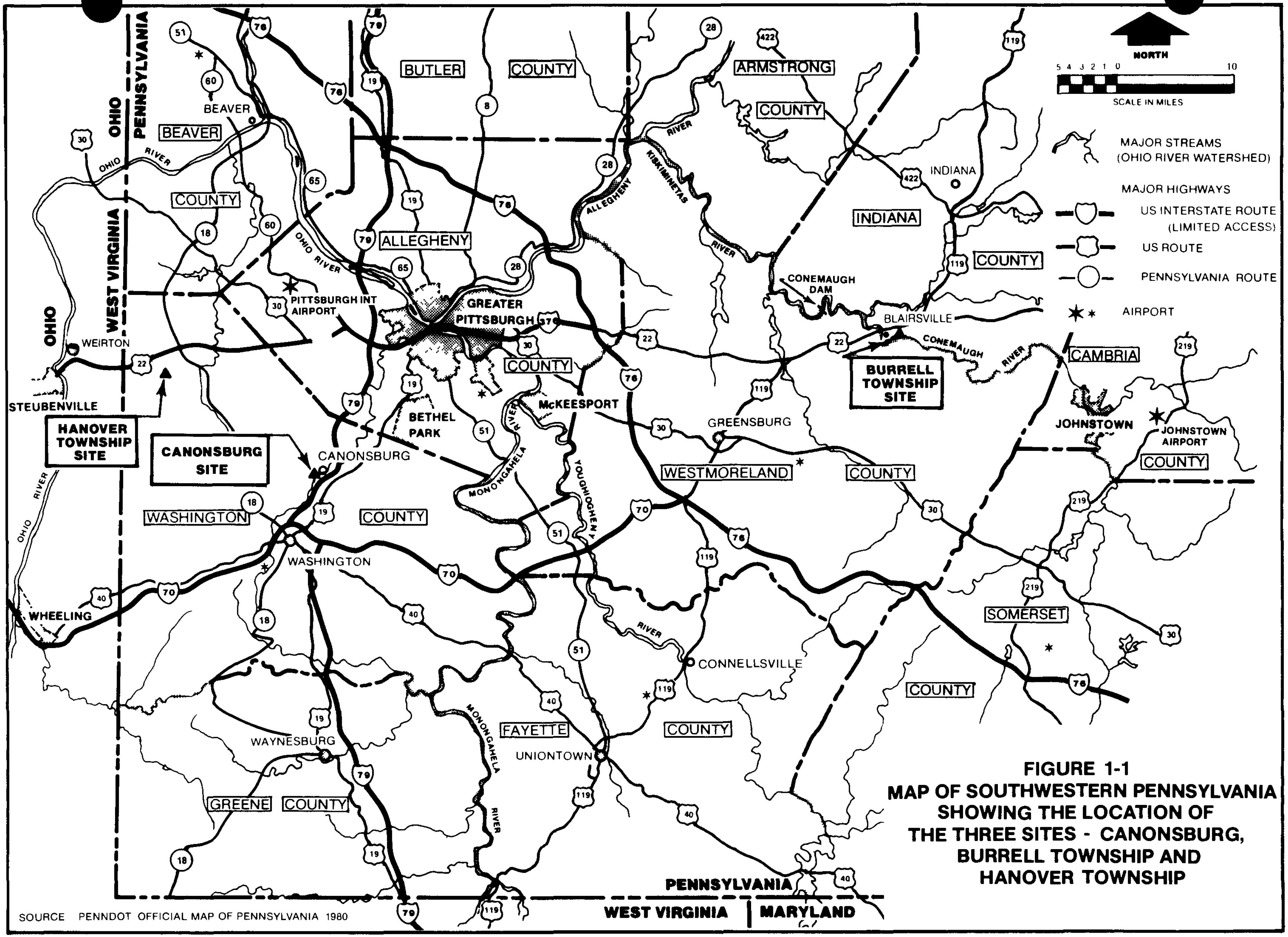


FIGURE 1-1
MAP OF SOUTHWESTERN PENNSYLVANIA SHOWING THE LOCATION OF THE THREE SITES - CANONSBURG, BURRELL TOWNSHIP AND HANOVER TOWNSHIP

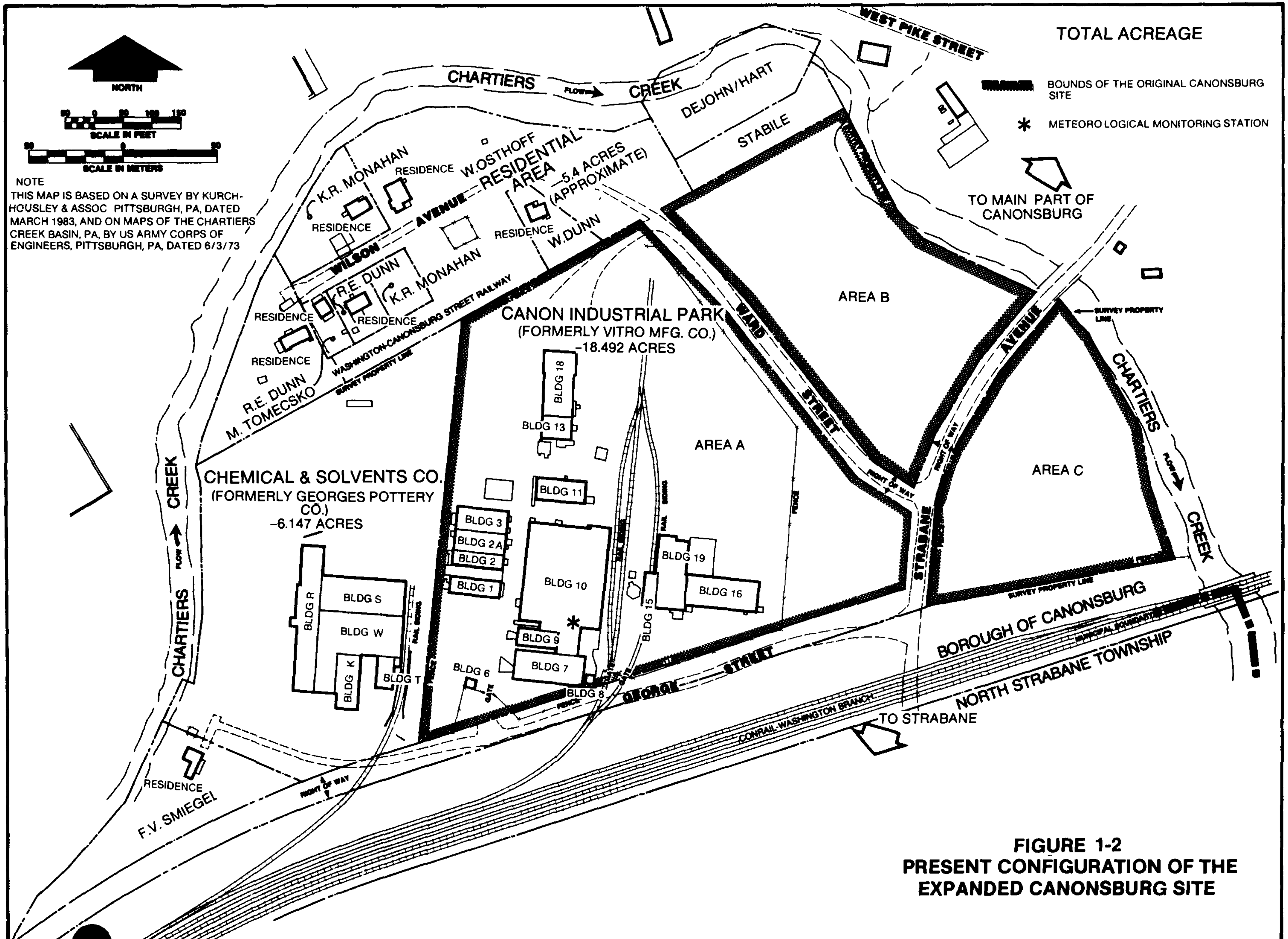


FIGURE 1-2
PRESENT CONFIGURATION OF THE EXPANDED CANONSBURG SITE

NORTH

400 200 100 0 400 800 1200

SCALE IN FEET

SOURCE
MAP FROM BOROUGH AND TOWNSHIP MAPS CHECKED AGAINST PENNDOT COUNTY MAP (WASHINGTON CO - 1976) AND USGS 7½ MIN QUADS (PHOTOREVISED TO 1969)

TONED AREA - INCORPORATED BOROUGHS OF CANONSBURG AND HOUSTON

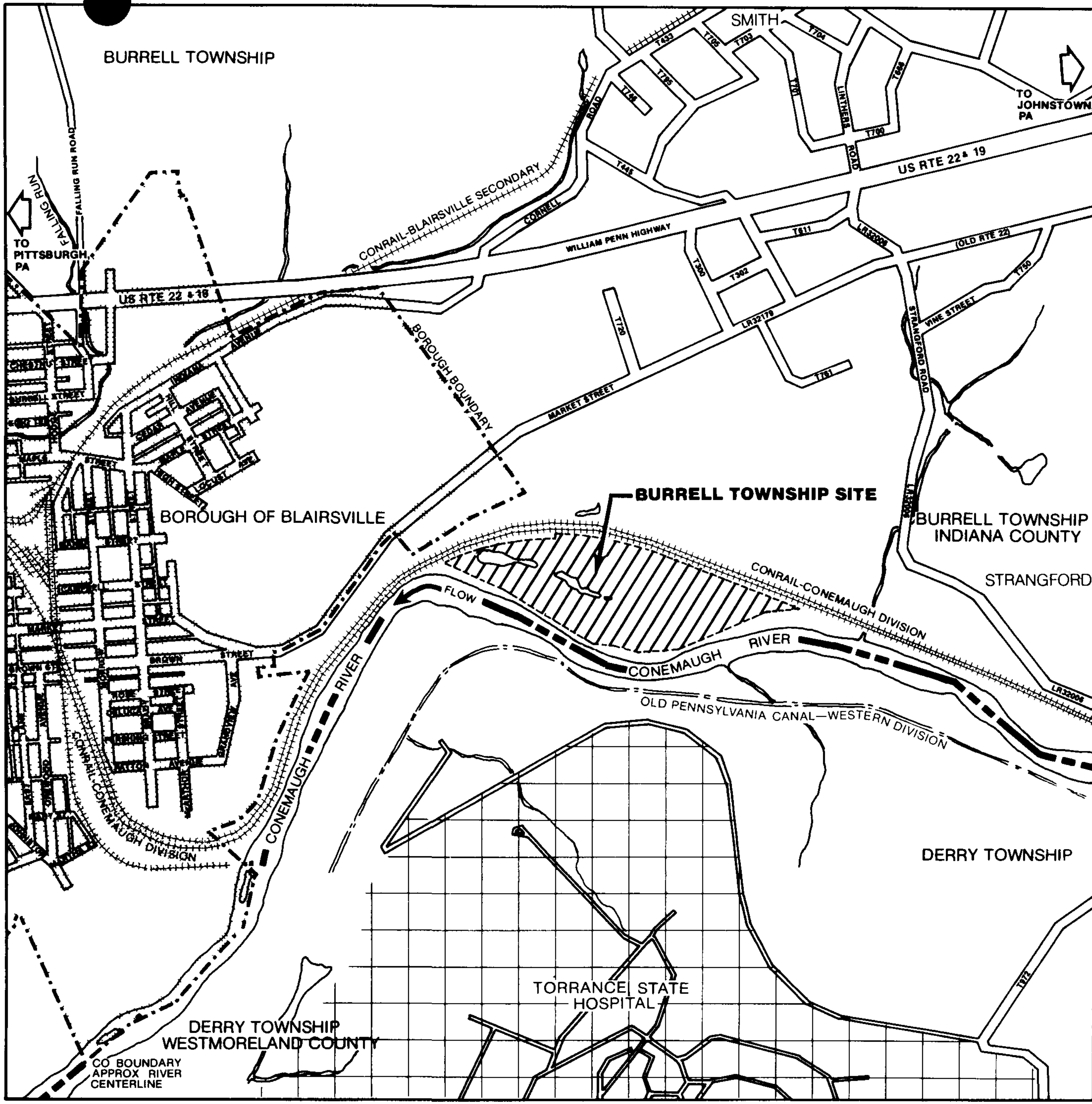
FIGURE 1-3
MAP OF THE AREA AROUND THE EXPANDED CANONSBURG SITE BOROUGH OF CANONSBURG, WASHINGTON COUNTY, PENNSYLVANIA

On November 1, 1953, the government and Vitro entered into a contract (AT-(30-1)-1683) that required Vitro to process certain government-owned materials. The contract required that Vitro store the residual radioactive materials from this operation at the Canonsburg site until November 1, 1955 because the AEC believed the residual radioactive materials might contain recoverable uranium. After attempts by Vitro to recycle the residual radioactive materials and attempts by the AEC to identify commercial interest in the residual radioactive materials, it was determined that the uranium in the residual radioactive materials was "unrecoverable" and the AEC authorized an inventory write-off pursuant to provisions of AEC Manual Chapter 7401-12. The AEC's Oak Ridge Operations Office approved the transfer of 11,600 tons of wet radioactively contaminated materials from the Canonsburg site to the Burrell site. The radioactively contaminated materials, containing approximately 6 tons of uranium oxide, were transported to the Burrell site from late 1956 to early 1957 (Leggett et al., 1979a).

The Burrell site is situated about 50 miles northeast of the Canonsburg site in Burrell Township, Indiana County, Pennsylvania (Figure 1-1). At the time of the 1956-1957 disposal, it was owned and operated by the Pennsylvania Railroad as a railroad landfill. Currently, it is owned by the George Burrows Company. The Burrell site covers approximately 49 acres; it is currently an undeveloped plateau along a bend of the Conemaugh River at the southern boundary of Indiana County (Figure 1-4). Its only significant surface features are three steep-banked ponds in the western area that are remnants of an old railroad disposal pit (Figure 1-5). Disposal of the 11,600 tons of radioactively contaminated materials removed from the Canonsburg site took place within an approximately 9-acre section in the western portion of the Burrell site. The radioactively contaminated materials were brought in by railcar, dumped into the disposal pit, and covered with an uneven layer of uncontaminated material.

Recovery operations at Vitro's Canonsburg plant ceased by 1957. The contractor's remaining residues and processing wastes were stored on the Canonsburg site by Vitro. Vitro's final source-material license expired, and in May 1961 Vitro applied to the AEC for another source-material license. On June 21, 1961, the AEC granted Vitro a license, for storage only, of a maximum of 23 tons of uranium contained in 4458 tons of material.

In 1962 Vitro's real property was sold to developers, with Vitro retaining title to the radioactively contaminated materials remaining on the Canonsburg site. In an effort to decontaminate the immediate plant area, in 1964 all of the materials then considered radioactively contaminated were consolidated into one pile in Area A. In 1965, Vitro obtained a permit from the Commonwealth to move this pile to Area C. At Area C it was buried beneath a relatively impermeable layer of steel-mill slag (red dog), and covered by clean fill material. Vitro's source-material license was then terminated, and the Canonsburg site was developed into its present use as the Canon Industrial Park in 1966.



NORTH

SCALE IN FEET

SOURCE

MAP FROM BOROUGH AND TOWNSHIP MAPS CHECKED AGAINST PENNDOT COUNTY MAPS (WESTMORELAND CO & INDIANA CO - 1976) AND USGS 7½ MIN QUADS (PHOTO-REVISED TO 1973)

TONED AREA - INCORPORATED BOROUGH OF BLAIRSVILLE

FIGURE 1-4
MAP OF THE AREA AROUND THE BURRELL TOWNSHIP SITE, BURRELL TOWNSHIP, INDIANA COUNTY, PENNSYLVANIA

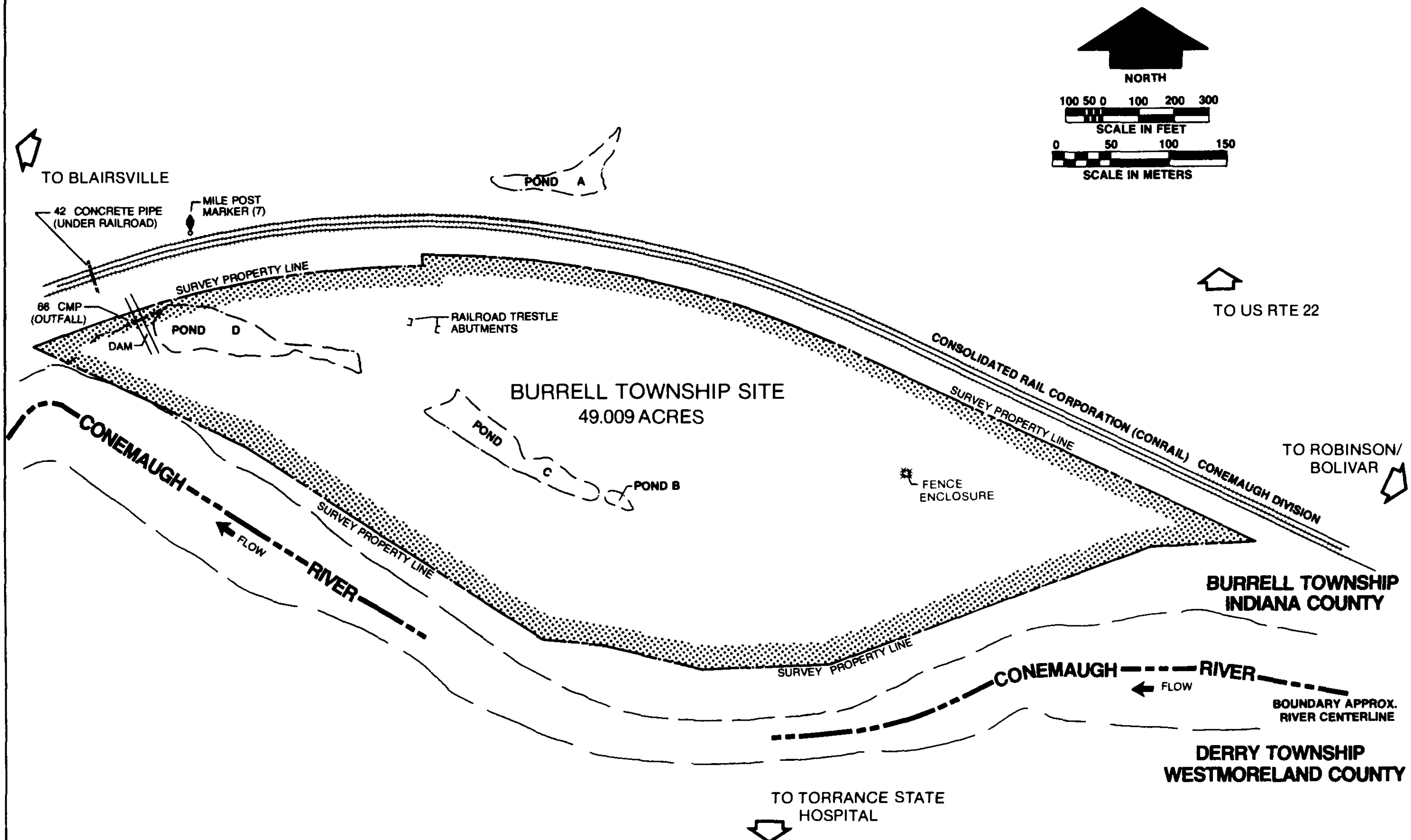


FIGURE 1-5
PRESENT CONFIGURATION OF THE BURRELL TOWNSHIP SITE

NOTE 1 PROPERTY LINE DATA FROM PLAN OF PROPERTY FOR UNION CARBIDE CORP, BY RICHARD G BACH & ASSOC ZELIENOPLE, PA-DATED 11/16/77

In 1978, the UMTRCA was enacted into law. On November 8, 1979 the Canonsburg site was designated by the DOE as a processing site eligible for remedial action under the UMTRCA. Effective September 5, 1980, the DOE and the Commonwealth entered into a cooperative agreement under UMTRCA, setting forth the terms and conditions for the DOE and the Commonwealth cooperative remedial-action effort, including 90 percent (DOE), 10 percent (Commonwealth) cost-sharing, the Commonwealth's real estate acquisition responsibilities, the Commonwealth's responsibility for nominating potential disposal sites, and provision for the DOE's development of a remedial-action plan after publication of the Canonsburg FEIS. (The remedial-action plan will be concurred on by the Commonwealth and the NRC.)

In 1980 representatives of the Commonwealth conducted a study (Pennsylvania, 1981) of potential areas where the Canonsburg site's radioactively contaminated materials could be taken if the Canonsburg site were to be decontaminated. This study used a preliminary draft of 10 CFR 61, Licensing Requirements for Land Disposal of Radioactive Waste (46 FR 38081ff; July 24, 1981), and included field investigations and the examination of existing reports, maps, files, data, and aerial photographs. As a result of this study, the Commonwealth identified seven areas in which disposal sites might potentially be located; these areas are numbered 1 through 7 on Figure 1-6. (The Burrell site was not included in the sites that were investigated during this study.)

In providing the results of the disposal site study to the DOE, the Commonwealth's representatives stated that Areas 6 and 7, both located in Hanover Township, Washington County, appeared to be better suited as potential disposal sites than the other five. Further study by the DOE confirmed this evaluation (U.S. DOE, 1981a). Within or near Areas 6 and 7, seven promising sites, identified as Sites A through G on Figure 1-7, were investigated further (U.S. DOE, 1981b). Of these seven sites, only Sites B and C have been judged acceptable. Site B ranks appreciably above Site C. Site C would require extensive excavation and clearing compared to Site B. Slope and subgrade stability of Site C could also present a problem as well as the smaller size of Site C compared to Site B. As a result, Site B (the Hanover site) (Figures 1-8 and 1-9) is considered in detail in the Canonsburg FEIS as the prime alternative disposal site.

1.2 DATA COLLECTION

After establishing the background of the Canonsburg and Burrell sites, and the location of the Hanover site, it was necessary to assemble the data on each of the sites. This included reviewing existing data and collecting new information. Compilation of the existing data was accomplished by researching government, public, and private sources.

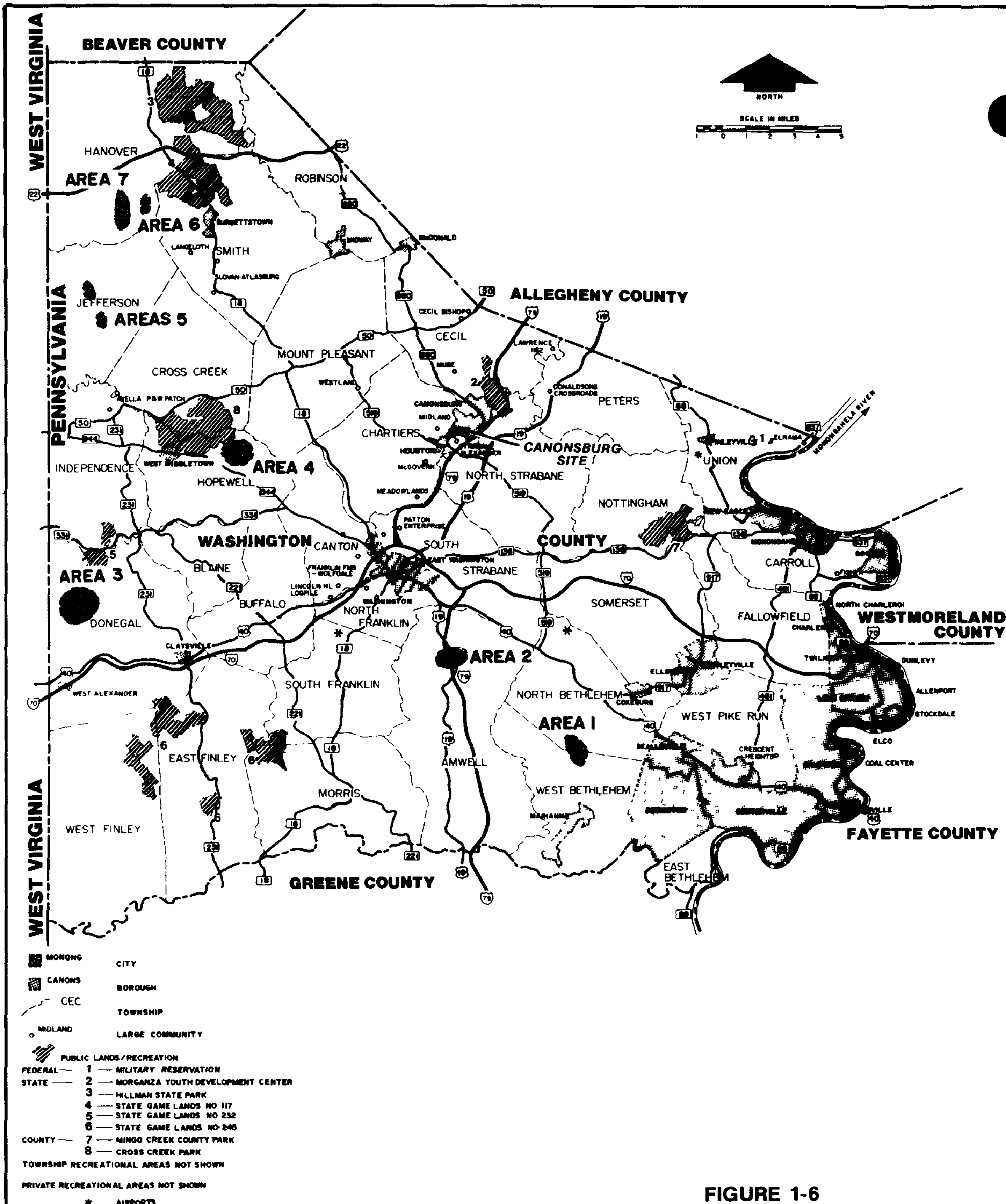
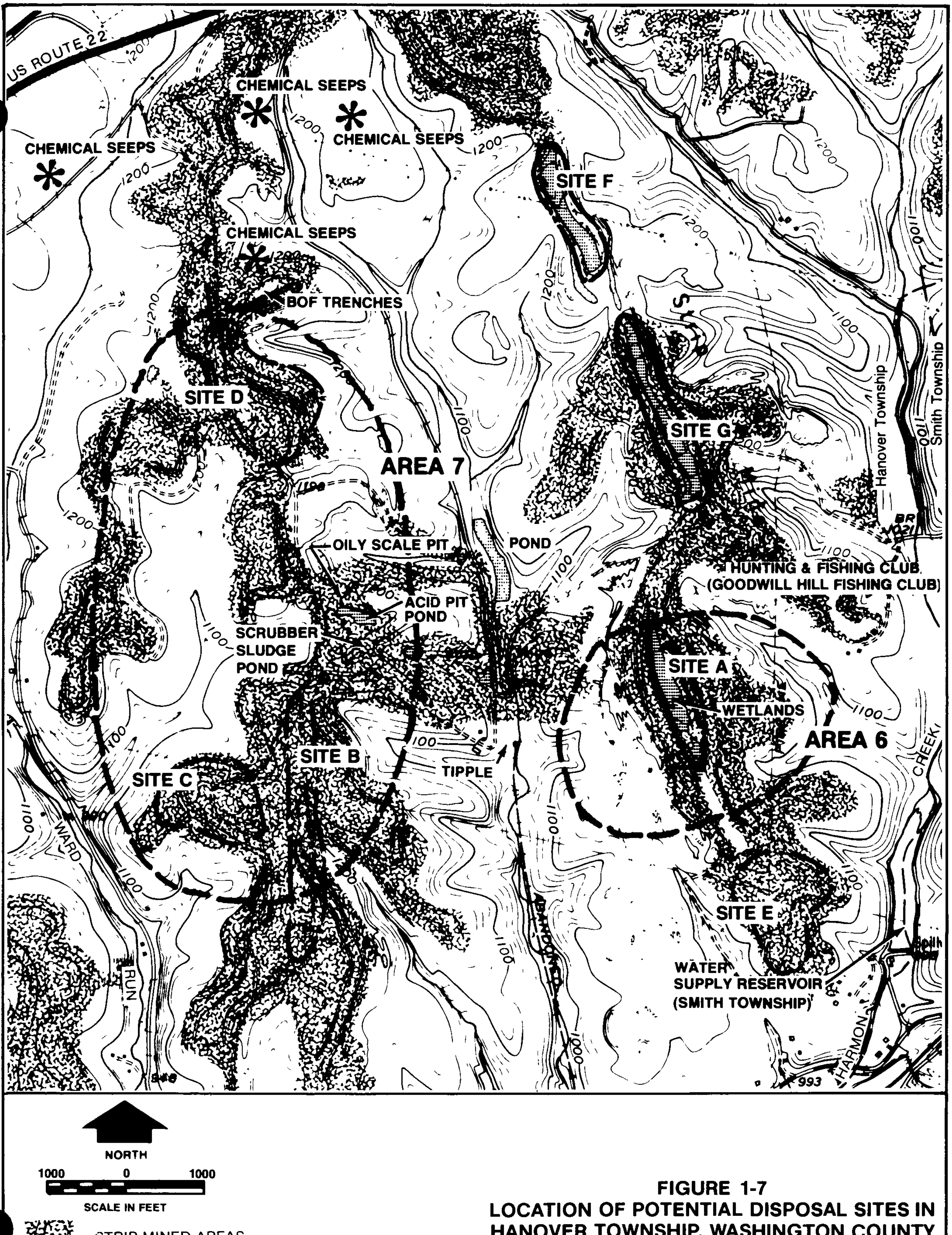


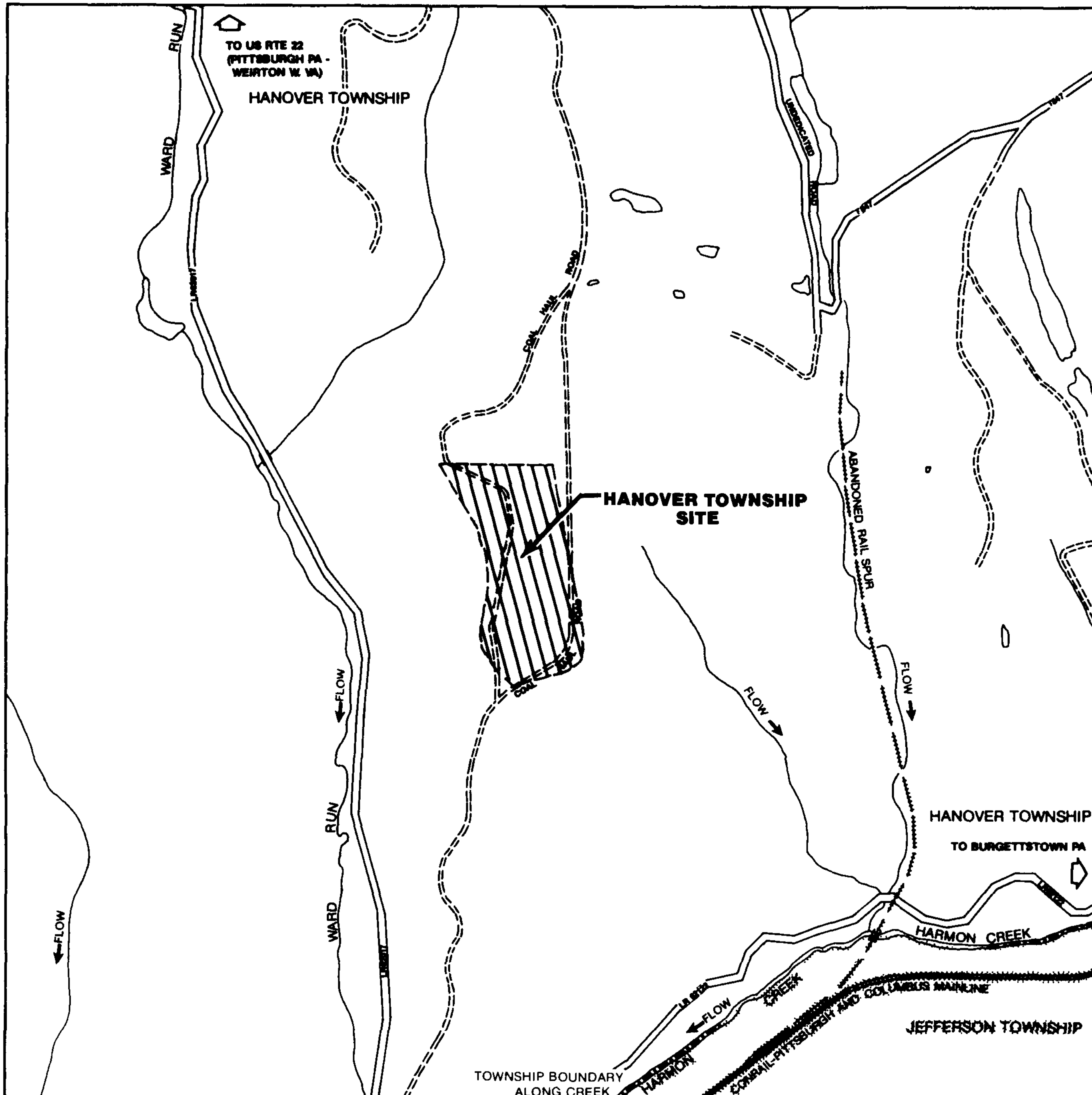
FIGURE 1-6
LOCATION OF POTENTIAL DISPOSAL AREAS IN WASHINGTON COUNTY, PENNSYLVANIA

SOURCES USGS MAPS PA-DOT GENERAL HIGHWAY MAP—WASHINGTON COUNTY 1976 OFFICIAL WASHINGTON COUNTY MAP 1978 SW PENNA REG PLANNING COMM, 208 PROJECT—FUTURE CONDITIONS 1978



SOURCE USGS, BURGETTSTOWN QUAD, 7½ MIN, P.R. 1979

FIGURE 1-7
LOCATION OF POTENTIAL DISPOSAL SITES IN HANOVER TOWNSHIP, WASHINGTON COUNTY PENNSYLVANIA



NORTH

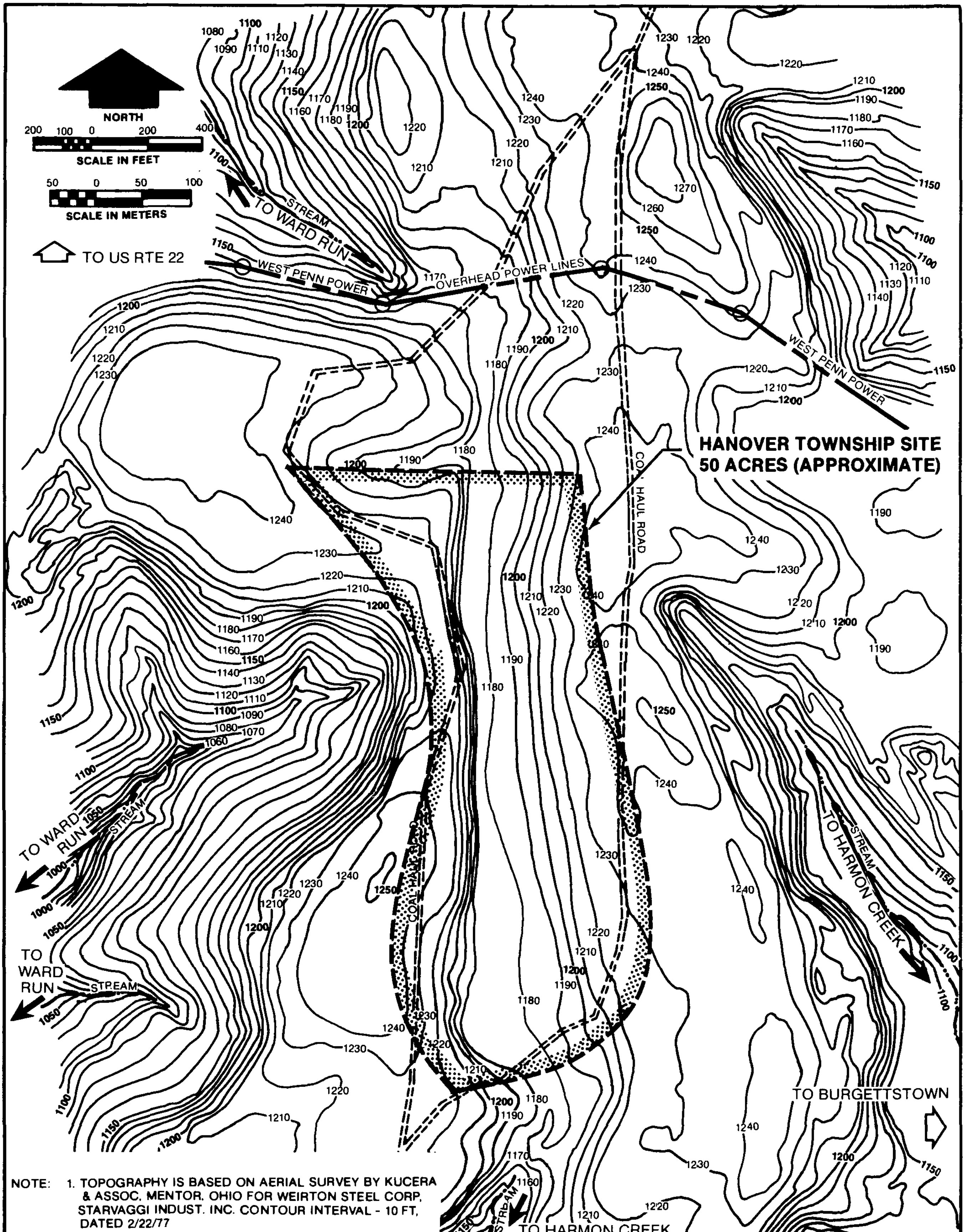
SCALE IN FEET

SOURCE

MAP FROM TOWNSHIP MAPS CHECKED AGAINST PENNDOT COUNTY MAP (WASHINGTON CO - 1976) AND USGS 7½ MIN QUADS (PHOTOREVISED TO 1979)

TONED AREA - PORTION OF JEFFERSON TOWNSHIP

FIGURE 1-8
MAP OF THE AREA AROUND THE HANOVER TOWNSHIP SITE, HANOVER TOWNSHIP, WASHINGTON COUNTY, PENNSYLVANIA



NOTE: 1. TOPOGRAPHY IS BASED ON AERIAL SURVEY BY KUCERA & ASSOC. MENTOR, OHIO FOR WEIRTON STEEL CORP, STARVAGGI INDUST. INC. CONTOUR INTERVAL - 10 FT, DATED 2/22/77

FIGURE 1-9
PRESENT CONFIGURATION OF THE HANOVER TOWNSHIP SITE

The literature review led directly to the planning and initiation of field and laboratory programs to gather the necessary additional data. These programs required personnel to be both on the sites and within the surrounding area to collect information. The types of data collected ranged from the number of people living in nearby houses to the concentrations of radioactively contaminated materials in ground water. The appendices accompanying this Canonsburg FEIS (Volume 2) present the detailed programs used by each of the technical disciplines to conduct these studies: i.e., engineering, air quality, soils, geology, hydrology, ecology, radiology, socioeconomics, noise, and transportation.

1.3 IDENTIFICATION OF ALTERNATIVES

After the information was collected, engineering studies were conducted to determine the feasibility of various solutions to the problem. All of the alternatives were selected to accomplish the same major goal: removing a potential public health hazard, i.e., cleaning up the radioactively contaminated materials at the Canonsburg and Burrell sites (U.S. DOE, 1982b).

Five alternatives have been identified for the remedial-action work at the Canonsburg and Burrell sites. They are as follows:

1. No action.

2. Decontamination of the Burrell site, transfer of the Burrell site's radioactively contaminated materials to the Canonsburg site, and stabilization of both the Canonsburg and Burrell sites' radioactively contaminated materials at the expanded Canonsburg site.

3. Stabilization of the Canonsburg site's radioactively contaminated materials at the expanded Canonsburg site and the Burrell site's radioactively contaminated materials at the Burrell site. Alternative 3 is the DOE's preferred alternative.

4. Decontamination of both the Canonsburg and Burrell sites, and disposal of all of the radioactively contaminated materials at the Hanover site.

5. Decontamination of the Canonsburg site, disposal of its radioactively contaminated materials at the Hanover site, and stabilization of the Burrell site's radioactively contaminated materials at the Burrell site.

The specific actions associated with each alternative are given in Table 1-1. The volumes of material, resource commitments, staffing, and duration of each alternative are given in Table 1-2.

Table 1-1. Summary of remedial-action activities

Project activities	Alternative 1		Alternative 2		Alternative 3		Alternative 4			Alternative 5		
	Canonsburg	Burrell	Canonsburg	Burrell	Canonsburg	Burrell	Canonsburg	Burrell	Hanover	Canonsburg	Burrell	Hanover
1. Roadway construction	---	---	X	X	X	X	X	X	X	X	X	X
2. Temporary roadway closing	---	---	X	---	X	---	X	---	---	X	---	---
3. Permanent roadway closing	---	---	X	---	X	---	---	---	---	---	---	---
4. Onsite building demolition	---	---	X	---	X	---	X	---	---	X	---	---
5. Temporary interruption of some vicinity property use	---	---	---	---	---	---	X	---	---	X	---	---
6. Permanent elimination of some vicinity property use	---	---	X	---	X	---	---	---	---	---	---	---
7. Excavation of site's radioactively contaminated materials	---	---	X	X	X	---	X	X	---	X	---	---
8. Export of site's radioactively contaminated materials	---	---	---	X	---	---	X	X	---	X	---	---
9. Import of radioactively contaminated materials from other places	---	---	X	---	X[a]	---	X[a]	---	X	X[a]	---	X
10. Encapsulation of radioactively contaminated materials	---	---	X	---	X	---	---	---	X	---	---	X
11. Covering of radioactively contaminated materials areas	---	---	X	---	X	X	---	---	---	---	X	---
12. Temporary lowering of water table	---	---	X	---	X	---	X	---	X	X	---	X
13. Use of truck-wash station	---	---	X	X	X	---	X	X	X	X	---	X
14. Use of onsite waste-water-treatment facilities	---	---	X	X	X	---	X	X	X	X	---	X

[a]The only radioactively contaminated material brought onto the Canonsburg site is the 30,000 cubic yards from the vicinity properties. Under Alternatives 2 and 3 it will remain on the expanded Canonsburg site permanently; under Alternatives 4 and 5 it will remain on the Canonsburg site temporarily until it is transferred to the Hanover site, along with the Canonsburg site's radioactively contaminated materials. The impacts associated with transporting the radioactively contaminated materials to the Canonsburg site are not part of this Canonsburg FEIS; these impacts were considered previously (U.S. DOE, 1982c).

Table 1-2. Approximate volumes of materials, resource commitments, staffing, and project duration required for each alternative

	Alternative 1		Alternative 2		Alternative 3		Alternative 4			Alternative 5		
	Canonsburg	Burrell	Canonsburg	Burrell	Canonsburg	Burrell	Canonsburg	Burrell	Hanover	Canonsburg	Burrell	Hanover
Volume of contaminated material excavated (cubic yards)	0	0	60,000	80,000	60,000	0	250,000	80,000	N/A	250,000	0	N/A
Volume of contaminated material exported from the site (cubic yards)	0	0	0	80,000	0	0	280,000[a]	80,000	N/A	280,000[a]	0	N/A
Volume of contaminated material imported to the site (cubic yards)	0	0	110,000[a]	0	30,000[a]	0	30,000[a]	0	360,000[a]	30,000[a]	0	280,000[a]
Volume of fill and construction materials imported (cubic yards)	0	0	270,000	16,000	270,000	30,000	270,000	16,000	200,000	270,000	30,000	170,000
Electricity requirement (kWh)	0	0	222,000	140,000	222,000	8,500	270,000	140,000	280,000	270,000	8,500	280,000
Engine fuels (gallons)	0	0	232,000	127,000	228,000	82,000	640,000	127,000	503,000	640,000	82,000	383,000
Water (gallons)	0	0	2,120,000	185,000	2,120,000	125,000	5,350,000	185,000	4,000,000	5,350,000	125,000	4,000,000
Average/maximum site staffing (persons)	0	0	28/55	20/35	28/50	15/30	28/50	20/35	30/50	28/50	15/30	30/50
Project duration (weeks)	0	0	96	80	86	32	105	80	120	105	32	120

[a]A portion of this value (30,000 cubic yards) is the material brought to the Canonsburg site from the vicinity properties. Under Alternatives 2 and 3 it will remain at the expanded Canonsburg site permanently; under Alternatives 4 and 5 it will remain at the Canonsburg site temporarily until it is transferred to the Hanover site, along with the Canonsburg site material. The impacts associated with transporting this material to the Canonsburg site are not part of this Canonsburg FEIS; they were considered previously (U.S. DOE, 1982c).

The primary difference between decontaminating and stabilizing a radioactively-contaminated site is that a decontaminated site will contain no radioactively-contaminated materials at levels above the EPA standards (40 CFR 192, Subpart B, "Cleanup ...") and may later be available for unrestricted use. A stabilized site will meet the EPA standards (40 CFR 192, Subpart A, "Standards for the Control ..."), but it will still retain its radioactively contaminated materials and therefore must remain undisturbed to protect the containment. Thus, its future use is permanently restricted.

None of the identified alternatives includes reprocessing the residual radioactive materials. Pursuant to Public Law 95-604, the DOE solicited expressions of interest in reprocessing from the current owner of each abandoned uranium-mill-tailings site (by individual letter) and from the general public (by notices in the Federal Register (45 FR 36470-36471, May 30, 1980) and by press releases). For the Canonsburg site there has been no response to these requests, probably because the small amount of reprocessible material and the long distance to established reprocessing plants make this alternative uneconomical. For this reason, reprocessing is not included in any of the five alternatives being considered. A brief description of each alternative follows.

1.3.1 Alternative 1: no action

This alternative consists of performing no remedial action, thereby allowing the present situation at the Canonsburg and Burrell sites to continue.

1.3.2 Alternative 2: decontamination of the Burrell site, transfer of the Burrell site's radioactively contaminated materials to the Canonsburg site, and stabilization of both the Canonsburg and Burrell sites' radioactively contaminated materials at the expanded Canonsburg site

All radioactively contaminated materials at the Burrell and Canonsburg sites would be stabilized at the expanded Canonsburg site. The Canon Industrial Park's buildings would be demolished, and the contaminated portions of them buried with the other radioactively contaminated materials. Seven nearby houses (six on Wilson Avenue and one on George Street) and the Georges Pottery buildings would also be demolished. The EPA standards (40 CFR 192) would be met by moving from the Burrell site all radioactively contaminated materials not meeting the EPA soil contamination standard (40 CFR 192) and encapsulating the radioactively contaminated materials with the more highly contaminated portion of the Canonsburg site's radioactively contaminated materials (radioactively contaminated materials with radium-226 concentrations that are or could become greater than 100 picocuries per gram of soil and at least 300 cubic yards contiguous in size) at the expanded Canonsburg site. This concentration was determined based on limiting radionuclide migration off the expanded Canonsburg site to levels meeting the EPA's National Interim

Primary Drinking Water Standards (40 CFR 141) and reducing radon emissions to below the EPA standards (40 CFR 192). The encapsulation process would consist of placing the radioactively contaminated materials in a disposal area that would be lined -- top, sides, and bottom -- with a relatively impermeable material to control contaminant migration and infiltration of precipitation. The remainder of the Canonsburg site's radioactively contaminated materials, including radioactively contaminated materials with radium-226 concentrations less than 100 picocuries per gram of soil and small quantities of material with radium-226 concentrations greater than 100 picocuries per gram of soil, would be stabilized in place by covering the expanded Canonsburg site (with the exception of the residential areas) with a minimum of 2 feet of uncontaminated fill.

The transport of all the radioactively contaminated materials associated with this and the other alternatives is discussed later in this Canonsburg FEIS. The Commonwealth has acquired the Canonsburg site. The U.S. Army Corps of Engineers is in the process of conducting title searches and property appraisals of the adjacent vicinity properties south of Chartiers Creek necessary to expand the site to approximately 30 acres following the Record of Decision (ROD) if Alternative 2 or 3 is chosen. Following completion of the project, title to the expanded Canonsburg site would be transferred from the Commonwealth to the Federal government. The NRC would issue a license for long-term maintenance and monitoring of the expanded Canonsburg site to the DOE or any other Federal agency charged with custody of the site. The Burrell site would be released for unrestricted use consistent with the Corps of Engineers flood control easement and local land-use controls.

1.3.3 Alternative 3: stabilization of the Canonsburg site's radioactively contaminated materials at the expanded Canonsburg site and the Burrell site's radioactively contaminated materials at the Burrell site (Alternative 3 is the DOE's preferred alternative.)

This alternative differs from Alternative 2 in that the Burrell site's radioactively contaminated materials would not be removed from the Burrell site. All of the radioactively contaminated materials at the Canonsburg site would be disposed of as under Alternative 2. At the Burrell site, the EPA standards (40 CFR 192) would be met by covering the radioactively contaminated materials with a layer of uncontaminated soil with the physical characteristics and thickness necessary to control radon emission and minimize infiltration and erosion. Recent studies (U.S. DOE, 1982d) have indicated that only small amounts of radioactively contaminated materials remain at the Burrell site, which may make excavation and encapsulation unnecessary. The expanded Canonsburg site and the Burrell site would both be acquired by the Commonwealth and the DOE. Following completion of the project, title to the expanded Canonsburg site and to the Burrell site would be transferred to the Federal government and their future use restricted in accordance with the NRC license.

1.3.4 Alternative 4: decontamination of both the Canonsburg and Burrell sites, and disposal of all of the radioactively contaminated materials at the Hanover site

All radioactively contaminated materials with radium-226 concentrations in excess of the EPA standards (40 CFR 192) would be removed from the Canonsburg and Burrell sites. Work at the Burrell site would be the same as under Alternative 2. At the Canonsburg site, however, a greater amount of radioactively contaminated materials would have to be excavated and handled during decontamination than during in-situ stabilization because in-situ stabilization does not require that all of the radioactively contaminated materials be excavated.

The radioactively contaminated materials would be encapsulated at the Hanover site by methods similar to those described for the Canonsburg site under Alternatives 2 and 3.

The Hanover site would be acquired by the Commonwealth. After project completion, the Canonsburg and Burrell sites would be available for unrestricted use, while title to the Hanover site would be transferred to the Federal government and its future use restricted in accordance with the NRC license.

1.3.5 Alternative 5: decontamination of the Canonsburg site, disposal of its radioactively contaminated materials at the Hanover site, and stabilization of the Burrell site's radioactively contaminated materials at the Burrell site

This alternative would be the same as Alternative 4 for the Canonsburg and Hanover sites, and Alternative 3 for the Burrell site.

Preliminary cleanup activities at those offsite properties contaminated with radioactively contaminated materials from the Canonsburg site that have been designated as vicinity properties have been addressed previously in an environmental assessment (EA) (U.S. DOE, 1982c). The radioactively contaminated materials removed from these properties will be temporarily stored on the Canonsburg site until remedial action on the Canonsburg site begins and then disposed of with the Canonsburg site's radioactively contaminated materials. The DOE made a finding of no significant impact (FONSI) for the cleanup of the vicinity properties on July 16, 1982 (47 FR 31061-31062, July 16, 1982). The Burrell site, the former Georges Pottery property, and the residences adjoining the Canonsburg site are vicinity properties not covered in the FONSI. These vicinity properties are included in the remedial-action alternatives for the Canonsburg site presented in this Canonsburg FEIS.

1.4 CHARACTERIZATION OF THE AFFECTED ENVIRONMENT

In order to predict the potential impacts of the remedial action, the baseline data were analyzed to determine each site's major physical, biological, and sociological characteristics.

The Canonsburg, Burrell, and Hanover sites are within 70 miles of each other in southwestern Pennsylvania. This is an area of rugged topographic features, many forests, and rich coal, oil, and gas resources. The land use and economic character of the area have been strongly influenced by these features. The pattern of land use shows distinct communities set in a region dominated by rural and open spaces. Air quality in the area of the three sites meets all of the National Ambient Air Quality Standards (NAAQS) except for ozone, and all of the Pennsylvania air-quality standards. (The entire Commonwealth has been designated as nonattainment for ozone.) Several major industrial and manufacturing centers, particularly those in the greater Pittsburgh area, are located along the Ohio River system and the interstate highways.

1.4.1 Canonsburg site

The expanded Canonsburg site is a 30-acre parcel consisting of the Canon Industrial Park (18.5 acres), the former Georges Pottery property (6.1 acres), and seven adjacent residences located on Wilson Avenue and George Street (5.4 acres). The expanded Canonsburg site is situated in a populated part of a residential section of the Borough of Canonsburg. The expanded Canonsburg site, which is currently zoned in part for industrial use and in part for residential use, consists of developed areas occupied by buildings and houses, and undeveloped areas covered by weeds and medium-sized trees. Larger trees grow along the banks of Chartiers Creek.

The Canonsburg site's location in the humid continental climate region of southwestern Pennsylvania results in temperatures ranging from a maximum of 95°F in the summer to a minimum of -6°F in the winter. Annual precipitation at the Canonsburg site averages 37 inches. Winds come mainly from the west at moderate speeds.

The topography of the Canonsburg site has been altered by past earth-moving and landfilling activities. The elevation of much of the Canonsburg site has been raised above natural levels, resulting in 30 feet of relief over this area. The lower portions of the expanded Canonsburg site are included in the 100-year and 500-year flood plains of Chartiers Creek (Figure D.1-1).

Chartiers Creek in the vicinity of the Canonsburg site is polluted by acid mine drainage and by nearby industrial and municipal discharges. Public water supplies for Canonsburg come from protected surface waters upstream of the Canonsburg site. Ground water at the Canonsburg site occurs in a water table system (unconsolidated material) and in a semi-confined system (bedrock).

The shallow ground-water system discharges into Chartiers Creek, and the deep ground-water system flows beneath Chartiers Creek. The ground water contains elevated levels of both sulfates, derived from the natural substrate material in the area, and of radium-226 and total uranium (Leggett et al., 1979b). The area has been extensively mined for coal, but the Pittsburgh coal seam does not occur on the Canonsburg site.

In addition to the radiological contamination of the ground water, the Canonsburg site contains a heterogeneous mixture of radioactively contaminated soil material. This includes unprocessed ores, radioactively contaminated soils, waste sludges and fines, and building materials. The radioactively contaminated materials are distributed as deep as 16 feet. Area A contains radioactively contaminated materials in both its top few feet of soil and beneath its buildings, with virtually all of its surface soils exceeding the EPA radium-226 standard (40 CFR 192) of 5 picocuries per gram of soil averaged over the first 15 centimeters of soil and 15 picocuries per gram of soil below that. Area B contains a 2- to 6-foot thick layer of radioactively contaminated materials contaminated with radium above the EPA standard (40 CFR 192) buried beneath 8 to 9 feet of clean fill. Area C contains radioactively contaminated materials with radioactive contamination above the EPA standard (40 CFR 192) from the surface to a depth of 16 feet.

1.4.2 Burrell site

In contrast to the Canonsburg site, the Burrell site is a 49-acre undeveloped property located in an open, unpopulated area. There are two small housing communities within 1 mile of the Burrell site, and the town of Blairsville is 1 mile to the west. The Burrell site is a low-lying plateau situated along the Conemaugh River with only 10 feet of topographic relief over most of the Burrell site. The Burrell site contains two steep-banked ponds in its western part.

The level of the Conemaugh River at the Burrell site is regulated by a U.S. Army Corps of Engineers dam about 10 miles downstream of the Burrell site. At the maximum flood pool elevation approximately 15 percent of the Burrell site would be inundated; however, recorded river levels have always been below the maximum. The Conemaugh River is polluted by the same types of materials as Chartiers Creek. Similar to the Canonsburg site, public-water supplies near the Burrell site come from protected surface waters.

There are two ground-water systems at the Burrell site, one in the fill and one in the bedrock. The shallow ground-water system does not recharge the bedrock system at the Burrell site. Ground water flows and discharges toward the Conemaugh River. The ground water is high in naturally-derived sulfates, but generally meets the EPA National Secondary Drinking Water guidelines (40 CFR 143).

Radiological analyses at the Burrell site have produced conflicting estimates of the levels of radioactive contamination. In 1977, surveys (Leggett et al., 1979a) revealed that soils as deep as 36 feet contained contamination at levels well above the then proposed EPA standards (40 CFR 192 (proposed). Surveys (U.S. DOE, 1982d) in 1981 and 1982 indicated that the Burrell site contains much less radioactively contaminated materials and that these radioactively contaminated materials are at shallower depths than seemed to be the case in 1977. The more detailed latter surveys (U.S. DOE, 1982d) are believed to reflect the current status of the Burrell site, and are the basis for remedial action. These surveys are also the basis for the assessment of the impacts presented in this Canonsburg FEIS.

1.4.3 Hanover site

The Hanover site is an undeveloped property situated in an unpopulated area. The Hanover site occupies 50 acres along a ridgetop, within a trench created by strip mining. The Hanover site is characteristically a reclaimed strip mine. Its substrate consists of rocky material with very little natural soil. The Hanover site's vegetation is limited to low-growing weeds.

The Hanover site lies within the watershed of Harmon Creek, a small, severely polluted stream. The only surface water at the Hanover site occurs in two wet areas that are formed by site drainage.

The water table at the Hanover site occurs at the interface between mine rubble and bedrock. The ground water does not meet the EPA National Interim Primary Drinking-Water standards (40 CFR 141), however, it does not contain any detectable amounts of radiation.

The Hanover site is being considered as a new disposal site, and currently contains no radioactively contaminated materials arising from activities at the Canonsburg site or elsewhere.

1.5 EVALUATION OF ENVIRONMENTAL IMPACTS

The impacts of the five alternatives are summarized and compared in Table 1-3 and discussed in detail in Chapter 5. It is helpful to separate these potential impacts into those that would be directly associated with the radioactively contaminated materials and those that would not. Among the nonradiological impacts the most significant would be the transportation impacts associated with moving the radioactively contaminated materials and fill dirt into and out of the sites. The Canonsburg site area would experience the greatest impact from both truck traffic and road closings. Trucks transporting material to and from the Canonsburg site may have to use the poor, narrow residential roads leading to the Canonsburg site. All of the

Table 1-3. Comparison of potential impacts at each site for each remedial-action alternative

	Alternative 1		Alternative 2		Alternative 3		Alternative 4			Alternative 5			Reference
	Canonsburg	Burrell	Canonsburg	Burrell	Canonsburg	Burrell	Canonsburg	Burrell	Hanover	Canonsburg	Burrell	Hanover	
Radiological													
Excess external whole body dose to population[a]													
During remed. action (man-rems)[b]	---	---	22	0.0934	22	0.0311	18	0.0934	0.00889	18	0.0311	0.00457	Tables 5-4 to 5-6
After remed. action (man-rem/yr)[c]	11	0.0864	0.254	~0	0.254	0.0233	~0	~0	0.000116	~0	0.0233	0.000116	Tables 5-1 to 5-3
Excess bronchial dose to population[a]													
During remed. action (man-rem)[b]	---	---	1,858	29.9	1,860	9.97	1,720	29.9	10.3	1,720	9.97	4.88	Tables 5-4 to 5-6
After remed. action (man-rem/yr)[c]	530	47.8	151	~0	151	11.5	~0	~0	0.152	~0	11.5	0.152	Tables 5-1 to 5-3
Excess lung cancer deaths to population[a]													
During remed. action (total deaths)[d]	---	---	0.0372	0.000598	0.0372	0.000199	0.0344	0.000598	0.000206	0.0344	0.000199	0.0000976	Tables 5-4 to 5-6
After remed. action (per year)[e]	0.0106	0.000956	0.00302	~0	0.00302	0.00023	~0	~0	0.00000304	~0	0.00023	0.00000304	Tables 5-1 to 5-3
Air Quality (incremental)													
Short term													
Annual TSP (g/cu m)	---	---	5.9	2.1	4.4	2.8	8.9	2.1	9.0	8.9	2.8	8.3	
Annual SO_2 (g/cu m)	---	---	4.9	3.1	4.6	3.3	6.2	3.1	3.2	6.2	3.3	3.2	
8-hour CO (mg/cu m)	---	---	1.86	2.60	1.89	1.80	2.11	2.60	1.81	2.11	1.80	1.87	Table 5-9
Annual NO_x (g/cu m)	---	---	54	32	50	35	66	32	33	66	35	33	
3-hour HC (g/cu m)	---	---	50	44	28	20	48	44	123	48	20	123	
Settleable particulates (tons/sq mi-month)	---	---	0.33	0.11	0.24	0.15	0.50	0.11	3.15	0.50	0.15	2.86	
Long term	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	
Soils													
Short term	Minimal impact	Minimal impact	No removal of soils. Import approximately 270,000 cubic yards of fill material. Import 80,000 cubic yards of Burrell site radioactively contaminated mateials. Import 30,000 cubic yards of vicinity property material.	Removal of 80,000 cubic yards of radioactively contaminated materials. Import 16,000 cubic yards of fill material.	No removal of soils. Import approximately 270,000 cubic yards of fill material. Import 30,000 cubic yards of vicinity property material.	No removal of soils. Import 30,000 cubic yards of fill material.	Removal of 280,000 cubic yards of radioactively contaminated materials. Import 270,000 cubic yards of fill material. Import 30,000 cubic yards of vicinity property materials.	Same as Alternative 2.	No soil removal. Import 360,000 cubic yards of radioactively contaminated materials. Import 200,000 cubic yards of fill material.	Same as Alternative 4.	Same as Alternative 3.	No soil removal. Import 280,000 cubic yards of radioactively contaminated materials. Import 170,000 cubic yards of fill material.	Subsections 3.1.1 to 3.1.5, 5.4.2
Long term	Minimal impact	Minimal impact	Soil stabilization	Soil stabilization	Soil stabilization	Soil stabilization	Soil stabilization	Soil stabilization	Soil stabilization	Soil stabilization	Soil stabilization	Soil stabilization	Subsections 3.1.1 to 3.1.5, 5.4.2
Mineral Resources													
Short and long term	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	Section 5.5
Topography													
Short term	No impact	No impact	Raise elevation of encapsulation area.	Lower elevation of excavated area.	Same as Alternative 2.	Raise elevation of stabilized area.	No new topographic highs or lows.	Same as Alternative 2.	Raise elevation in section of trench.	Same as Alternative 4.	Same as Alternative 3.	Same as Alternative 4.	Subsection 5.4.1
Long term	No impact	No impact	Overall site grading to even slopes.	Grade surrounding area to slope evenly past excavated area.	Same as Alternative 2.	Grade surrounding area to slope evenly past stabilized area.	Overall site grading to even slopes.	Same as Alternative 2.	Overall site grading to even slopes.	Same as Alternative 4.	Same as Alternative 3.	Same as Alternative 4.	Subsection 5.4.1

Table 1-3. Comparison of potential impacts at each site for each remedial-action alternative (continued)

	Alternative 1		Alternative 2		Alternative 3		Alternative 4			Alternative 5			Reference
	Canonsburg	Burrell	Canonsburg	Burrell	Canonsburg	Burrell	Canonsburg	Burrell	Hanover	Canonsburg	Burrell	Hanover	
Surface Waters													
Short term	Erosion Contaminant discharge Possibility of washing contaminants into Chartiers Creek during flooding.	No erosion or runoff into river. Indirect discharge into river. No major potential for contaminant load during flooding.	Possibility of erosion of sediments and contaminants into creek during project controlled by erosion and sedimentation controls. Discharge from WWTP[f] controlled under NPDES[g] permit. No change in water quantity: water supplied from local supply; discharge from WWTP <1 CFS.	Use of erosion and sediment controls during project. Discharge from WWTP controlled under NPDES permit. No change in water quantity: water supplied from well; discharge from WWTP <1 CFS.	Same as Alternative 2.	Use of erosion and sediment controls. Minimal possibility for impact because of no excavation or exposure of contaminated material.	Same as Alternative 2.	Same as Alternative 2.	Possibility for erosion of sediment and contaminants into Harmon Creek during project controlled by erosion and sedimentation controls. Discharge from WWTP controlled under NPDES permit. No change in water quantity: water supplied from well; discharge from WWTP <1 CFS.	Same as Alternative 2.	Same as Alternative 3.	Same as Alternative 4.	Subsection 5.6.1
Long term	Same as short term	Same as short term	Reduced input of contaminants into creek. Improved site drainage.	Reduced potential for contaminants entering river.	Same as Alternative 2.	Minimal possibility of impact.	Same as Alternative 2.	Same as Alternative 2.	No input of radiological contaminants into the creek. Improved site drainage.	Same as Alternative 2.	Same as Alternative 3.	Same as Alternative 4.	Subsection 5.6.1
Ground Waters													
Short term	Continued leaching of radiological contaminants into ground water.	Minimal movement of radiological contaminants into ground water.	Reduce leaching of contaminants into ground water. Temporary lowering of water table in Area C.	Stop leaching of contaminants into ground water.	Same as Alternative 2.	Reduce leaching of contaminants into ground water.	Stop leaching of contaminants into ground water.	Same as Alternative 2.	Reduce leaching of contaminants into ground water.	Same as Alternative 4.	Same as Alternative 3.	Same as Alternative 4.	Subsection 5.6.2
Long term	Same as short term	Same as short term	Reduce leaching of contaminants into ground water.	Same as short term	Same as Alternative 2.	Same as short term	Same as short term	Same as Alternative 2.	Same as short term	Same as Alternative 4.	Same as Alternative 3.	Same as Alternative 4.	Subsection 5.6.2
Ecology													
Terrestrial													
Short term	No impact	No impact	Temporary disruption and loss of habitat during project.	Temporary disruption and loss of habitat during project.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.	Temporary disruption and loss of habitat during project.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 4.	Subsection 5.7.1
Long term	No impact	No impact	Habitat will be reestablished after project.	Habitat will be reestablished after project.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.	Habitat will be reestablished after project.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 4.	Subsection 5.7.1
Aquatic													
Short term	Minimal impact	Minimal impact	Potential for temporary habitat alteration and biological impact from accidental contaminant discharge.	Minimal impact	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.	Potential for temporary habitat alteration and biological impact from accidental contaminant discharge.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 4.	Subsection 5.7.2
Long term	Minimal impact	Minimal impact	Return to preproject conditions after project.	Minimal impact	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.	Return to preproject conditions after project.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 4.	Subsection 5.7.2
Socioeconomics													
Land use													
Short term	No impact	No impact	Temporary closing of site for several years.	Minimal impact	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.	Minimal impact	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 4.	Section 5.8
Long term	No impact	No impact	Permanent commitment of site as disposal area.	Availability of site for development and use in accordance with land-use controls.	Same as Alternative 2.	Permanent commitment of site.	Availability of site for development and use in accordance with land-use controls.	Same as Alternative 2.	Permanent commitment of site as disposal area.	Same as Alternative 4.	Same as Alternative 3.	Same as Alternative 4.	Section 5.8

Table 1-3. Comparison of potential impacts at each site for each remedial-action alternative (continued)

	Alternative 1		Alternative 2		Alternative 3		Alternative 4			Alternative 5			Reference
	Canonsburg	Burrell	Canonsburg	Burrell	Canonsburg	Burrell	Canonsburg	Burrell	Hanover	Canonsburg	Burrell	Hanover	
Socioeconomics (cont.)													
Truck traffic													
Short term	No impact	No impact	<90 trucks per day over 32 weeks for construction materials.[h] <40 truck trips per day over 20 weeks for Burrell material.	<40 truck trips per day over 4 weeks for construction materials. <40 truck trips per day over 20 weeks for material removal.	<90 trucks per day over 32 weeks for construction materials.[h]	<60 truck trips per day over 15 weeks for construction materials.	<90 truck trips per day over 32 weeks for construction materials.[h] <70 truck trips per day over 46 weeks, for material removal.[h]	Same as Alternative 2.	Low rate of import of construction materials over 52 weeks. <70 truck trips per day over 46 weeks for Canonsburg material.[h] <40 truck trips per day over 20 weeks for Burrell material.	Same as Alternative 4.	Same as Alternative 3.	Low rate of import of construction materials over 52 weeks. <70 truck trips per day over 46 weeks for Canonsburg material.[h]	Subsections 3.1.1 to 3.1.5 and Table 5-19
Long term	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	
Population													
Short term	No impact	No impact	Increase in local population of a maximum of 55 remedial-action workers.	Increase in local population of a maximum of 35 remedial-action workers.	Increase in local population of a maximum of 50 remedial-action workers.	Increase in local population of a maximum of 30 remedial-action workers.	Increase in local population of a maximum of 50 remedial-action workers.	Increase in local population of a maximum of 35 remedial-action workers.	Increase in local population of a maximum of 50 remedial-action workers.	Same as Alternative 4.	Same as Alternative 3.	Same as Alternative 4.	Table 5-14
Long term	No impact	No impact	Decrease in vicinity population by 7 families.	No impact	Decrease in vicinity population by 7 families.	No impact	Temporary relocation of 7 families.	No impact	No impact	Same as Alternative 4.	No impact	No impact	Section 5.8
Housing requirements													
Short term													
Partial project duration	0	0	48	30	43	30	44	30	19	44	30	19	
Most of project duration	0	0	7	5	7	0	6	5	31	6	0	31	Table 5-15
Long term	0	0	0	0	0	0	0	0	0	0	0	0	
Noise													
Short term	No impact	No impact	Minimal impact	Minimal impact	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.	Minimal impact	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 4.	Section 5.9
Long term	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	
Transportation													
Short term	No impact	No impact	Temporary closing of Strabane and Wilson Aves. and and Ward and George Sts.	Impact on local roads	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.	Impact on local roads	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 4.	Section 5.14
Long term	No impact	No impact	Permanent closing of Wilson Ave., Ward and George Sts.	No impact	Same as Alternative 2.	No impact	No impact	No impact	No impact	No impact	No impact	No impact	Section 5.14
Project Requirements													
Manpower -- average/maximum													
Short term	0	0	28/55	20/35	28/50	15/30	28/50	20/35	30/50	28/50	15/30	30/50	Subsections 3.1.1 to 3.1.5 and Table 5-14
Long term	0	0	0	0	0	0	0	0	0	0	0	0	
Financial[i]	No cost		$21,705,000		$13,366,000		$38,965,000			$31,491,000			Table A.4-1

[a] Population = persons living within 6.2 miles of the Canonsburg site (63,942) and 1.2 miles of the Burrell site (4,546) and Hanover site (114).
[b] Total man-rems for the remedial action.
[c] Man-rems per year existing for an indefinite time period.
[d] For the population in (a) only.
[e] Deaths per year existing for an indefinite time period.
[f] WWTP = waste-water treatment plant.
[g] NPDES = National Pollutant Discharge Elimination System.
[h] The number of trucks required does not include those trucks needed to transport the vicinity property material.
[i] Excluding the cost of decontaminating the vicinity properties.

remedial-action alternatives would require closing Strabane Avenue through the Canonsburg site, a major local road, for the project duration. In addition, both Ward Street and Wilson Avenue would be closed through the expanded Canonsburg site; permanently under Alternatives 2 and 3, and temporarily under Alternatives 4 and 5.

In addition to transportation impacts, there would be the direct impacts to several people whose homes or business locations would be acquired. The seven residences located on Wilson Avenue and George Street and the former Georges Pottery buildings would be either acquired and demolished (Alternatives 2 and 3) or closed for approximately 2 years (Alternatives 4 and 5). The Canon Industrial Park has been condemned by the Commonwealth and the remaining businesses are currently in the process of being relocated. The DOE would assist the homeowners in finding temporary housing under Alternatives 4 and 5, and would acquire their properties under Alternatives 2 and 3. The owners of the houses and industries are entitled to relocation assistance.

The remainder of the nonradiological impacts would be small. There would be typical construction noises and dust, temporarily inconveniencing people at certain times, and there could be some localized siltation of Chartiers Creek at the expanded Canonsburg site, but these impacts would be no greater than those experienced from other construction projects such as building a new highway or erecting a new shopping center. All of these impacts would be manageable and appropriate measures such as dust suppression, vehicle mufflers, work scheduling, waste-water treatment, and erosion control would be taken to mitigate their severity.

The remaining potential impacts would be those connected with the radioactively contaminated materials at the Canonsburg and Burrell sites. There are 63,942 people living within 6.2 miles of the Canonsburg site, and 4,546 people living within 1.24 miles of the Burrell site. The normal lung cancer death rate is 1 in 33 (National Academy of Sciences, 1980); this means that the normally-expected lung cancer mortality rate is 63 deaths per year over the remaining lifetime of these 68,488 people. Calculations show that the radioactively contaminated materials at the Canonsburg and Burrell sites may be currently causing an excess lung cancer mortality rate of 0.012 deaths per year among these 68,488 people over their remaining lifetime. An individual in this population has an approximately 1 in 5000 increased chance of dying from lung cancer because of the present condition of the Canonsburg and Burrell sites. With no action, this rate of excess lung cancer deaths will continue into the future.

Preliminary results from two recent studies (Lanes, 1982; and Talbott et al., 1982), show that the cases of lung and thyroid cancer among people living near the Canonsburg site are not statistically different from those for the general public not living near the Canonsburg site. These preliminary results are not considered definitive because the study of lung cancer, the expected consequence of exposure to radon-222 and its daughter products, was based on a very small sample and thyroid cancer is not the expected consequence of exposure to this type of radiation. Recent changes (Haurwitz, 1983; Lash,

1983) in the results of the Talbott et al. (1982) study indicate that the incidence of thyroid abnormalities among the Canonsburg Borough women tested is "marginally significant" compared to the original "not statistically significant."

Each of the alternatives, except for Alternative 1, would reduce the already small increase in lung cancer deaths. Any of the remedial actions would decrease the number of annual excess lung cancer deaths to the 63,942 people living within 6.2 miles of the Canonsburg site to about 0.003 over their remaining lifetime, or any individual in this population would have approximately a 1 in 20,000,000 increased chance of dying from lung cancer in any one year over their remaining lifetime. In reality this means that there would be a very small probability that a lung cancer death would result directly from exposure to the radioactively contaminated materials present at the Canonsburg site after the remedial action is completed. The chances of cancer deaths would be similarly small at the Burrell and Hanover sites. Both of these areas are more isolated than the Canonsburg site and are not subject to the same frequency of human activity as is the Canonsburg site.

1.6 REMEDIAL ACTIONS

The actual work will be done on the sites during this phase of the program. Remedial actions would be performed by the DOE's prime remedial-action contractor (RAC) and its subcontractors. The RAC will competitively award firm, fixed-price subcontracts for the building demolition, earth-moving, construction, and material-handling activities required at each site, which would provide business opportunities for several local firms. The construction would follow a predetermined schedule in which major activities have been planned and a time period for each step developed. Tables 1-1 and 1-2 indicate the remedial-action activities and the basic engineering-related requirements for each alternative.

During the construction period a set of safety and contamination controls would be followed to ensure that no workers are exposed to radiation levels beyond acceptable limits, and that no significant amount of radioactive material escapes into the surrounding area.

Additional information on the remedial-action activities at the three sites will be published as indicated in Table 1-4.

Table 1-4. Document publication schedule -- Canonsburg remedial-action project

Document type	Scheduled publication date
Final site documents	
Remedial action plan (including health and safety plan and radiological support plan)	Late summer 1983
Site conceptual design	Late summer 1983
Site design criteria	Late summer 1983
Site characterization report	Late summer 1983
Final design and specifications	Late fall 1983
Site licensing plan	1984
Site surveillance and maintenance plan	1984
Final UMTRA project documents	
Project licensing plan	Early fall 1983
Project surveillance and maintenance plan	Early fall 1983
Project health and safety plan	Summer 1983

1.7 MAINTENANCE AND MONITORING

After all of the cleanup work is finished, the DOE, or another Federal agency charged with custody of the disposal site, would continue to monitor the final disposal site to ensure that the remedial-action program continues to comply with the EPA standards (40 CFR 192). This could include measurements of parameters such as air and water contaminant levels as specified by the NRC in its license, and maintenance of the site as required. The EPA standards (40 CFR 192) would have to be met before the remedial action is considered officially completed. The proposed monitoring programs that would be implemented during the remedial action are discussed in Appendices F.4 and F.5.

REFERENCES FOR CHAPTER 1

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U.S. DOE (Department of Energy), Uranium Mill Tailings Remedial Action Project Office, Albuquerque Operations Office, 1982b. Remedial-Action Concept Paper for the Uranium Mill Tailings Site at Canonsburg, Pennsylvania, UMTRA-DOE/ALO-31, Albuquerque, New Mexico.

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U.S. EPA (Environmental Protection Agency), Office of Radiation Programs, 1982. Final Environmental Impact Statement for Remedial Action Standards for Inactive Uranium Processing Sites (40 CFR 192), EPA 520/4-82-013-1, Washington, DC.

2 Purpose and Need

The remedial-action alternatives (except no action) presented in this Canonsburg FEIS are possible strategies for reducing the radioactivity levels at the Canonsburg and Burrell sites to meet the EPA standards (40 CFR 192) and other Federal and state laws applicable to the cleanup of inactive processing sites. The purpose of these standards is to protect the public health and safety and the environment from potential radiological and nonradiological hazards associated with radioactively contaminated materials at the sites. The remedial-action project would accomplish one major goal: removing a potential public health hazard, i.e., that potential hazard associated with radioactively contaminated materials.

In 1978, Congress passed the UMTRCA, Public Law 95-604, expressly acknowledging that uranium-mill-tailings located at inactive (and active) mill sites may pose a potential health hazard to the public. The UMTRCA charges the EPA with the responsibility for promulgating remedial-action standards for inactive processing sites. Under the UMTRCA the DOE is authorized to enter into cooperative agreements with affected states or Indian tribal governments to perform remedial actions to bring the radiation levels at the sites in their jurisdictions to within the EPA standards (40 CFR 192). The DOE will fund 90 percent of the remedial-action-cleanup costs (except on Indian land where DOE will fund 100 percent); the affected state will provide the remaining 10 percent. All remedial actions performed under the UMTRCA must be done in accordance with the EPA standards (40 CFR 192) and with the concurrence of the NRC, which will issue a license for the long-term maintenance and monitoring of the disposal site after the cleanup work is complete.

Title I to the UMTRCA identified 22 inactive processing sites to be designated by the Secretary of the DOE for remedial action. On November 8, 1979, the Secretary of the DOE designated those 22 sites and an additional three sites; the Canonsburg site was one of the designated sites. The DOE and the Commonwealth entered into a cooperative agreement effective September 5, 1980, for remedial action at the Canonsburg site and its associated vicinity properties, including the Burrell site.

2.1 HISTORY AND PRESENT STATUS

In the early 1900's, the Standard Chemical Company initiated the development of a method to extract and concentrate radium from carnotite ore. The company established its radium-processing facilities at Canonsburg, Pennsylvania, and produced the first salable quantities of radium in 1913 (Standard Chemical Co., 1919). The company ceased processing operations in the early 1920's (probably around 1922), but continued to act as a marketing agent for some foreign radium producers.

Vitro purchased the Canonsburg facility in 1933 and utilized it for the extraction of uranium, vanadium, and radium from various residues, ores, and concentrates. From 1942 until the facility's closing in 1957, Vitro and its successor, the Vitro Corporation of America, owned and operated the plant on the Canonsburg site. The operations were directed toward the production of uranium concentrates. The only customer from 1942 to 1957 was the United States Government. The uranium and other rare metals were extracted from both onsite (contractor-owned) residues and ores, and government-owned ores, concentrates, and scrap. During this time various ores, concentrates, and scrap materials were brought from different Atomic Energy Commission (AEC) installations to the Canonsburg site for uranium recovery. The end products of these processes were delivered to the AEC in accordance with terms of government procurement contracts. All solid process wastes were stored temporarily on the Canonsburg site. The liquid wastes were discharged through a drainage system beneath Strabane Avenue into the former swamp in Area C that discharged through a drainage ditch into Chartiers Creek. This swamp has since been filled in.

On November 1, 1953, the government and Vitro entered into a contract (AT-(30-1)-1683) that required Vitro to process certain government-owned materials. The contract required that Vitro store the residual radioactive materials from this operation at the Canonsburg site until November 1, 1955 because the AEC believed the residual radioactive materials might contain recoverable uranium. After attempts by Vitro to recycle the residual radioactive materials and attempts by the AEC to identify commercial interest in the residual radioactive materials, it was determined that the uranium in the residual radioactive materials was "unrecoverable" and the AEC authorized an inventory write-off pursuant to provisions of AEC Manual Chapter 7401-12. The AEC's Oak Ridge Operations Office approved the transfer of 11,600 tons of wet radioactively contaminated materials from the Canonsburg site to the Burrell site. The radioactively contaminated materials, containing approximately 6 tons of uranium oxide, was transported to the Burrell site from late 1956 to early 1957 (Leggett et al., 1979a).

The Burrell site is situated about 50 miles northeast of the Canonsburg site in Burrell Township, Indiana County, Pennsylvania (Figure 1-1). At the time of the 1956-1957 disposal, it was owned and operated by the Pennsylvania Railroad as a railroad landfill. Currently, it is owned by the George Burrows Company. The Burrell site covers approximately 49 acres; it is currently an undeveloped plateau along a bend of the Conemaugh River at the southern boundary of Indiana County (Figure 1-4). Its only significant surface features are three steep-banked ponds in the western area that are remnants of an old railroad disposal pit (Figure 1-5). Disposal of the 11,600 tons of radioactively contaminated materials removed from the Canonsburg site took place within an approximate 9-acre section in the western portion of the Burrell site. The radioactively contaminated materials were brought in by railcar, dumped into the disposal pit, and covered with an uneven layer of uncontaminated material.

Recovery operations at Vitro's Canonsburg plant ceased by 1957. The contractor's remaining residues and processing wastes were stored on the Canonsburg site by Vitro. Vitro's final source-material license expired, and in May 1961 Vitro applied to the AEC for another source-material license. On June 21, 1961, the AEC granted Vitro a license, for storage only, of a maximum of 23 tons of uranium contained in 4458 tons of material.

In 1962 Vitro's real property was sold to developers, with Vitro retaining title to the radioactively contaminated materials remaining on the Canonsburg site. In an effort to decontaminate the immediate plant area, in 1964 all of the materials then considered radioactively contaminated were consolidated into one pile in Area A. In 1965, Vitro obtained a permit from the Commonwealth to move this pile to Area C. At Area C it was buried beneath a relatively impermeable layer of steel-mill slag (red dog), and covered by clean fill material. Vitro's source-material license was then terminated, and the Canonsburg site was developed into its present use as the Canon Industrial Park in 1966.

In 1978, the UMTRCA was enacted into law. On November 8, 1979 the Canonsburg site was designated by the DOE as a processing site eligible for remedial action under the UMTRCA. Effective September 5, 1980, the DOE and the Commonwealth entered into a cooperative agreement under UMTRCA, setting forth the terms and conditions for the DOE and the Commonwealth cooperative remedial-action effort, including 90 percent (DOE), 10 percent (Commonwealth) cost-sharing, the Commonwealth's real estate acquisition responsibilities, the Commonwealth's responsibility for nominating potential alternative disposal sites, and provision for the DOE's development of a remedial-action plan after publication of the Canonsburg FEIS. (The remedial-action plan will be concurred on by the Commonwealth and the NRC.)

At various times throughout the years radioactively contaminated soils and building materials were removed from the Canonsburg site and used in local construction projects. It is estimated that over 100 properties in the vicinity of the Canonsburg site have these radioactively contaminated soils and building materials. A separate EA (U.S. DOE, 1982b) addresses the potential environmental impacts of preliminary cleanup activities at these properties.

The Canonsburg site requires cleanup to reduce its radioactivity level to meet the EPA standards (40 CFR 192). Radiological surveys made of the Canonsburg site in 1977 (Leggett et al., 1979b) indicated that significant amounts of radioactively contaminated materials remain on the Canonsburg site and that the radiation levels in the buildings, soils, and ground water exceeded the then-proposed EPA standards (40 CFR 192 (proposed)). The radioactively contaminated materials at the Canonsburg site are heterogeneously distributed; they consist of unprocessed ores, contaminated soils, waste sludges and fines, and building materials.

The radioactively contaminated materials at the Burrell site (Figure 1-4) are mixed with a large amount of debris, especially railroad ties (Leggett et al., 1979a). The Hanover site (Figure 1-8), proposed as a possible disposal site for the radioactively contaminated materials, currently contains no radioactively contaminated materials. It is located in an abandoned strip-mine area and is in the vicinity of land contaminated with chemical and industrial wastes.

As required by the NEPA (PL 91-190) this Canonsburg FEIS has been prepared to provide environmental information before decisions are made and before action is taken. It predicts and analyzes the effects on the environment from performing each alternative. It also addresses the major areas of public concern expressed during the scoping meetings and the public hearings.

2.2 EPA STANDARDS

Under Public Law 95-604, no remedial action may begin until final cleanup standards have been promulgated. The Canonsburg DEIS (U.S. DOE, 1982a) used the proposed EPA standards (40 CFR 192 (proposed)). The Canonsburg FEIS uses the final EPA standards (40 CFR 192). Subpart A of the EPA standards (40 CFR 192), which pertains to disposal sites, is applicable to the expanded Canonsburg site under Alternatives 2 and 3, to the Burrell site under Alternatives 3 and 5, and to the Hanover site under Alternatives 4 and 5. Subpart B of the EPA standards (40 CFR 192), which pertains to decontaminated sites, is applicable to the Canonsburg site vicinity properties, to the Canonsburg site under Alternatives 4 and 5, and to the Burrell site under Alternatives 2 and 4. Pertinent parts of the final EPA standards (40 CFR 192) are quoted in this subsection. A comparison of the proposed and final EPA standards (40 CFR 192) and a discussion of the reasons for selecting the final EPA standards (40 CFR 192) were presented by the EPA in the Federal Register (48 FR 590-604, January 5, 1983). The EPA published an EIS (U.S. EPA, 1982) on the development and impacts of the standards (40 CFR 192).

Subpart A

"Section 192.02 (Disposal) Standards

Control shall be designed[a] to:

(a) Be effective for up to one thousand years, to the extent reasonably achievable, and, in any case, for at least 200 years, and,
(b) Provide reasonable assurance that releases of radon-222 from residual radioactive material to the atmosphere will not:
   (1) Exceed an average[b] release rate of 20 picocuries per square meter per second, or
   (2) Increase the annual average concentration of radon-222 in air at or above any location outside the disposal site by more than one-half picocurie per liter."

Subpart B

"Section 192.12 (Cleanup) Standards

Remedial actions shall be conducted so as to provide reasonable assurance that, as a result of residual radioactive materials from any designated processing site:
(a) The concentration of radium-226 in land averaged over any area of 100 square meters shall not exceed the background level by more than:
   (1) 5 pCi/g (picocuries/gram) averaged over the first 15 cm (centimeters) of soil below the surface, and
   (2) 15 pCi/g, averaged over 15 cm thick layers of soil more than 15 cm below the surface.
(b) In any occupied or habitable building --
   (1) The objective of remedial action shall be, and reasonable effort shall be made to achieve, an annual average (or equivalent) radon decay product concentration (including background) not to exceed 0.02 WL (working level). In any case, the radon decay product concentration (including background) shall not exceed 0.03 WL, and
   (2) The level of gamma radiation shall not exceed the background level by more than 20 microroentgens per hour."

"[a]Because the standard applies to design, monitoring after disposal is not required to demonstrate compliance."

"[b]This average shall apply over the entire surface of the disposal site and over at least a one-year period. Radon will come from both residual radioactive materials and from materials covering them. Radon emissions from the covering materials should be estimated as part of developing a remedial action plan for each site. The standard, however, applies only to emissions from residual radioactive materials to the atmosphere."

With respect to water quality, the following statements have been excerpted:

"(2) Protection of water should be considered in the analysis for reasonable assurance of compliance with the provisions of Section 192.02. Protection of water should be considered on a case-specific basis, drawing on hydrological and geochemical surveys and all other relevant data ...."

"Judgements on the possible need for remedial or protective actions for groundwater aquifers should be guided by relevant considerations described in EPA's hazardous waste management system (47 FR 32274, July 26, 1982) and by relevant State and Federal Water Quality Criteria for anticipated or existing uses of water over the term of the stabilization."

2.3 NRC LICENSING

The NRC has not issued and does not intend to issue regulations that apply to the cleanup and disposal of residual radioactive materials at inactive uranium-processing sites. The DOE will select and execute a plan of remedial action that will satisfy the EPA standards (40 CFR 192). In conformance with Section 104(f)(2) of the UMTRCA, the required NRC concurrence with the proposed remedial actions and the NRC licensing of disposal sites will be for the purpose of ensuring compliance with these EPA standards (40 CFR 192).

Section 104(f)(2) further states that "upon completion of the remedial action program . . . such property and minerals shall be maintained pursuant to a license issued by the Commission (the NRC) in such manner as will protect the public health, safety, and the environment. The Commission may . . . require the Secretary (of the DOE) or other Federal agency having custody of such property and minerals to undertake such monitoring, maintenance, and emergency measures as necessary to protect public health and safety and other actions as the Commission deems necessary . . . ."

REFERENCES FOR CHAPTER 2

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U.S. EPA (Environmental Protection Agency), Office of Radiation Programs, 1982. Final Environmental Impact Statement for Remedial Action Standards for Inactive Uranium Processing Sites (40 CFR 192), EPA 520/4-82-013-1, Washington, DC.

3 Alternatives Including the Proposed Action

3.1 DESCRIPTION OF THE ALTERNATIVES

Five alternative actions have been developed for dealing with the radioactively contaminated materials at the Canonsburg and Burrell sites. In all the alternatives except no action, the effort would begin by decontaminating the local vicinity properties now contaminated with radioactively contaminated materials taken from the Canonsburg site. Materials removed from these properties would be consolidated at the Canonsburg site. The remedial-action alternatives for the Canonsburg and Burrell sites, are described in detail in this subsection. Alternatives eliminated from consideration are given in Subsection 3.1.6.

- Alternative 1 -- No action
- Alternative 2 -- Decontamination of the Burrell site, transfer of the Burrell site's radioactively contaminated materials to the Canonsburg site, and stabilization of both the Canonsburg and Burrell sites' radioactively contaminated materials at the expanded Canonsburg site.
- Alternative 3 (proposed action) -- Stabilization of the Canonsburg site's radioactively contaminated materials at the expanded Canonsburg site and the Burrell site's radioactively contaminated materials at the Burrell site.
- Alternative 4 -- Decontamination of both the Canonsburg and Burrell sites, and disposal of all of the radioactively contaminated materials at the Hanover site.
- Alternative 5 -- Decontamination of the Canonsburg site, disposal of its radioactively contaminated materials at the Hanover site, and stabilization of the Burrell site's radioactively contaminated materials at the Burrell site.

The primary difference between decontaminating and stabilizing a radioactively contaminated site is that a decontaminated site will contain no radioactively contaminated materials at levels above the EPA standards (40 CFR 192) and may later be available for unrestricted use. A stabilized site will meet the EPA standards (40 CFR 192), but it will still retain its radioactively contaminated materials and therefore must remain undisturbed to protect the containment. Thus, its future use is permanently restricted. Each of the alternatives (except no action) includes maintenance and monitoring programs to ensure the effectiveness of the remedial actions (see Appendix F.4).

The basic strategies considered for carrying out the remedial actions are to stabilize the radioactively contaminated materials at their present locations or to transport them to a new disposal site (U.S. DOE, 1982b). Tables 3-1 through 3-3 summarize the basic methods that would be used to dispose of the radioactively contaminated materials at each of the three sites under each of the alternatives.

A number of site activities are a part of every alternative except no action. They include the following:

1. Surveying the site and placing benchmarks at specific work locations.

2. Installing site security barriers and developing the road network that is required on the site, including both constructing new roads and closing or rearranging existing roads.

3. Setting up personnel trailers and decontamination facilities and establishing areas for stockpiling materials. This will include implementing strict dust-control measures during any handling of contaminated material.

4. Developing and installing a waste-water collection and treatment system for those alternatives involving handling contaminated materials.

5. Transferring 30,000 cubic yards of radioactively contaminated materials from the vicinity properties near the Canonsburg site onto the Canonsburg site.

As stated in Section 1.1, two areas adjoining the Canon Industrial Park are proposed for incorporation into the expanded Canonsburg site for the Canonsburg site stabilization alternatives (Alternatives 2 and 3). These areas are the former Georges Pottery property and the seven residences on Wilson Avenue and George Street. The reasons for this approach are as follows:

1. There would be a lack of access to the properties both during and after the remedial action unless a separate new road is built.

2. There would be interference between the construction equipment on the site and the vehicles going to the residences.

3. It would be more cost effective and less personally disruptive to permanently relocate the residents.

4. Inclusion of the two areas would allow the entire site to be buffered by two existing barriers -- the creek and the railroad.

5. The most effective way to perform in-situ stabilization would be by using the entire area (see Appendix A.1).

Table 3-1. Summary of possible environmental controls and engineering features for stabilization of the radioactively contaminated materials at the Canonsburg site (Alternatives 2 and 3)[a]

Environmental issues and requirements	Engineering features
1. Control of radon-emanation rate	a. Encapsulation of highly contaminated materials from Areas A and C and the former Georges Pottery property.
	b. Demolition of buildings in Area A and the former Georges Pottery property.
	c. Use of multilayer cover system (clay and soil, and soil layers) for radon-222 attenuation in encapsulation area.
	d. Drain layer in cover and under capsule.
	e. Use of soil cover for balance of site.
2. Surface-radiation levels	a. Encapsulation of highly-contaminated materials.
	b. Soil cover over balance of site depending on radiation levels.
	c. Stabilization and vegetation of site.
3. Subsurface-water quality	a. Removal of highly contaminated materials from saturated zone in Area C.
	b. Dewatering of Area C and treatment of recovered water during construction.
	c. Encapsulation of highly contaminated material.
	d. Use of multilayer cover system to minimize the potential for leachate generation in encapsulation cell.
	e. Use of clay and soil liner for waste containment, and attenuation of leachate contaminants.
	f. Reduction of infiltration throughout the site using cover, drainage, and stabilization of surface.
4. Surface-water quality	a. Removal of highly contaminated materials from flood plain (Areas B and C).
	b. Construction of temporary flood-control berm around the excavated areas.
	c. Improving drainage and control of runoff.
	d. Collection and treatment of contaminated water and waste water during construction period.

[a]See Appendix A.1 and U.S. DOE (1982c) for additional information.

Table 3-1. Summary of possible environmental controls and engineering features for stabilization of the radioactively contaminated materials at the Canonsburg site (Alternatives 2 and 3)[a] (continued)

Environmental issues and requirements	Engineering features
5. Soil-contamination levels	a. Removal of highly contaminated materials from Areas A, B, and C and the former Georges Pottery property. b. Encapsulation of highly contaminated material. c. Soil cover over remaining contaminated areas. d. Building demolition in Area A and the former Georges Pottery property. e. Stabilization of site surface using soil cover and revegetation.
6. Long-term stability	a. Use of natural material (soil, clay, rock) for liner and cover construction. b. Use of passive control techniques. c. Physical and structural stabilization of highly contaminated material prior to encapsulation.
7. Radiation protection (public and construction personnel)	a. Control of site access (fence, gates, signs, etc.) during and after the remedial-action program. b. Establishment of employee health and support facilities (showers, protective clothing, dosimeters, etc.). c. Closing of Wilson Avenue and Ward and George Streets, relocation of the commercial and residential tenants and government acquisition of the contaminated Canon Industrial Park buildings, machinery, and equipment. d. Radiation monitoring and surveillance. e. Quality control and assurance.

[a]See Appendix A.1 and U.S. DOE (1982c) for additional information.

Table 3-2. Summary of possible environmental controls and engineering features for stabilization of the radioactively contaminated materials at the Burrell site (Alternatives 3 and 5)[b]

Environmental issues and requirements	Engineering features
1. Control of radon-emanation rate	a. Soil cover over localized high radiation spots.
2. Surface radiation	a. Cover system (soil) over localized high radiation spots. b. Stabilization and revegetation of the contaminated areas of the site.
3. Subsurface-water quality	a. Cover system to reduce excessive infiltration through contaminants.
4. Surface-water quality	a. Covering localized high-radiation spots. b. Improving runoff and drainage patterns. c. Site stabilization and revegetation of areas prone to erosion.
5. Soil-contamination levels	a. Covering localized high-radiation spots. b. Site stabilization and revegetation.
6. Long-term stability	a. Use of natural earth and durable material (e.g., stone, soil, slag, and clay) for site stabilization and cover. b. Design of cover to accommodate projected subsidence of waste material. c. Use of passive control techniques.
7. Radiation protection (public and construction personnel)	a. Control of site access (fence, gates, signs, etc.) during and after the remedial-action program. b. Establishment of employee health and support facilities(showers, protective clothing, dosimeters, etc.) . c. Radiation monitoring and surveillance. d. Quality control and assurance.

[b]See Appendix A.2 and U.S. DOE (1982d) for additional information.

Table 3-3. Summary of possible environmental controls and engineering features for decontamination of the Canonsburg and Burrell sites and disposal of the radioactively contaminated materials at the Hanover site (Alternatives 4 and 5)

Environmental issues and requirements	Engineering features
1. Control of radon-emanation rate	a. Encapsulation of waste and contaminated material and use of multilayer cover consisting of clay cap, stone, and soil layers.
2. Surface radiation	a. Use of adequate cover material and thickness. b. Stabilization and revegetation of the site.
3. Subsurface-water quality	a. Locating encapsulation cells above ground-water table. b. Control of ground-water levels using drainage devices. c. Use of multilayer cover system to minimize the potential for leachate generation in encapsulation cells. d. Use of clay and soil liner for waste containment and attenuation of leachate contaminants.
4. Surface-water quality	a. Construction of runoff, drainage, and erosion-control devices. b. Stabilization and revegetation of site surfaces. c. Collection and treatment of contaminated run-off and leachate during construction and waste placement periods.
5. Soil-contamination levels	a. All waste and contaminated material and soils will be placed in the encapsulation cell between clay liner and multilayer cover system.
6. Long-term stability	a. Use of natural material for liner and cover material. b. Use of passive control techniques. c. Optimum compaction of waste and contaminated material during placement in encapsulation cells. d. Design and construction of cover system that could accommodate some degree of settlement and subsidence.

Table 3-3. Summary of possible environmental controls and engineering features for decontamination of the Canonsburg and Burrell sites and disposal of the radioactively contaminated materials at the Hanover site (Alternatives 4 and 5) (continued)

Environmental issues and requirements	Engineering features
7. Radiation protection (public and construction personnel)	a. Control of site access (fence, gates, signs, etc.) during remedial-action program. b. Establishing employee health and support facilities (showers, protective clothing, dosimeters, etc.). c. Radiation monitoring and surveillance. d. Quality control and assurance.

6. Inclusion of the two areas would eliminate the possibility of damage to private structures from heavy equipment operation.

7. Inclusion of the two areas would eliminate the possibility of private vehicle contamination.

8. Inclusion of the two areas would allow sufficient room for temporary storage of clean fill.

A preliminary evaluation has been made of the feasibility and cost of transporting the radioactively contaminated materials by rail (Appendix I). Rail haul of these radioactively contaminated materials may be physically possible, assuming the use of unit trains, sufficient upgrading of rights-of-way, new spur construction, and the construction of bulk loading and unloading facilities. However, the costs associated with rail transportation would be significantly higher than those costs for truck transportation. The DOE has determined that rail transportation does not represent a reasonable alternative for transporting the radioactively contaminated materials or the clean fill materials.

3.1.1 Alternative 1 -- no action

This alternative entails leaving the Canonsburg and Burrell sites in their present condition.

3.1.2 Alternative 2

In this alternative all radioactively contaminated materials, including those at the Burrell site and at the local vicinity properties, would be placed at the expanded Canonsburg site.

The Burrell site would be decontaminated and the Canonsburg and Burrell sites' radioactively contaminated materials stabilized at the expanded Canonsburg site. The major stabilization activities at the expanded Canonsburg site would fall into three categories: structure demolition, excavation, and burial of the radioactively contaminated materials. The decontamination activities at the Burrell site would include excavating and removing the radioactively contaminated materials, and filling and grading the Burrell site.

Structures that would be demolished at the expanded Canonsburg site include the industrial park buildings, the railroad spur, the former Georges Pottery buildings, and the seven Wilson Avenue and the George Street residences. (These are shown on Figure 1-2.) The residences would be treated either under the vicinity property program or the Canonsburg remedial-action plan. The industrial park buildings are radioactively contaminated and would be cleaned and painted to fix surface contamination before demolition. Uncontaminated rubble would be buried without prior cleaning or treatment. The rubble would be stockpiled until it could be buried on the expanded Canonsburg site. Steel could be salvaged from the Canon Industrial Park and the former Georges Pottery buildings and transported off the expanded Canonsburg site after being decontaminated, if necessary, to the levels specified in NRC Regulatory Guide 1.86 (U.S. NRC, 1976). The railroad spur material is also contaminated and would eventually be buried on the expanded Canonsburg site.

The excavation activities at the expanded Canonsburg site would occur in stages. The initial stage would include excavating the boundaries of an encapsulation cell for laying the drain and gravel layers.

The second stage of construction at the expanded Canonsburg site would entail excavating the radioactively contaminated materials in Areas A and C and the former Georges Pottery property for encapsulation. Areas to be excavated would be delineated using a survey grid. The survey would maximize the probability of identifying for encapsulation a contiguous volume of soil greater than 300 cubic yards and contaminated with radium-226 at concentrations greater than 100 picocuries per gram of soil. Smaller contiguous volumes of greater than 15 cubic yards that could have an average concentration of radium-226 greater than the 100 picocuries per gram of soil throughout the facility's design life would be excavated and encapsulated if detected by the grid survey or excavation. This would result in spot removals in Area A and the former Georges Pottery property, and excavation of a major portion of Area C.

The water table in Area C is relatively high, often within 4 feet of the surface. Therefore, this area would have to be dewatered during the entire excavation period. It has been estimated that a maximum of 300,000 gallons per day would have to be pumped out initially to depress the water table and a maximum of 20,000 gallons per day thereafter to maintain a depressed level. These estimates are based on assumed aquifer characteristics. The rate of delivery of this water to the treatment plant could be controlled in order to match the rate of treatment capacity. This water would be routed through a sedimentation basin and an onsite waste-water-treatment plant before discharge into Chartiers Creek. Discharged water would meet the National Pollutant Discharge Elimination System (NPDES) standards (40 CFR 124). Since most of the radioactively contaminated materials in Area B with radium-226 concentrations greater than 100 picocuries per gram of soil are deeply buried, and the total radium-226 activity is considered small relative to that on the entire Canonsburg site, very little excavation would take place in this area.

The encapsulation cell that would be used at the expanded Canonsburg site includes a multilayer cover and a low-permeability liner. The cover is designed to limit the radon-222 emanation from the encapsulated radioactively contaminated materials to below 20 picocuries per square meter per second and to limit the water infiltration as much as possible. The liner serves the dual purpose of minimizing water movement and passively treating any water that does move through. The cover and liner would be constructed of natural materials brought onto the expanded Canonsburg site from local sources, possibly augmented by admixing with bentonite clay imported from outside the local area to meet permeability criteria. The liner would consist of a layer of compacted clay. The liner must be placed on a stable prepared base and adequate separation must be maintained between the seasonal high water table and the bottom of the liner. Vegetation would be established to reduce erosion and thus to enhance the longevity of the cover. A gravel layer would be placed between the clay cap and the vegetation layer to control root and animal penetration into the encapsulation cell.

Historically, cover failure of poorly designed systems often resulted in the "bathtub" effect. This effect occurs when the rate of infiltration into the cell exceeds the rate of exfiltration out of the cell and results in seeps (plumes) of contaminants. Based on studies of failed systems and laboratory research, it is now known that this phenomenon may happen through flaws in the design (e.g., permeabilities are less for the liner than cover), or systems failure (e.g., cover failure).

To prevent these problems from occurring, the design and specifications for material selection will consider, at a minimum, the following:

1. Types and characteristics (e.g., permeabilities, ion exchange potential) of available native materials.

2. Need for imported natural materials (e.g., bentonite).

3. Cell configuration (e.g., slopes, topography).

4. Water balance analysis (e.g., rates of infiltration and exfiltration).

5. Others (e.g., compaction, construction sequencing).

To reduce the potential for encapsulation cell failure because of differential settlement, erosion, and adverse weathering, the concept calls for a thick (several feet) clay cap covered by a soil cover layer. In addition, a drain layer comprised of gravel or cobble could be placed between the clay and soil layers. The soil and pit run rock layers over the cap would provide adequate protection from freeze-thaw (frost depth in this area is 2 to 3 feet) and surface drying-cracking damage. The capillary break (coarse sand) layer would break capillary action, thereby preventing continuous saturation and further minimize the effects of freeze-thaw. Proper placement and compaction of the radioactively contaminated materials in the cell should minimize the potential for differential settlement.

Burial of the radioactively contaminated materials at the expanded Canonsburg site would be planned to minimize stockpiling. As soon as a portion of the encapsulation cell is complete, the initial radioactively contaminated materials excavated from Area A would be emplaced. If rail transportation is not used to bring in the radioactively contaminated materials from the Burrell site, the radioactively contaminated materials resulting from dismantling the railroad spur coming into Area A would also be emplaced in the encapsulation cell as soon as possible. If rail transportation were used, the spur would be revitalized. As an alternative to revitalization of the rail spur, the imported radioactively contaminated materials could be off-loaded alongside the main railroad line and moved by conveyor onto the site. The Burrell site's radioactively contaminated materials would be brought onto the expanded Canonsburg site and deposited directly into the encapsulation cell. Similarly, the radioactively contaminated materials from Areas A and C would be deposited in the encapsulation cell as they are excavated. The radioactively contaminated materials from Area C would be wet and would be mixed with the dry radioactively contaminated materials from Area A. At the close of each working day the exposed radioactively contaminated materials in the encapsulation cell would either be sprayed with water or would be covered with a tarpaulin to prevent wind erosion. If radioactively contaminated organic materials were found, they would be shredded and spread over the expanded Canonsburg site outside the encapsulation cell and covered with soil.

Strict dust-control measures would be implemented during any handling of the radioactively contaminated materials. Pending Commonwealth approval, it is proposed that dust be controlled through the use of Best Available Technology (BAT). This could include the use of water sprays with surfactants at emission sources (e.g., stockpiles, excavated areas, haul roads, etc). Special control emphasis would be placed on building decontamination and demolition at the expanded Canonsburg site, transfer points (construction vehicles), and stockpiles. Additional controls could include the use of cover over excavation areas, road maintenance, or the use of other types of dust suppressors.

Depending on its radioactive contamination levels, the radioactively contaminated materials previously brought onto the Canonsburg site from cleaning the vicinity properties and stored on Area A would either be encapsulated or spread over the expanded Canonsburg site and covered with soil.

All of the excavated holes would be backfilled and graded to natural contours. The entire expanded Canonsburg site, other than the present residential area and the low areas along Chartiers Creek, would be covered with cover soil, topsoil, and seeded. There would be both excavation and fill activities occurring in the 100-year flood plain to remove radioactively contaminated materials (Areas B and C), and to construct the base for the encapsulation cell (Area B).

The excavation work at the Burrell site would entail removing all radioactively contaminated materials not meeting EPA standards (40 CFR 192) and transporting them to the expanded Canonsburg site. This work would include the original residual radioactive materials, as well as other material that has become radioactively contaminated. Miscellaneous radioactively contaminated organic materials (e.g., wood) would be segregated for shredding and disposal on the expanded Canonsburg site. Following radioactively contaminated-materials excavation, the Burrell site would be filled, regraded, and reseeded.

The major material-handling activities at the expanded Canonsburg site during Alternative 2 would be importing and burying the radioactively contaminated Burrell site materials, excavating and burying the Canonsburg site's radioactively contaminated materials, spreading or burying the vicinity properties' radioactively contaminated materials, and importing approximately 270,000 cubic yards of fill and construction materials. The 270,000 cubic yards of imported fill and construction materials could be brought onto the expanded Canonsburg site by 20-ton dump trucks at a rate of 90 trips per day over a 32-week period. The Burrell site's radioactively contaminated materials (up to 80,000 cubic yards) could be brought onto the expanded Canonsburg site by 20-ton dump trucks at a rate of 40 trips per day over a 20-week period or by rail in 70-ton side-dumping railroad cars in two or three trains per week in approximately the same time.

The radioactively contaminated materials to be moved on the expanded Canonsburg site consist of the following:

Former Georges Pottery property	3,000 cubic yards
Area A preliminary excavation	4,000 cubic yards
Railroad spur material	3,000 cubic yards
Major Area A excavation	10,000 cubic yards
Area C excavation	40,000 cubic yards
Vicinity property material	30,000 cubic yards
Total	90,000 cubic yards

Material handling at the Burrell site would consist of exporting the radioactively contaminated materials and importing clean fill. It is estimated that 16,000 cubic yards of clean fill would be required. This would be brought to the Burrell site at a rate of 40 truck trips per day over a 4-week period and stockpiled until needed. If trains were used to haul the clean fill, the delivery period would be about the same.

The decontamination of the Burrell site would occur over an estimated 80-week period, while the stabilization of the expanded Canonsburg site would require an estimated 95 to 100 weeks. (The duration of the four alternatives discussed in this section represents all activity from the first day of site mobilization through the last day of site demobilization. Radioactively contaminated materials handling would not occur over this entire span.) The stabilization of the expanded Canonsburg site and the decontamination of the Burrell site would not be scheduled to start at the same time. The Canonsburg site's staffing levels would average an estimated 25 to 30 site workers, with approximately 55 persons during the peak activity. Staffing levels at the Burrell site would average approximately 20 persons on the Burrell site at any one time, with a maximum of 35. Typical construction and earth-moving equipment would be used at both sites. After all remedial actions were completed, the stabilized Canonsburg site would be fenced and both sites monitored to ensure the integrity of the work.

This schedule assumes year-round activity performed during a normal workday. It includes some provisions for bad weather delays.

3.1.3 Alternative 3 -- the proposed action

This alternative would result in onsite stabilization of the radioactively contaminated materials at the expanded Canonsburg site and the Burrell site separately. The activity at the expanded Canonsburg site would be identical to that described for Alternative 2, except that there would be no inflow of radioactively contaminated materials from the Burrell site. This would result in a much smaller encapsulation cell at the expanded Canonsburg site.

The Burrell site's radioactively contaminated materials would be stabilized in place without excavation. The conceptual design for this process is detailed in Appendix A.2, based in part on information presented in U.S. DOE (1982e). The principal feature of the design concept is the capping of the surface to control radon exhalation and to inhibit water infiltration. The completed stabilized area would encompass approximately 4 acres in the northwest portion of the Burrell site. Cover material would be brought from other locations on the Burrell site or from the immediate area to form a low permeability cover. The surface would be graded to maximize runoff and vegetated to minimize erosion.

While the Burrell site has been designated a vicinity property, it is the DOE's intent to redesignate the Burrell site as a disposal site under this alternative. Therefore, it would be necessary for the government to acquire and maintain title to the radioactively contaminated portion of the Burrell site.

Material handling at the expanded Canonsburg site during Alternative 3 would entail excavating and burying the radioactively contaminated materials on the expanded Canonsburg site, spreading or burying the vicinity properties' radioactively contaminated materials, and importing 270,000 cubic yards of fill and construction materials. These activities would be performed in the same way as described for Alternative 2.

Material handling at the Burrell site would be limited to importing the 30,000 cubic yards of construction and fill materials. These construction and fill materials would be brought to the Burrell site in 20-ton trucks over a 15-week period at a rate of less than 60 truck trips per day. If rail transportation were used, the material could be delivered in 70-ton freight cars in about the same time period. The construction and fill materials would be stockpiled on the Burrell site and used as needed.

The stabilization of the expanded Canonsburg site would require an estimated 85 to 90 weeks, approximately 10 fewer than for Alternative 2. The staffing levels would average an estimated 25 to 30 onsite workers, peaking to a maximum of approximately 50.

The stabilization of the Burrell site would occur over an estimated 30- to 35-week period, less than half the time required for Alternative 2. The staffing levels would average approximately 15 persons on the Burrell site with a maximum of 30.

3.1.4 Alternative 4

Under this alternative all radioactively contaminated materials with radium-226 concentrations greater than those permitted under the EPA standards (40 CFR 192) would be excavated from the Canonsburg and Burrell sites and disposed of at the Hanover site.

The activities at the Canonsburg site would consist primarily of demolishing buildings, excavating and removing radioactively contaminated materials, and filling the excavated holes. The demolition of the buildings and the railroad spur would be performed as discussed for Alternative 2, with the exception of the former Georges Pottery property and the Wilson Avenue and George Street residences. These would remain standing, and Ward Street would be returned to public use following the remedial work. The radioactively contaminated rubble from the industrial park buildings and the railroad spur (totaling approximately 7000 cubic yards) would also be transported to the Hanover site for disposal.

Significantly greater amounts of radioactively contaminated materials would be excavated from the Canonsburg site during this alternative than in Alternative 2, because of the requirement for removing radium contamination rather than simply reducing surface radon flux. Approximately 250,000 cubic yards of radioactively contaminated materials would have to be excavated at the Canonsburg site. This amounts to 140,000, 34,000, and 76,000 cubic yards from Areas A, B, and C, respectively. (The stockpiled vicinity-property radioactively contaminated materials would add approximately 30,000 cubic yards.)

The excavation of Area A would cover a larger general area in comparison to the spot removals during Alternative 2. The excavation of Area C, although involving a greater volume, would be performed as described for Alternative 2, complete with lowering the water table and mixing wet radioactively contaminated materials with dry Area A radioactively contaminated materials. Unlike the stabilization alternatives, radioactively contaminated materials would also be excavated and removed from Area B.

The radioactively contaminated materials would be exported from the Canonsburg site as soon as they were excavated, with very little stockpiling, over a 46-week period using 20-ton trucks at a rate of less than 70 truck trips per day. If rail transportation were used, it would be necessary to rehabilitate a considerable length of abandoned spur in the Hanover site area.

The fill and construction materials to be used at the Canonsburg site for this alternative would consist of 32,000 cubic yards of road and berm materials, 220,000 cubic yards of clean fill, and 18,000 cubic yards of topsoil. These materials would be brought on the Canonsburg site over an estimated 30- to 35-week period at a daily rate of less than 90 truck trips; an alternative transportation method could again be rail. The materials would be stockpiled on the Canonsburg site until used.

The decontamination of the Burrell site would be performed as described for Alternative 2, with the same volume of material, and number of trips. The only difference would be the transportation route for the radioactively contaminated materials, i.e., from the Burrell site to the Hanover site instead of to the Canonsburg site.

The decontamination of the Canonsburg site would take place over approximately 105 weeks. There would be an average of 25 to 30 persons working on the site at any time. The maximum staff would be approximately 50 persons during the height of the excavation and transporting activities.

The decontamination of the Burrell site would occur over approximately 80 weeks. The staff levels would average 20 persons and peak to an estimated 35.

The Canonsburg and Burrell sites' radioactively contaminated materials would be stabilized at the Hanover site in an encapsulation cell. This encapsulation cell would be constructed in the same design as that constructed at the Canonsburg site under Alternatives 2 and 3. Once a portion of the liner was completed at the Hanover site, the contaminated Burrell and Canonsburg sites' radioactively contaminated materials would be placed in the encapsulation cell as they arrive.

A leachate-collection system would be installed at the Hanover site at the low point in the encapsulation-cell excavation. This system would be in operation during project activities to collect storm water and to transport it to the wastewater treatment plant. Once burial was completed, the collection system would be abandoned. A temporary water-supply well and pond would be constructed on the Hanover site to provide a source of wash water for equipment decontamination.

The construction and fill materials (approximately 200,000 cubic yards total of crushed stone, fill, clay, and topsoil) would be brought to the Hanover site by 20-ton dump trucks over an estimated 50- to 55-week period or they could be delivered by rail if the spur is rehabilitated, and stockpiled. The radioactively contaminated materials would arrive at the Hanover site at the same rate as they were removed from the Canonsburg and Burrell sites.

The stabilization activities at the Hanover site would require approximately 120 weeks to complete. The onsite staff would average an estimated 30 persons, with a maximum of up to 50.

3.1.5 Alternative 5

This alternative would entail decontaminating the Canonsburg site and disposing of its radioactively contaminated materials at the Hanover site, while the Burrell site's radioactively contaminated materials would be stabilized in place.

The activities that would be performed at the Canonsburg site are identical to those presented for Alternative 4. Excavating and removing the radioactively contaminated materials to the Hanover site would be conducted in the same way as for Alternative 4. This alternative would require the same length of time and staffing levels.

The Burrell site would be stabilized as discussed for Alternative 3. The activities, radioactively contaminated materials-handling volumes, transporting rates, staffing, and scheduling would be the same as for Alternative 3.

The stabilization activities at the Hanover site would be generally the same as presented for Alternative 4. The primary difference between these alternatives would be in the project duration and the volume of disposed radioactively contaminated materials. The Burrell site's radioactively contaminated materials would not be brought to the Hanover site. Approximately 170,000 cubic yards of construction and fill materials would be brought to the Hanover site. The activity at the Hanover site would take place over an estimated 120 weeks. The manpower requirements would average approximately 30 people, with a maximum of 50.

3.1.6 Alternatives eliminated from further consideration

Additional remedial-action alternatives were identified but eliminated from further consideration because they do not represent reasonable alternatives. These alternatives and the reasons for their elimination are discussed in the subsections that follow.

Use of rail instead of truck transportation is reviewed in Appendix I. Based on this analysis, the DOE has concluded that rail transportation is not a reasonable alternative. The study process conducted in cooperation with the Commonwealth that led to the selection of the Hanover site as the reasonable alternative offsite disposal site is outlined in Section 1.1.

3.1.6.1 Decontaminate the Canonsburg site and stabilize the Canonsburg and Burrell sites' radioactively contaminated materials at the Burrell site

This alternative would involve transporting the greater bulk of radioactively contaminated materials over 50 miles from Washington County to Indiana County. This violates one of the guidelines for disposal-site selection suggested by the Commonwealth (Pennsylvania, 1981); the one that calls for keeping the majority of the radioactively contaminated materials within the county where they are now. Most importantly, this alternative would require the construction of a disposal facility that would probably be larger than the Burrell site could handle.

3.1.6.2 Stabilize the Canonsburg site, decontaminate the Burrell site, and dispose of the Burrell site's radioactively contaminated materials at the Hanover site

This alternative would also require transporting large quantities of radioactively contaminated materials across county borders and through metropolitan Pittsburgh. The costs of this alternative in terms of finances, level of effort, and risks significantly outweigh the benefits; in effect, it would require the same magnitude of costs as Alternatives 2 and 4.

3.1.6.3 Decontaminate the Canonsburg and Burrell sites and dispose of the radioactively contaminated materials in above-ground containment structures

There is no historical experience that demonstrates the ability of any type of above-ground structure to provide long-term isolation with minimal maintenance. The use of natural materials for the underground containment structure should provide a more lasting structure than a rigid metal container. The climate of Pennsylvania complicates the problem because it would subject the containment structure to seasonal temperature extremes.

The isolation of at least 330,000 cubic yards of radioactively contaminated materials would require an extremely large structure. In addition to the engineering difficulties associated with this endeavor, serious aesthetic and social problems could occur. One example is a structure 10 yards high and 200 yards in diameter (two football fields in diameter).

3.1.6.4 Decontaminate the Canonsburg and Burrell sites and dispose of all of the radioactively contaminated materials in a central Federal repository for all UMTRAP sites

At present no such Federal repositories exist, nor have any been planned. This alternative would entail extensive financial and time costs and is not justifiable. The effort required to implement such an action would preclude the performance of any remedial action at the Canonsburg site during the foreseeable future. In addition, the risk of transportation-related accidents would be greatly increased under this alternative compared to onsite stabilization. Therefore, this action does not comply with the intent of the UMTRCA to provide for effective and swift removal of the potential public health hazard caused by the radioactively contaminated materials at all UMTRAP sites.

3.1.6.5 Decontaminate the Canonsburg and Burrell sites and dispose of all of the radioactively contaminated materials in a deep underground (geological) disposal area

Disposal in a deep underground (geological) disposal area (e.g., a specially selected stable area or an existing worked-out mine) would be extremely expensive vis-a-vis the five alternatives considered, and is not warranted considering the extremely low radiation level of the radioactively contaminated materials located at the Canonsburg and Burrell sites. Deep geological disposal is considered applicable to spent nuclear fuel, high level waste, and transuranic waste.

3.1.6.6 Decontaminate the Canonsburg and Burrell sites and reprocess the radioactively contaminated materials

None of these alternatives includes the reprocessing of the tailings. Pursuant to Public Law 95-604, the DOE solicited expressions of interest in reprocessing from the owners of each uranium-mill-tailings pile (by individual letter) and from the general public (by notices in the Federal Register (45 FR 36470-36471, May 30, 1980) and press releases). For the Canonsburg site there has been no response to these requests, probably because the small amount of reprocessible material and the long distance to established reprocessing plants make reprocessing uneconomical. For this reason, reprocessing is not included as a viable alternative.

3.2 ENVIRONMENTAL IMPACTS

3.2.1 Comparison of impacts

The major differences among the remedial-action alternatives (2 through 5) are discussed in this section. Chapter 5 contains a complete description of all of the environmental impacts associated with the remedial-action alternatives, and Table 1-3 summarizes these impacts. Chapter 1 explains the changes that were made in the document between the Canonsburg DEIS (U.S. DOE, 1982a) and the FEIS.

One of the major areas of environmental concern in comparing the alternatives is their radiological impacts. Under the no-action alternative, people living near the Canonsburg and Burrell sites would continue to be exposed to uncontrolled radioactively-contaminated materials contained at the Canonsburg and Burrell sites. The 63,942 people living within 6.2 miles (10 kilometers) of the Canonsburg site would receive an excess bronchial dose of 530 man-rems per year; the 4,546 people living within 1.24 miles of the Burrell site would receive an excess bronchial dose of 48 man-rems per year. These doses could cause 0.011 excess lung cancer deaths per year over the remaining lifetime of the 63,942 people living within 6.2 miles of the Canonsburg site, and 0.001 excess lung cancer deaths per year over the remaining lifetime of the 4,546 people living within 1.24 miles of the Burrell site. Under the no action alternative these rates of excess lung cancer deaths would continue into the future. Each of the remedial-action alternatives would meet the EPA standards (40 CFR 192) for radioactively contaminated materials disposal. Each alternative would have similar short- and long-term effects on population exposure. Exposure during project implementation would be approximately twice the present (no action) level, while after project completion, the exposure would be reduced by a factor of approximately 4 from the present level. This reduction in exposure after completion of the remedial actions would result in an expected 0.003 additional lung cancer deaths per year among the 63,942 people living within 6.2 miles of the Canonsburg site over their remaining lifetime over those lung cancer deaths expected naturally; deaths would continue at this rate into the future.

The main difference between the remedial-action alternatives with respect to radiological conditions is that Alternatives 2 and 3 would involve potential disposal sites presently contaminated with radioactively contaminated materials, and Alternatives 4 and 5 would involve a potential disposal site presently not contaminated with radioactively contaminated materials.

A major nonradiological concern for Alternatives 2 through 5 pertains to transportation impacts. Each of the remedial-action alternatives would require extensive handling of both radioactively contaminated and uncontaminated materials. The feasibility of rail transport for some or all of these materials was assessed in terms of site and borrow pit locations, and existing rail line conditions (Appendix I). Because of the distance of the borrow pits from rail lines and the necessity for revitalizing several track sections between the sites, rail transport has been determined not to be economically viable. However, the trucks would have to access each site by minor roads. The Canonsburg site area would be the most sensitive area because the trucks would have to use narrow, congested roads through residential areas. Based on the lesser amounts of material movement during these alternatives, Alternatives 2 and 3 would entail the least amount of truck traffic into the expanded Canonsburg site (16,500 and 12,500 total truck trips, respectively). Alternatives 4 and 5 would each require 25,000 total truck trips to the Canonsburg site. Each remedial action would also affect traffic patterns in the vicinity of the Canonsburg site during project implementation. The temporary closing of Strabane Avenue through the Canonsburg site, a major connecting route between the Borough of Canonsburg and the Village of Strabane, would require motorists to travel over one-half mile to the east or west to cross Chartiers Creek. This could lead to traffic congestion in these two areas.

The remedial-action alternatives would differ in their short-term air-quality impacts. Alternatives 2 and 3 would not result in any air-quality impacts that would exceed the NAAQS (40 CFR 50) at either the Canonsburg or Burrell site. For both Alternatives 4 and 5 the 24-hour total-suspended-particulate concentration is predicted to be greater than the secondary standard (40 CFR 50), and the annual concentration, when added to the background for the Hanover site, is predicted to marginally exceed the primary standard (40 CFR 50). All other pollutants at all sites for Alternatives 4 and 5 are predicted to be below the NAAQS (40 CFR 50).

Socioeconomic impacts at the sites would differ among the alternatives. Stabilized sites (the expanded Canonsburg site under Alternatives 2 and 3, the Burrell site under Alternatives 3 and 5, and the Hanover site under Alternatives 4 and 5) would be permanently committed as disposal sites and would not be available for future commercial or residential development. All alternatives would create offsite land-use impacts at the expanded Canonsburg site. Under Alternatives 2 and 3, seven houses adjacent to the Canon Industrial Park and their access roads (Ward Street, Wilson Avenue, and George Street) would be permanently closed. Under Alternatives 4 and 5 these houses and their access roads would be closed for two or three years.

None of the alternatives would cause large-scale population changes. At the expanded Canonsburg site, there would be a permanent relocation of the persons occupying the seven houses on Wilson Avenue and George Street under Alternatives 2 and 3, and a temporary relocation of these people under Alternatives 4 and 5. Each of the remedial-action alternatives would create an influx of workers during project activities. Because most of these workers would be from the greater Pittsburgh area and would have periods of employment less than the entire project duration, this short-term population shift would not have a serious effect on local housing or community services in the site areas. Also, the slight difference in staffing requirements between the alternatives would not be enough to create significant differences in housing or community services impacts.

Each of the alternatives would have a small economic impact in the project areas. Over the short term, there would be an inflow of some project funds at each site area. Material and supply purchases would be the major imput of funds into the local economies. Only a small portion of wage monies would enter the local economies because of the workers' nonpermanent status. Closing the Canon Industrial Park (Alternatives 2 through 5), and closing the former Georges Pottery property and the seven houses at the Canonsburg site (temporarily during Alternatives 4 and 5, and permanently during Alternatives 2 and 3) would eliminate the tax revenues collected from these land uses.

3.2.2 Mitigating measures

Each remedial-action alternative (2 through 5) would include the same types of mitigation controls to prevent or lessen potential environmental impacts during project implementation.

Radiation releases and human exposure would be controlled by a combination of physical and management techniques to reduce wind and water erosion and to minimize direct human contact with the radioactively contaminated materials.

Radioactively contaminated materials would be covered each evening with tarps or sprinkled with water, if needed. Under high-wind conditions no radioactively contaminated materials would be handled. The offsite transport of dust would be controlled by washing trucks when necessary and by containing their loads with tight-fitting covers and tailgates. Other controls such as spraying unimproved roads with water or surfactants could also be used.

Water erosion of radioactively contaminated materials would be controlled by installing erosion-control berms at each site around all areas where radioactively contaminated materials would be exposed. There would also be a berm built along Chartiers Creek at the expanded Canonsburg site for all remedial-action alternatives. This structure would keep water from flowing into the radioactively contaminated areas, and would collect all precipitation that falls onto these areas. All collected water would be routed to the onsite waste-water treatment plant where it would be treated to NPDES standards (40 CFR 124) before being disposed of in Chartiers Creek. In addition to precipitation and runoff, the waste-water-treatment plant would treat process waste water, and ground water pumped during dewatering.

Direct human contact with radioactively contaminated materials would be minimized by restricting access to the project sites. Protective equipment would be provided to the remedial-action workers, as needed. At the expanded Canonsburg site those persons living in the seven residences on Wilson Avenue and George Street would be either temporarily (Alternatives 4 and 5) or permanently (Alternatives 2 and 3) relocated.

Nonradiological air-quality impacts would be reduced by the use of exhaust controls on equipment and vehicles, and by dust control in work areas. Fugitive dust would be controlled by the same measures used to prevent wind erosion of the radioactive dust, i.e., spraying unimproved roads and covering stockpiled materials.

The noise generated by equipment and vehicles would be reduced by the use of mufflers. In addition, noise levels experienced off the site would be made less annoying by scheduling project activities for daylight hours only.

Mitigation of transportation-related impacts would rely largely on route selection and scheduling. Traffic routes would be selected and hauling activities scheduled to avoid the most sensitive areas and times, i.e., school zones during school hours. Road repairs and maintenance would be evaluated during all transportation actions. Alternative routes, crosswalks, etc. will be considered in the remedial action plan.

Following project completion, a monitoring and maintenance program would be conducted for the final stabilized disposal site as required under the terms of the license issued by the NRC. This program would include measures for protecting structure integrity, such as restricting tree growth over the stabilized area and establishing a complete site security system.

3.2.3 Summary of impacts

Three major issues have been identified in the impact analysis. These pertain to radiation, transportation, and costs.

Alternatives 2 through 5 would all meet the EPA standards (40 CFR 192) for cleanup of inactive uranium-mill-tailings sites and disposal of uranium-mill tailings. Alternative 1 does not, and is therefore unacceptable. All of the remedial-action alternatives (2 through 5) would reduce the residual radiation-population doses from the radioactively contaminated materials nearly to background levels. However, there would be minor differences in levels of population exposure during the remedial action, as well as differences in the number of persons who would be affected; i.e., people near the Canonsburg and Burrell sites would be affected under all of the alternatives, while Alternatives 4 and 5 would also involve people near the Hanover site.

Based on the considerations detailed in Appendix I, the DOE is proposing the use of trucks rather than rail transportation to bring in fill dirt and to move out radioactively contaminated materials for each site under all remedial-action alternatives. The DOE has determined that rail transportation is not a reasonable alternative. Fill dirt would be needed at the Canonsburg and Burrell sites in all of the remedial-action alternatives, and at the Hanover site under Alternatives 4 and 5. No radioactively contaminated materials would be moved from the Canonsburg site under Alternatives 2 and 3, or from the Burrell site under Alternatives 3 and 5. Radioactively contaminated materials would be taken to the Hanover site under Alternatives 4 and 5. The material transport required for each alternative would involve not only the use of large trucks on minor roads, but also public concern about radiation exposure.

Since each alternative would require some degree of truck transport of material, differences among the transportation-related impacts of each alternative would be in the number of trucks used, the number of sites involved, and the roads used. Alternative 3 would require the least amount of truck traffic because there would be no offsite movement of radioactively contaminated materials and only two sites would be involved. Alternative 4 would entail greater transportation impacts because it would involve three sites, and would require the transport of radioactively contaminated materials from both the Canonsburg and Burrell sites to the Hanover site.

The costs that would be associated with the alternatives are summarized in subsection 5.13.2. They range over a factor of three, in the following order: Alternative 3 ($13.4 million), Alternative 2 ($21.7 million), Alternative 5 ($31.5 million), and Alternative 4 ($39.0 million).

REFERENCES FOR CHAPTER 3

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4 Affected Environment

4.1 A BRIEF DESCRIPTION OF THE REGION AND THE AFFECTED AREA

4.1.1 Regional characteristics

The Canonsburg, Burrell, and Hanover sites are located within 70 miles of each other in southwestern Pennsylvania (see Figure 1-1). They are situated south, east, and west, respectively, of the city of Pittsburgh, which is the major industrial and population center of the region. Secondary economic centers include the city of Johnstown to the east and the cities of Steubenville, Ohio, and Weirton, West Virginia to the west.

Economic growth and development in southwestern Pennsylvania is heavily influenced by its geologic features. This region lies within the Appalachian Mountain system and contains rich coal seams and numerous natural gas and oil deposits, which represent the major natural resources of the region. Washington County, which includes the Canonsburg and Hanover sites, and Indiana County, which includes the Burrell site, are the leading coal-producing counties in Pennsylvania, ranking first and second, respectively.

These geologic resources are also responsible for shaping the industrial character of this area. Electricity-generating facilities are primarily coal-fired. Industrial activities are dominated by steel and primary-metals production, while the major manufacturing activities are centered around machinery production, including mining equipment, glass products, and electrical equipment.

The major renewable resource in southwestern Pennsylvania is forest land. In several counties, forests account for the greatest land use, making this area a leading producer of forest products. In addition, the forests in southwestern Pennsylvania support a significant wildlife population, making hunting an important secondary use of this resource. Agricultural production is the second largest land use in this region. Much of the farmland is dedicated to dairy and livestock production because the rugged topography often limits field-crop production.

The overall pattern of land-use development in southwestern Pennsylvania is one of distinct communities set in a region dominated by rural areas and open space. Coal mines and oil and gas fields occur throughout the region, while manufacturing activities generally occur in association with the larger communities.

Southwestern Pennsylvania is connected to the greater regional area by a well-developed transportation network. The Greater Pittsburgh International Airport, the Ohio River, and various rail lines and interstate highways, such as I-79 running north and south and I-70 running east and west, provide interstate service. Population and industrial centers within the region are interconnected by numerous highways and rail lines. The layout of the local highway system is typically influenced by the topography. Local roads are often narrow with steep slopes, abrupt curves, and poor surfaces.

The region contains an extensive surface-water network that eventually drains into the Ohio River system. The most notable surface-water feature of this area is the confluence of the Allegheny and Monongahela Rivers forming the Ohio River in Pittsburgh. The headwaters of the area's streams generally have good water quality and support healthy fisheries. However, much of the downstream water quality is adversely affected by acid drainage from mining activities. As a result, many streams are characterized by a low pH and are high in iron, sulfates, and total dissolved solids.

The air quality in the area of southwestern Pennsylvania near the Canonsburg, Burrell, and Hanover sites is classified as attainment for the National Ambient Air Quality Standards (NAAQS) (40 CFR 50) for all criteria pollutants except photochemical oxidants. (The entire Commonwealth is classified as nonattainment for ozone.) However, the potential exists for temporary poor air-quality conditions in localized areas. The rugged terrain tends to decrease wind speeds, which increases the potential for a buildup of high concentrations of airborne pollutants. Manufacturing activity is mainly concentrated in valley areas such as the Ohio, Allegheny, and Monongahela River valleys and, in conjunction with coal-mining operations and coal-fired power plants, is often responsible for generating significant air impacts. During temperature inversions, when air masses remain in a confined area, contaminants can reach unhealthy levels.

4.1.2 Canonsburg site

The Canonsburg site is located within the Borough of Canonsburg, Washington County, in southwestern Pennsylvania. It lies approximately 20 miles southwest of downtown Pittsburgh (Figure 1-1). The former Vitro Rare Metals Plant property (18.5 acres), now the Canon Industrial Park, is the area designated by the UMTRCA as containing the residual radioactive materials and is the area implied in this FEIS when discussing the Canonsburg site. The Canonsburg site property is divided by Strabane Avenue and Ward Street into three separate areas: A, B, and C (Figure 1-2). Area A covers 11 acres and is bounded by Ward Street, Strabane Avenue, George Street, and the former W. S. Georges Pottery Company. All of the buildings of the Canon Industrial Park are situated in Area A. Area B covers approximately 4.5 acres and is vacant. It is bounded by Chartiers Creek, Strabane Avenue, Ward Street, and the no-longer-operating Washington-Canonsburg Street Railway right-of-way. Area C covers 3 acres and is also vacant. It is bounded by Chartiers Creek, Strabane Avenue, and the ConRail right-of-way. The expanded Canonsburg site includes two other areas adjacent to the Canonsburg site that are needed to complete two of the remedial-action alternatives (Alternatives 2 and 3) involving onsite stabilization; these areas are the former Georges Pottery property (6.1 acres), and the seven residences situated on Wilson Avenue and George Street

(5.4 acres). The expanded Canonsburg site is an approximate 30-acre area bounded by Chartiers Creek to the north, west, and east, and by the ConRail right-of-way to the south (Figure 1-3). The expanded Canonsburg site is located in an urban area. There are residences across the ConRail tracks to the south as close as 250 feet to the expanded Canonsburg site.

The Canonsburg site was owned by the Canon Development Company which had operated it as the Canon Industrial Park from 1966 to 1982, but it has been acquired by the Commonwealth in accordance with the provisions of the DOE-Pennsylvania cooperative agreement, entered into under PL 95-604, Section 104. As of April 1983 there were two firms, employing a maximum of 11 persons, located on the Canonsburg site (Yusko, 1983). These two firms will vacate the premises prior to October 1, 1983.

4.1.3 Burrell site

The Burrell site is located in Burrell Township along the southern border of Indiana County (Figure 1-1). It lies approximately 40 miles east of Pittsburgh, and 1 mile east of the Town of Blairsville. It is situated about 50 miles in a straight line northeast of the Canonsburg site. The Burrell site lies within a bend of the Conemaugh River along its northern bank (Figure 1-4). The ConRail main line passes along the northern boundary of the Burrell site (Figure 1-5). The Burrell site consists of 49 acres, which is a portion of a larger tract presently owned by the James Burrows Company. There are no structures on the property, and except for the ConRail right-of-way along the northern boundary, there are no public thoroughfares. The most outstanding surface features of the Burrell site are two steep-banked ponds (three at low water) located within the western sector. These correspond to ponds B, C, and D on Figure 1-5. (Pond A, located north of the railline, is included on the figure only for completeness; it is not contained on the Burrell site.) The general area of the Burrell site is sparsely developed; the nearest residence is 500 feet away.

4.1.4 Hanover site

The Hanover site is located in southwestern Pennsylvania in Hanover Township, Washington County (Figure 1-1). It is approximately 25 miles from downtown Pittsburgh and 16 miles from the Canonsburg site. The nearest community is Burgettstown, which lies 3 miles to the east of the Hanover site. Steubenville, Ohio and Weirton, West Virginia are 10 and 6 miles to the west of the Hanover site, respectively. The area considered for the Hanover site in Hanover Township covers about 50 acres of a much larger parcel of land owned by Starvaggi Industries (Figure 1-8). The Hanover site consists of a long trench that was formed as a result of strip-mining activities (Figure 1-9). There are no structures on the Hanover site, and the only access is by unimproved gravel-access roads along its eastern and western boundaries. The

Hanover site is surrounded by a large amount of uninhabited land. There are only a few residences within the general area; and the nearest home is over 2000 feet away from the Hanover site.

4.2 DESCRIPTION OF THE CANONSBURG AND BURRELL SITE RESIDUES

4.2.1 Canonsburg site

In the early 1900's, the Standard Chemical Company initiated the development of a method to extract and concentrate radium from carnotite ore. The company established its radium-processing facilities at Canonsburg, Pennsylvania, and produced the first salable quantities of radium in 1913 (Standard Chemical Co., 1919). The company ceased processing operations in the early 1920's (probably around 1922), but continued to act as a marketing agent for some foreign radium producers.

Vitro purchased the Canonsburg facility in 1933 and utilized it for the extraction of uranium, vanadium, and radium from various residues, ores, and concentrates. From 1942 until the facility's closing in 1957, Vitro and its successor, the Vitro Corporation of America, owned and operated the plant on the Canonsburg site. The operations were directed toward the production of uranium concentrates. The only customer from 1942 to 1957 was the United States Government. The uranium, and other rare metals, was extracted from both onsite (contractor-owned) residues and ores and government-owned ores, concentrates, and scrap. During this time various ores, concentrates, and scrap materials were brought from different Atomic Energy Commission (AEC) installations to the Canonsburg site for uranium recovery. The end products of these processes were delivered to the AEC in accordance with terms of government procurement contracts. All solid process wastes were stored temporarily on the Canonsburg site. The liquid wastes were discharged through a drainage system beneath Strabane Avenue into the former swamp in Area C that discharged through a drainage ditch into Chartiers Creek. This swamp has since been filled in.

On November 1, 1953, the government and Vitro entered into a contract (AT-(30-1)-1683) that required Vitro to process certain government-owned materials. The contract required that Vitro store the residual radioactive materials from this operation at the Canonsburg site until November 1, 1955 because the AEC believed the residual radioactive materials might contain recoverable uranium. After attempts by Vitro to recycle the residual radioactive materials and attempts by the AEC to identify commercial interest in the residual radioactive materials, it was determined that the uranium in the residual radioactive materials was "unrecoverable" and the AEC authorized an inventory write-off pursuant to provisions of AEC Manual Chapter 7401-12. The AEC's Oak Ridge Operations Office approved the transfer of 11,600 tons of wet radioactively contaminated materials from the Canonsburg site to the Burrell site. The radioactively contaminated materials, containing approximately 6 tons of uranium oxide, were transported to the Burrell site from late 1956 to early 1957 (Leggett et al., 1979a).

The Burrell site is situated about 50 miles northeast of the Canonsburg site in Burrell Township, Indiana County, Pennsylvania (Figure 1-1). At the time of the 1956-1957 disposal, it was owned and operated by the Pennsylvania Railroad as a railroad landfill. Currently, it is owned by the George Burrows Company. The Burrell site covers approximately 49 acres; it is currently an undeveloped plateau along a bend of the Conemaugh River at the southern boundary of Indiana County (Figure 1-4). Its only significant surface features are three steep-banked ponds in the western area that are remnants of an old railroad disposal pit (Figure 1-5). Disposal of the 11,600 tons of radioactively contaminated materials removed from the Canonsburg site took place within an approximately 9-acre section in the western portion of the Burrell site. The radioactively contaminated materials were brought in by railcar, dumped into the disposal pit, and covered with an uneven layer of uncontaminated material.

Recovery operations at Vitro's Canonsburg plant ceased by 1957. The contractor's remaining residues and processing wastes were stored on the Canonsburg site by Vitro. Vitro's final source-material license expired, and in May 1961 Vitro applied to the AEC for another source-material license. On June 21, 1961, the AEC granted Vitro a license, for storage only, of a maximum of 23 tons of uranium contained in 4458 tons of material.

In 1962 Vitro's real property was sold to developers, with Vitro retaining title to the radioactively contaminated materials remaining on the Canonsburg site. In an effort to decontaminate the immediate plant area, in 1964 all of the materials then considered radioactively contaminated were consolidated into one pile in Area A. In 1965, Vitro obtained a permit from the Commonwealth to move this pile to Area C. At Area C it was buried beneath a relatively impermeable layer of steel-mill slag (red dog), and covered by clean fill material. Vitro's source-material license was then terminated, and the Canonsburg site was developed into its present use as the Canon Industrial Park in 1966.

In 1978, the UMTRCA was enacted into law. On November 8, 1979 the Canonsburg site was designated by the DOE as a processing site eligible for remedial action under the UMTRCA. Effective September 5, 1980, the DOE and the Commonwealth entered into a cooperative agreement under UMTRCA, setting forth the terms and conditions for the DOE and the Commonwealth cooperative remedial-action effort, including 90 percent (DOE), 10 percent (Commonwealth) cost-sharing, the Commonwealth's real estate acquisition responsibilities, the Commonwealth's responsibility for nominating potential disposal sites, and provision for the DOE's development of a remedial-action plan after publication of the Canonsburg FEIS. (The remedial-action plan will be concurred on by the Commonwealth and the NRC.)

Radiological surveys were made of the Canonsburg site in 1977 under the Atomic Energy Commission's 1974 "Formerly Utilized MED/AEC Sites Remedial Action Program" (Leggett et al., 1979b). It was determined that significant amounts of radioactively contaminated materials remained on the Canonsburg site and that the radiation levels measured in the buildings, soils, and ground water in certain areas exceeded existing standards, proposed standards, or guidelines.

The Canonsburg site exhibits a widely distributed, heterogeneous pattern of radioactive contamination in each of its three areas: A, B, and C. The radioactively contaminated materials consist of unprocessed ores, contaminated soils, waste sludges and fines, and building materials. These radioactively contaminated materials are distributed from the surface to a depth of 16 feet. Decontamination of the Canonsburg site to a radium-226 concentration of 15 picocuries per gram would require removing approximately 250,000 cubic yards of radioactively contaminated materials.

Surveys of Area A indicate that radioactively contaminated materials are present in soil beneath, and adjacent to, many of the buildings as well as in the top few feet of soil over much of the area. Virtually all of the surface soil samples taken in this area indicate radium-226 concentrations above EPA standards (40 CFR 192). Radon-222 and radon-daughter concentrations measured in the buildings in Area A exceed EPA standards (40 CFR 192) and NRC standards (10 CFR 20). Airborne concentrations of thorium-230 measured in air of two of the buildings exceed NRC standards (10 CFR 20). Alpha-contamination levels, beta-gamma dose rates, and external gamma-radiation levels in some areas of the buildings and outdoors in Area A are above NRC surface-contamination guidelines (U.S. NRC, 1976) or NRC standards (10 CFR 20), as applicable. The ground water in Area A contains concentrations of radium-226 above NRC standards (10 CFR 20). Subsurface contamination in this area occurs within 8 feet of the surface, mostly at depths of 0 to 4 feet.

Surveys of Area B indicate that contamination on the surface is above NRC standards (10 CFR 20), but at lower levels than found in Area A. Radioactive contamination is concentrated in the northeastern and southeastern portions of the area. Beta-gamma dose rates, external gamma radiation levels, radium-226 in ground water, and radium-226 in soil are, in some samples or measurements, above the applicable NRC standards (10 CFR 20), and EPA standards (40 CFR 192), respectively. The 2- to 6-foot layer of contaminated soil on this area appears to be under approximately 8 to 9 feet of clean fill, which has held surface radiation levels in this area below those of Area A.

Area C, a former lagoon area, was used as a depository for liquid wastes during uranium- and radium-recovery operations, as well as for disposal of solid wastes during the transfer of the stockpiled radioactively contaminated materials from Area A to Area C in 1965. The subsurface contamination in Area C contains radionuclides in higher concentrations at greater depths than in Areas A and B. A mucky radioactively contaminated material remains beneath the surface, with elevated concentrations of uranium-238 and radium-226. Radium-226 concentrations in soil and ground water exceed EPA standards (40 CFR 192) and NRC standards (10 CFR 20), respectively. Beta-gamma dose rates and potential doses from external gamma radiation levels measured over a large portion of this area exceed NRC standards (10 CFR 20). Surveys indicate that Area C is contaminated to a depth of approximately 16 feet.

4.2.2 Burrell site

The Burrell site was never operated under an AEC license. The radiological contamination at the Burrell site is the result of a one-time disposal operation. From October 1956 through January 1957, Vitro, with the approval of the AEC and the Pennsylvania Railroad, disposed of approximately 11,600 wet tons of radioactively contaminated materials from its Canonsburg facility at the Burrell site. The radioactively contaminated materials reportedly contained carbonate cake, pitchblende, calcium fluoride, and magnesium fluoride (Leggett et al., 1979a).

These radioactively contaminated materials were further described as containing an average of 0.097 percent uranium oxide by weight (or about 6 tons of uranium oxide), which corresponds to approximately 1.5 curies of uranium-238. The Canonsburg site's radioactively contaminated materials were transported by rail to the Burrell site and stockpiled in a relatively small section between a railroad spur and the railroad disposal area in the western portion of the Burrell site. From there they were pushed by bulldozer into the railroad disposal area. This type of disposal did not allow the radioactively contaminated materials to mix uniformly with uncontaminated material and resulted in virtually all of the radioactively contaminated materials being located in a small section of the railroad disposal area. The radioactively contaminated materials were covered with an uneven layer of uncontaminated material.

The radioactively contaminated materials are located between the ConRail tracks and the ponds in the western portion of the Burrell site (Leggett et al., 1979a). Field surveys by Oak Ridge National Laboratory (ORNL) (Leggett et al., 1979a) indicated that more than 75 percent of the radioactively contaminated materials were located between 10 and 36 feet below the surface. It was estimated that the total radium-226 and uranium-238 activity in the radioactively contaminated materials were 4 curies and 1.3 curies, respectively. This included the Vitro residual radioactive materials and any other materials that had become radioactively contaminated.

In late 1981, WESTON drilled additional wells at the Burrell site to assess its water quality and stratigraphy, and to obtain additonal radiological information. This data (U.S. DOE, 1982c) indicated that the concentrations of the more deeply buried radioactively-contaminated material had been reduced since 1977. As a confirmation of these results, Bendix Field Engineering Corporation drilled more wells and performed additional well drilling and data collection in early 1982. The results of the Bendix survey (U.S. DOE, 1982c) agreed with the WESTON data and are considered to be the conditions that currently exist on the Burrell site. The results of these surveys are discussed in more detail in subsection 4.8.2. Based on these more recent and more extensive data it is believed that only one-third to one-tenth of the radiological activity originally placed on the Burrell site in 1956-1957 remains there, and that most of this radiological activity occurs at depths of less than 12 feet. Therefore, the Burrell site currently meets the EPA standards (40 CFR 192), except in a few small areas. This, in turn, could imply that a much smaller remedial-action plan is necessary than originally envisioned (viz, acquiring the Burrell site, covering the radioactively contaminated portion of the Burrell site with a minimum soil cover, and designating that portion as a disposal site as described in Appendix A.2). The Burrell site is currently classified as a vicinity property, but the DOE is proposing to redesignate the Burrell site as a disposal site. The Burrell site's use is currently restricted by the U.S. Army Corps of Engineers flood-control easement for the Conemaugh Dam.

4.3 WEATHER

Weather data for the Canonsburg site were collected from a meteorological monitoring station operated at the Canonsburg site (Figure 1-2) (Appendix B.1), which measured wind speed, wind direction, and temperature from 1979 through 1981. An identical system was installed at the Burrell site; however, within a month it was vandalized. Based on the one month's worth of simultaneous monitoring (Appendix B.1), wind estimates for the Burrell site for 1979 through 1981 were derived by altering the Canonsburg site's values to reflect the Burrell site's topographic conditions. This was done by making a 30-degree clockwise shift in the recorded Canonsburg site wind directions. Average temperature and precipitation information for the Burrell site were obtained from the Indiana Airport, approximately 15 miles to the north.

The Hanover site meteorological data were obtained from measurements made at the Pittsburgh International Airport for the 1979 through 1981 period. The airport is located 13 miles east of the Hanover site and has a similar topographic setting. Although meteorological data for the Pittsburgh Airport are available for a longer time period, these two years were used to be consistent with the information available for the Canonsburg and Burrell sites. All meteorological data are presented as hourly averages.

4.3.1 Weather patterns

The Canonsburg, Burrell, and Hanover sites are located in the humid continental climatic region. This region experiences distinct seasons with seasonal variations slightly moderated by the nearness of the Great Lakes and the Atlantic seaboard.

The regional climate is dominated by a succession of low- and high-pressure centers and fronts that migrate through the area during the year. The constant movement of these weather systems from west to east and the sites' proximity to moisture sources (i.e., the Great Lakes) provide a generally uniform distribution of precipitation and winds in the areas of relatively flat, open terrain.

The summer season is generally mild but frequently humid because of invasions of tropical air from the Gulf of Mexico. The winter months are brisk with occasional periods of extreme cold. Cloud cover is persistent during the winter because of the frequent passage of moisture-laden air masses from the Great Lakes and the region's location in the path of west-to-east migratory storms. Spring and fall are transitional seasons with moderate-to-cool temperatures. Rapid and wide variations in day-to-day weather conditions are common during the spring and fall.

4.3.2 Temperature

Temperatures for this region from 1979 through 1981 ranged from 99°F in the summer to -18°F in the winter (Table B.1-2). July and August are typically the warmest months of the year, while December, January, and February are the coldest. During the winter it is not uncommon for subfreezing temperatures to persist for 1 to 2 weeks.

The average annual temperature in the region is approximately 50°F as reported for all three sites. Average winter temperatures range between 28°F at the Canonsburg site to 32°F at the Hanover site, while summer temperatures average between 68°F at the Burrell site to 73°F at the Hanover site.

4.3.3 Precipitation and floods

Precipitation in this climatic region primarily results from cyclonic storms in winter, spring, and fall; from thunderstorms in the summer; and infrequently, from remnants of hurricanes and tropical storms in late summer and fall. The annual precipitation in this area is fairly evenly distributed throughout the year.

Precipitation in the Canonsburg-Hanover sites' vicinity averages 37.0 inches per year. March and June are the wettest months, averaging 3.8 inches each, while February and November are the driest, averaging 2.4 inches each. The average annual snowfall in the Canonsburg-Hanover sites area is 45.3 inches, and has varied from 16.6 inches to 82.0 inches. The snow season typically occurs from October to May with the heaviest fall in January.

The average annual precipitation in the Burrell site vicinity is 44.4 inches. The highest monthly precipitation occurs in June and July, and the lowest occurs in December. The snowfall values for the Canonsburg-Hanover sites vicinity are also representative of the Burrell site.

The Canonsburg and Hanover sites precipitation events are based on data from the Pittsburgh International Airport for the period from 1941 to 1980. Precipitation information for the Burrell site is from the Indiana Airport for the period 1960 to 1972. No data are available on extreme events for the Burrell site; however, information for extreme events from Pittsburgh are representative because these events generally occur as a result of large-scale systems affecting the entire three-site area.

Although thunderstorms are common in the vicinity of the Canonsburg, Burrell, and Hanover sites during the spring and summer months, hurricanes or low-pressure-tropical systems rarely affect the region. Approximately 36 thunderstorms occur annually, most frequently in summer (June, July, and August). Tornados are rare, but can occur during the summer.

Since 1931 an average of only two hurricanes reach the United States coast each year. Significantly fewer storms will actually affect the study area. Based on data collected since 1953 only 1.2 tornadoes occur in Pennsylvania each year. Only 8 tornadoes were reported in the three-site area between 1916 and 1950, which translates into an average of 0.25 tornadoes per year.

A portion of the Canonsburg site is located in the flood plain of Chartiers Creek (Figure D.1-1), which has a history of flooding. The most significant flooding occurred in 1912. Other major floods occurred in August 1956, April 1961, March 1963, and February 1966 (FEMA, 1979).

Although the Burrell site is within the maximum flood pool of the Conemaugh River (Figure D.1-3), the potential for flooding at the Burrell site is believed to be minimal since even Hurricane Agnes in 1972, considered to be a 1000-year storm, did not create a flood pool high enough to inundate the site. During that storm the onsite ponds did not completely fill.

The Hanover site is located on a plateau and therefore is not subject to flooding.

Preliminary conversations have been held with the U.S. Army Corps of Engineers (COE), which has jurisdiction over Federal projects in flood plains and wetlands, pursuant to Executive Orders 11988 and 11990. The COE has indicated that probably no permit will be required to do the work needed at the Canonsburg site under any of the proposed alternatives. The Burrell site is subject to a perpetual easement for flood control, and the terms of that easement will have to be modified to be consistent with whatever remedial action is carried out there. The flood-plain assessment required under the DOE regulations (10 CFR 1022) is integrated into this Canonsburg FEIS and summarized in Appendix J. The DOE will issue the required flood-plain findings when a remedial-action alternative is chosen in the Record of Decision.

4.3.4 Winds

The Canonsburg site is situated in the east-to-west-oriented Chartiers Creek valley, which channels wind flows. As a result, the predominant wind direction (occurring over 50 percent of the time) is from the west-to-northwest sector (Figure B.1-1). Cross-valley flows (north and south) are limited to periods of relatively high wind speeds. These typically occur in the winter as northerly winds. The average annual wind speed as measured from 1979 to 1980 at the Canonsburg site was 4.7 miles per hour. Over 90 percent of the recorded one-hour average wind speeds were less than 11.2 miles per hour, and none exceeded 22.4 miles per hour. Calm periods (wind speeds less than 0.7 miles per hour) occurred less than 2 percent of the time.

The Canonsburg site is strongly affected by the topography of the surrounding area. The relatively high hills south and north of the Canonsburg site tend to shield the area from high-speed winds in these quadrants. The elevated terrain induces a drag on the wind causing a decrease in speed and a corresponding change in direction. The lower wind-speed conditions, which are generally associated with either very stable or very unstable conditions, reduce the potential for significant transport of pollutants from the site and increase the potential for relatively high localized-pollutant concentrations. The low wind-speed conditions, in conjunction with the high frequency of up-valley winds, further enhance the potential for high localized pollutant concentrations.

The predominant wind direction at the Burrell site is from the west and northwest sectors (Figure B.1-2). The wind distribution reflects the strong topographic influence on local wind conditions. The wind-speed distribution at the Burrell site is very similar to that at the Canonsburg site.

The Burrell site is also strongly influenced by local topography. High hills to the north and east of the Burrell site tend to shield this area from the winds in these quadrants. Similar reductions in speed and corresponding changes in direction will occur at the Burrell site because of the effects of the hills. The reduction in wind speed will reduce the potential for transport of pollutants off the Burrell site, but will increase the potential for locally high pollutant concentrations. Stability, dispersion, and mixing are likely to be similar at the Burrell and Canonsburg sites.

The wind distribution at the Hanover site is generally uniform, indicating that winds here are not strongly influenced by the topography (Figure B.1-3). Although the predominant wind direction is westerly, a southerly flow is common during the warmer months. The average-annual-recorded one-hour average wind speed at Hanover is 9.4 miles per hour, with more than 80 percent less than 11.2 miles per hour. Calm periods exist only 9 percent of the time, while wind speeds greater than 22.4 miles per hour occur less than 2 percent of the time.

The strong similarity between the two-year (1979 to 1981) average wind-direction data and the ten-year (1967 to 1976) average wind-flow data for the Hanover site suggest that the two-year data used at the Canonsburg and Burrell sites are also representative of longer-term wind conditions.

The Hanover site is located on a plateau that is at least as high as the surrounding hills, making it unlikely that winds would be affected by the terrain. The potential for offsite transport and dispersion of pollutants at Hanover is greater than for the Canonsburg and Burrell sites, resulting in a lower potential for a local buildup of pollutants.

4.4 AIR QUALITY

The Canonsburg, Burrell, and Hanover sites are all located in the southwest Pennsylvania Interstate Air Quality Control Region (AQCR). None of the sites are located in a Pennsylvania Department of Environmental Resources (PA DER)-designated air basin. Air-quality standards adopted by the PA DER include the EPA National Ambient Air Quality Standards (NAAQS) (40 CFR 50) and Pennsylvania standards (Table B.2-1). These standards cover the following pollutants:

1. National Ambient Air Quality Standards (40 CFR 50).
    a. Carbon monoxide (CO).
    b. Hydrocarbons (HC) (Although the EPA has revoked the primary and secondary NAAQS (40 CFR 50) for hydrocarbons (48 FR 628-629, January 5, 1983), the revoked standard is still included for completeness.)
    c. Nitrogen dioxide (NO_2).
    d. Ozone (O_3).
    e. Total suspended particulates (TSP).
    f. Sulfur dioxide (SO_2).
    g. Lead (Pb).

2. Pennsylvania standards (25 PA Code 131).
    a. Settleable particulates.
    b. Beryllium.
    c. Sulfates.
    d. Fluorides.
    e. Hydrogen sulfides.

The part of the southwest Pennsylvania Interstate AQCR containing the three sites is classified as attainment for all criteria pollutants except photochemical oxidants (ozone). The entire state of Pennsylvania has been designated as nonattainment for ozone. Based on measurements at Johnstown, Pennsylvania and for the Lower Beaver Valley Air Basin, the average annual ozone concentration is approximately 0.020 parts per million. However, during the summer months the area probably experiences excursions greater than the 0.12 parts per million ozone limit allowed under the EPA NAAQS (40 CFR 50). The only air-quality data that are collected in this area that are representative of conditions at the Canonsburg, Burrell, and Hanover sites are total suspended particulates and sulfur dioxide (Osmon, 1982). Total suspended particulates are routinely measured in the city of Washington, in central Washington County, approximately 8 miles southwest of Canonsburg. Sulfur dioxide is measured in the City of Florence, in northern Washington County at the intersection of Routes 22 and 18, about 18 miles northeast of Canonsburg. The monitors at Washington and Florence are the only ones near the sites that are not significantly impacted by nearby sources. The Pennsylvania DER confirmed that these two measurement locations are the most representative for the Canonsburg-Burrell-Hanover sites area (Osmon, 1982).

The total suspended-particulate data collected in 1981 indicate that the annual geometric-mean concentration was 67 micrograms per cubic meter, which is 89 percent of the EPA primary NAAQS (40 CFR 50), and 112 percent of the EPA secondary NAAQS (40 CFR 50). The maximum 24-hour concentration measured during 1981 was 194 micrograms per cubic meter, and the second highest value was 119 micrograms per cubic meter. The second highest value was 46 percent of the EPA primary NAAQS (40 CFR 50) and 79 percent of the EPA secondary NAAQS (40 CFR 50). It should be noted that for purposes of determining secondary attainment, the Pennsylvania DER uses the 24-hour total suspended-particulate values (25 PA Code 131). Hence, the area of the three sites is classified as both primary and secondary attainment for total suspended-particulates based on the monitoring data alone.

Sulfur-dioxide data collected in 1981 indicated a mean annual concentration of 47 micrograms per cubic meter (59 percent of the EPA primary NAAQS (40 CFR 50)). The maximum 3-hour concentration measured was 532 micrograms per cubic meter (41 percent of the EPA secondary NAAQS (40 CFR 50)), and the maximum 24-hour concentration was 170 micrograms per cubic meter (46 percent of the EPA primary NAAQS (40 CFR 50)).

4.5 SURFACE AND SUBSURFACE FEATURES

4.5.1 Topography and soils

4.5.1.1 Canonsburg site

The topography of the Canonsburg site, originally a low-lying flood plain, has been altered through filling and earth-moving activities (Figure C.1-1). The Canonsburg site's general slope is from the southwest corner of Area A toward Chartiers Creek, with a total relief of 30 feet. Area A, which contains buildings and a railroad spur, exhibits the greatest relief. Area B is a plateau that is elevated 7.5 feet above its perimeter; it was created through the disposal of dredged material from Chartiers Creek. Area C is the lowest portion of the Canonsburg site and is relatively flat. The former Georges Pottery property and the Wilson Avenue residences also exhibit minimal relief except where they drop off sharply to Chartiers Creek along the northern and western sides.

The natural soil structure of the Canonsburg site has been disturbed by site use. The soils range from sandy loams to silty clay loams (Tables C.1-1 and C.1-2). The soil materials exhibit a wide variation in characteristics (Tables C.1-3 and C.1-4). Coarser materials (sandy loams) are found in Area B as a result of the disposal of dredged materials. The finer materials represent the Canonsburg site's natural flood-plain soils. The soil pH ranges from a low of 2.8 in Area C where the steel-mill waste (red dog) was placed, to a high of 7.5 in association with the natural alluvium along Chartiers Creek.

The organic content of the soils ranges from 0.10 percent in the natural soil to 11.09 percent in the dredge fill. The cation-exchange capacity follows a similar trend of 9.4 milliequivalent per 100 grams in the natural soils to 31.7 milliequivalent per 100 grams in the dredged material (due to the high organic content).

Soil-infiltration rates (the rate at which water enters the soil surface), range from 5.5×10^{-6} to 3.9×10^{-3} inches per second (Table C.1-5). The slowest rates are found in the undisturbed soil profile in Area A, while the rate for the dredged material and flood-plain soils ranges from 7.0×10^{-4} to 3.9×10^{-3} inches per second.

Soil-percolation rates (the rate at which water moves through the soil in all directions) range from 1.7×10^{-4} to 1.6×10^{-3} inches per second in the natural soils and from 1.1×10^{-5} to 2.2×10^{-4} inches per second in the disturbed and dredged soils.

The laboratory permeability test results range from 3.58×10^{-8} to 3.98×10^{-8} inches per second (Table C.1-6). Detailed soil data are presented in Appendix C.1.

The total amount of soil currently lost via the erosional process from the expanded Canonsburg site annually is estimated at 84.2 tons, or 2.8 tons per acre (Table A.5-1).

4.5.1.2 Burrell site

The Burrell site is a plateau formed by landfilling. Its major topographic feature is an east-to-west trending valley about 40 feet deep that occupies approximately 25 percent of the Burrell site area (Figure C.1-2). This valley remains from the previous site-filling operations. The valley contains two ponds (three ponds at low water). The remainder of the Burrell site varies in elevation between 970 and 980 feet from the north to the south across a 1300-foot horizontal distance. There is a 50-foot drop from the edge of the plateau to the Conemaugh River.

Soils at the Burrell site have also been disturbed by excavating and landfilling operations. No original soils were encountered in the study area; instead, fill material was found to depths of 50 to 60 feet. The fill consists of gravelly loam and sandy loam mixed with ashes, cinders, gravel, railroad ties, bricks, boards, and sandstone fragments (Table C.1-7). There are numerous voids throughout the fill due to its random placement and settling. Soil percolation rates range from 6.7×10^{-4} to 2.8×10^{-3} inches per second. Soil infiltration rates range from 1.7×10^{-4} to 9.7×10^{-3} inches per second (Table C.1-8).

The fill material at the Burrell site, which includes railroad ties and bulky debris with very little natural soil, is not conducive to determining soil characteristics such as percent organic matter and cation-exchange capacity. This material could not be sampled or analyzed as soil. The site is presently fully covered with herbaceous and woody plants, and its soil-like material is well stabilized. The present annual soil loss from the entire Burrell site has been calculated as 64.5 tons, or 1.3 tons per acre (Table A.5-1).

4.5.1.3 Hanover site

The Hanover site is located on a ridge top in a broad trench that was formed during strip-mining (Figure C.1-3). The trench walls are composed of mine rubble and reach elevations of 1250 feet. The trench floor slopes gently from north to south, from elevations of 1180 to 1170 feet.

Soils at the Hanover site have been disturbed during strip-mining operations; therefore, at present they do not exist as a stratified unit. The soil material at the Hanover site is a composite of medium-textured loams, sandy loams, and silty loams. The soil is mixed with numerous sandstone, shale, and coal fragments ranging in size from small gravel to boulders over 2 feet in diameter (Table C.1-9). Soil percolation rates ranged from 5.5 x 10^{-5} to 1.2 x 10^{-3} inches per second (Table C.1-10). This range indicates that once precipitation enters the unsaturated fill, it moves through the material at a moderately rapid rate. Like the Burrell site, the Hanover site is composed of disturbed and fill material; therefore, it is extremely difficult to determine the soil characteristics. The steep slopes (7 to 8 percent) over most of the site and the shale-sandstone composition of the overburden contribute to soil loss. The annual amount of soil loss from the Hanover site has been determined to be 240.8 tons, or 4.8 tons per acre (Table A.5-1). However, because of the unevenness of the terrain, the runoff is detained during a rainfall, providing time for solids to settle out of solution. The total suspended solids in runoff recorded during a sampling program were low, averaging 1.1 x 10^{-4} pounds per gallon (Table D.1-12).

4.5.2 Geology

The structural pattern in Washington County is that of subparallel folds with northeast axis orientation. In the northwestern corner of the county there are several dome structures; the Candor Dome, the Westland Dome, and the Gillespie Dome.

4.5.2.1 Canonsburg site

The Canonsburg site is underlain by four types of material: soil, fill, alluvium, and bedrock. The onsite soils are discussed in subsection 4.5.1.1, which also includes descriptions of the fill and alluvium as they relate to soil development. Data were collected on the distribution and character of the onsite materials during drilling programs conducted from 1978 to 1983. Wells were drilled in Areas A, B, and C on the Canonsburg site, and on other areas both on and off the expanded Canonsburg site to provide an in-depth profile of the subsurface stratigraphy (Figure D.2-2 shows the well locations).

Cross-sections of the soils and bedrock underlying the Canonsburg site were prepared for three section lines across the area. Their locations are shown on Figure C.2-1. The cross sections (Figures C.2-1 and C.2-2) were composed using information from well logs and soil borings. Based on the well logs and cross-sections, a detailed description of the subsurface strata was made.

Fill covers the entire Canonsburg site, ranging in thickness from 9 feet to less than 1 foot. The most common component of the fill is cinders. In Area A, along Ward Street, halfway between the northern property line and George Street, there is a pocket of almost pure cinders roughly 9 feet thick, while over the remainder of the site, cinders are mixed with soil, stones, and building rubble.

Area B contains dredge material from Chartiers Creek. This material ranges in thickness from 4 feet to 20 feet, and is described as gray sandy fine-grained silt. The dredged material was deposited in the center of Area B and formed a flat-topped mound of higher elevation than the surrounding landscape. It is difficult to distinguish the bottom limit of the fill from the original materials. On the eastern margins of Area B and Area C, along Chartiers Creek, alluvial material that was deposited during flood stages of the creek is exposed. Portions of Area C had been a swamp, but these parts were filled with radioactively contaminated materials from site operations.

The predominant bedrock types encountered beneath the Canonsburg site were interbedded gray and black carbonaceous shales and sandy shales, along with several thin coal seams and limey shales. A marker bed of red shale was found beginning at a depth of 70 to 108 feet below ground surface (at approximately 375 feet above mean sea level). These features indicate that the bedrock underlying the Canonsburg site belongs to the Casselman Formation of the Pennsylvanian Age Conemaugh Group. This formation consists of cyclical sequences of red and gray shale and silt stones with thin limestones and coals (Pennsylvania DER, 1960). There is a 10- to 20-foot thick red-bed unit in the Casselman Formation about 100 feet above the base (Pennsylvania DER, 1960).

Shale near the bedrock surface is broken and weathered to thin brittle plates 0.3 to 0.5 inch in size. Exposure of the Conemaugh Formation at the surface is apparently the result of erosion by Chartiers Creek since these rocks are exposed only in the vicinity of the confluence of Chartiers Run, Plum Run, and Chartiers Creek. The rock type exposed at the surface in the surrounding area is the Monongahela Formation, which can be seen in road cuts in Canonsburg and Strabane. The Monongahela Formation overlies the Conemaugh Formation; it is described as cyclical sequences of sandstone, shale, limestone, and coal (Pennsylvania DER, 1960). The local significance of the formation is that its lowest member is Pittsburgh coal, which is mined extensively in the area. The Pittsburgh coal was never mined under the Canonsburg site; it was eroded away in past geologic time. Table 4-1 presents the generalized local stratigraphic sequence and the onsite sequence.

The Canonsburg site is located between the Washington anticline and the Nineveh syncline. Based on the contours of the Pittsburgh coal present in the immediate vicinity, there is a bedrock ridge along the axis of the Washington anticline that slopes east to a bedrock valley along the axis of the Nineveh syncline. The bedrock relief between the top of the anticline and the bottom of the syncline is approximately 400 feet. The Canonsburg site is located east of the axis of the Washington anticline. At the Canonsburg site, bedrock elevations for a particular marker bed would be approximately 72 feet below the maximum elevation for that marker bed along the anticlinal axis (Figure C.2-7)

Additional regional and local structural elements have been defined by satellite imagery on the basis of linear topography, drainage patterns, and tonal changes in vegetation (Briggs and Kohle, 1976). Most of the lineaments in the Canonsburg site area are based on topography and vegetation. As shown on Figure C.2-8, the lineaments cross the fold axis and therefore postdate the folding. The nature of these lineaments has not been identified.

Table 4-1. Stratigraphic sequence

Age	Formation or unit: Canonsburg vicinity[a]	Formation or unit: Canonsburg site	Description
Recent	--	"Red dog"	Steel-mill slag, found only in Area C near the surface.
		Fill	Cinders, building rubble, mixed soil, and cobbles. Occurs over the entire site.
		Fluvial material	Sandy silt dredged from Chartiers Creek and used for fill on Area B.
		Alluvium	Chartiers Creek flood-plain sediments found on the margins of Area B and Area C.
Quaternary, Holocene, Pleistocene	Alluvium	Alluvium	Regional thickness is 0 to 19 meters. Well to poorly sorted deposits of clay, sand, gravel, and cobbles. Some fill material on the site resembles this material.
Permian	Greene Formation	--	Regional thickness is 19 to 79 meters shale and shaley sandstone, a few thin limestone beds, and thin coal beds; red shale lenses.
Permian Pennsylvanian	Washington Formation	--	Regional thickness is 11 to 39 meters. Alternating layers of shale and fine-grained sandstone, thin-bedded limestone, and several coalbeds.
Pennsylvanian	Monongahela Formation	--	Regional thickness of 15 to 121 meters. Limestone beds of variable thickness, discontinuous sandstone, and coal.
	Conemaugh Formation	Conemaugh Formation	Regional thickness of 13 to 134 meters. Grey-green and red shale with discontinuous sandstone, limestone, and coal.

[a]Newport, 1973.

The results of the onsite-drilling programs show the relief in the bedrock surface at the Canonsburg site as 35 feet. The general trend of bedrock topography, as shown in the contours on Figure C.2-9, is toward the northeast and Chartiers Creek. The highest point of the bedrock surface is on the southwestern corner of Area A. The lowest point is in Area C. The bedrock depression in Area C (Figures C.2-1 and C.2-9) is apparently an erosional feature related to the migration of Chartiers Creek. There are no bedrock exposures on or near the Canonsburg site that are available to identify orientations of local geologic structures.

Fracturing was observed in bedrock core samples as a result of the analysis of recovery and rock quality values measured for the 300R and 500 series wells. Rock quality data (RQD_{50}) values ranged from 0 to over 90, indicating highly friable fractures in the upper 5 to 20 feet of bedrock beneath the Canonsburg site. Recovery and rock quality generally increased with increasing depth in each well. Fracture density was greatest near the surface (in the upper 5 to 20 feet of bedrock). At greater depths, the fractures are separated by larger vertical intervals, but are significant for ground-water transmissivities, as discussed in subsection 4.6.2.1.

The red shale marker bed in the Conemaugh Formation was used to determine strike and dip for the bedrock beneath the Canonsburg site. Based on the orientation of that bed, dip is less than 1 degree, and strike is northeast.

4.5.2.2 Burrell site

Subsurface conditions at the Burrell site are the result of former site uses (Figure C.2-3). The Burrell site is underlain by three separate materials: fill, unconsolidated sediments, and sedimentary rocks (Figure C.2-4). The fill material consists of railroad ties, ashes, rubble, coal, and scrap metal. The thickness of the fill varies; the maximum thickness is approximately 56 feet. Unconsolidated sediments underlie the fill and include both colluvium (or talus) and alluvium. The colluvium is composed of unweathered, broken rocks that vary widely in size. These rocks have been eroded from the steep bluff face north of the Burrell site. The maximum thickness of the colluvium at the Burrell site is approximately 20 feet near the bluff. The alluvium is fine- to coarse-grained silty sand deposited by the Conemaugh River; its maximum thickness on the site is approximately 11.5 feet. The bedrock at the Burrell site is composed of alternating layers of shale, limestone, sandstone, siltstone, coal, coal underclays, and claystone. These rocks belong to the Casselman Formation of Pennsylvanian age, a member of the Conemaugh Group of coal-bearing formations. The bedrock is well defined, with most units ranging from 1 foot to 5.7 feet thick. Structurally, the local bedrock lies in a gently-folded northeast-trending anticline.

4.5.2.3 Hanover site

The near-surface geology at the Hanover site has been disturbed by strip mining the Pittsburgh coal. Before mining operations were started, the area was overlain by shale and sandstone of the Monongahela Formation. When the Hanover site was strip mined beginning in 1917-1918, the shales and sandstones were removed to expose the underlying coal. After the coal was removed, the overburden was replaced as the Hanover site was reclaimed. The Hanover site is now underlain by mine rubble that is composed of shale and sandstone boulders, pebbles, and soil (Figure C.2-5). The fill material is 5 to 10 feet thick on the trench floor. On the upland portions of the Hanover site, mine rubble is approximately 85 to 98 feet thick. Below the mine rubble is an undisturbed underclay layer that was directly beneath the Pittsburgh coal. Where the underclay is present it is 5.7 feet thick. The clay was not encountered in all borings in the center of the valley floor (presumably portions of the clay were removed during strip-mining operations). The underclay is the lowest unit of the Monongahela Formation. Below the underclay is the Casselman Formation, the upper unit of the Conemaugh Group. At the Hanover site this unit is fractured shale with minor interbedded sandstone. It was common practice in the area to blast the bottoms of mine pits to increase drainage. It is possible that there was fracturing at the Hanover site caused by this type of blasting during the strip-mining operations; however, there are no records of this practice at the Hanover site.

4.5.3 <u>Mineral resources</u>

If significant mineral resources are found under a disposal site following remedial action, the Secretary of the Interior, with NRC concurrence, could sell or lease the subsurface mineral rights (as specified in PL 95-604, Section 104(h)). The DOE will acquire the mineral rights under the disposal site(s).

4.5.3.1 Canonsburg site

The primary mineral resources in Washington County are coal, oil, and gas. The most significant source of coal in the Canonsburg area is the Pittsburgh coal seam. Recent production rates in Washington County have been approximately 20 million tons per year. However, the U.S. Geological Survey (Cortis et al., 1975) has indicated that, as of 1971, most of the coal in the Canonsburg, Houston, and Strabane areas had been mined. Pittsburgh coal does not occur on the Canonsburg site. It was not mined from the Canonsburg site; instead, it has been eroded away in past geologic time.

Although oil-producing zones do occur in the Conemaugh Group that underlies the Canonsburg site, there are no available records that indicate that there is a potential producing zone beneath the Canonsburg site. In the oil field closest to the Canonsburg site, the shallowest producing zone is the Gordon sand, which is approximately 2510 feet below the surface. The Canonsburg site has not been included on any maps of oil or gas fields in Washington County.

4.5.3.2 Burrell site

The only mineable coal resources in the vicinity of the Burrell site occur in the Lower Freeport unit that subcrops approximately 2 miles from the Burrell site. No major gas or oil fields have been mapped for this area (Lytle and Balogh, 1977).

4.5.3.3 Hanover site

The Hanover site has been strip mined to remove the Pittsburgh coal seam; the strip pits were 41 to 115 feet deep, depending on the location. In 1970-1971 the Hanover site was reclaimed by backfilling with overburden (sandstone, slate, and shale). The coal seam below the Pittsburgh coal is the Upper Freeport unit that is approximately 1000 feet below the surface. The seam is not currently mineable in the area of the Hanover site.

Within 1.24 miles of the Hanover site are two shallow gas fields, several small, shallow oil fields, and a gas-storage field (Lytle and Balogh, 1977). There are also numerous abandoned gas wells in the Hanover site area. It is not known if these gas wells were properly plugged when abandoned (Chnupa, 1983).

4.5.4 Seismicity

The Canonsburg, Burrell, and Hanover sites are located in seismic risk zone 1, according to the seismic risk map of the United States. This map is based on the known distribution of damaging earthquakes and the intensities associated with them, as well as evidence of strain release, and consideration of major geologic structures and provinces believed to be associated with earthquake activity. The probable frequency of damaging earthquakes was not considered in assigning ratings to the various zones. Four zones were developed by Algermissen (Coffman and von Hake, 1973), as follows:

Zone 0 -- no damage.

Zone 1 -- minor damage.

Zone 2 -- moderate damage.

Zone 3 -- major damage.

In zone 1, during distant earthquakes some buildings may be damaged to a degree that corresponds to intensities V and VI on the Modified Mercalli Scale of 1931 (Figure C.2-6).

The maximum potential ground acceleration for the Canonsburg site has been determined to be 0.05 gravity (U.S. DOE, 1983).

4.6 WATER

4.6.1 Surface water

Nonradiological surface-water quality data are presented in this section. Radiological surface-water quality data are presented in Section 4.8.

4.6.1.1 Canonsburg site

The Canonsburg site lies in the Chartiers Creek basin along the creek's southern bank, approximately 15 miles upstream of its confluence with the Ohio River. In the Canonsburg area Chartiers Creek is a meandering stream with a channel width varying from 75 to 100 feet and a channel depth of about 5 feet. The actual creek dimensions at the Canonsburg site are usually much less than these values. Chartiers Creek drains approximately 265 square miles, of which about 80 square miles are upstream of the Canonsburg site. The average flow past the Canonsburg site ranges from 90 to 130 cubic feet per second. Although a portion of the Canonsburg site is located in the flood plain of Chartiers Creek (Figure D.1-1), which includes the area between the 500-year flood contour and Chartiers Creek, past floods from the creek have had no serious impacts on the Canonsburg site (Table D.1-1), and the 500-year flood would probably also not have a serious impact on the Canonsburg site. All of the remedial-action alternatives would involve activity within the flood plain. Encapsulation of radioactively contaminated materials on the Canonsburg site under Alternative 2 or 3 would take place outside the 500-year flood plain. Excavation and grading activities occurring within the flood plain would be necessary under all of the remedial-action alternatives because the radioactively contaminated materials are currently located in the flood plain.

Extreme flood events, e.g., either a 1000-year flood or a probable maximum flood, would result in increased flooding and minor streambed realignments at the Canonsburg site. Chartiers Creek, in the vicinity of the expanded Canonsburg site, encircles the expanded Canonsburg site such that stream realignment is likely to shift outward because the maximum velocity distribution is radially outward.

The surface topography divides the Canonsburg site into six distinct subbasins (Figure D.1-2). Runoff from four of the basins flows directly into Chartiers Creek. An area in the middle of the Canonsburg site collects runoff along George Street and Strabane Avenue and then flows to the creek. In the remaining area, the runoff collects along the Washington-Canonsburg Street Railway and then flows to the creek. The berm created by the ConRail trackbed along George Street isolates the Canonsburg site from upland runoff from Strabane Village (Figure D.1-2, Table D.1-2), and routes runoff toward Chartiers Creek downstream of the Canonsburg site.

Chartiers Creek is polluted by acid mine drainage and industrial and municipal discharges (Table D.1-3). The Pennsylvania water-quality limits (25 PA Code 93) have previously been exceeded for iron, sulfates, manganese, dissolved solids, and fecal coliforms. The high levels of sulfates and iron are a result of acid drainage from abandoned mines in the creek basin. Acid mine drainage and other pollutant discharges to Chartiers Creek still occur and thus the water quality of Chartiers Creek is not expected to improve.

Storm water runoff from the Canonsburg site was analyzed and found to be high in iron, lead, sulfates, and arsenic, exceeding the Pennsylvania water-quality limits (25 PA Code 93) (Table D.1-4). When compared to the present level of contamination in Chartiers Creek upstream of the Canonsburg site, any Canonsburg site contribution to further surface-water quality degradation is not detectable (Table D.1-4) . The results of this survey, however, indicated that the Canonsburg site contributes a small but measurable amount of total organic carbon (TOC) and boron to Chartiers Creek.

The public water used in the Canonsburg site area is generally supplied by reservoirs on tributaries to Chartiers Creek. Water served to the Canonsburg site area is provided by the Canonsburg plant of the Western Pennsylvania Water Company, which draws water from Little Chartiers Creek (Table D.1-5). The water treatment plant and intake are located 3.4 miles east of the Canonsburg site (Chnupa, 1983). Chartiers Creek is used as a public-water-supply source; however, the intake of the Western Pennsylvania Water Company's Washington Plant is located upstream of the Canonsburg site. The Western Pennsylvania Water Company uses Chartiers Creek as a water source to supplement their water source from two unnamed tributaries (Chnupa, 1983). Chartiers Creek is a tributary of the Ohio River, which is used as a public-water-supply source in Pennsylvania by five water plants (Chnupa, 1983). They are the following:

1. West View Municipal Authority -- Ohio River mile point 4.9.
2. Dixmont State Hospital -- Ohio River mile point 7.6.
3. Robinson Township Municipal Authority -- Ohio River mile point 8.8.
4. Sewickley Borough Water Authority -- Ohio River mile point 11.2.
5. Midland Borough Municipal Authority -- Ohio River mile point 36.2.

The impact of any current pollution from the Canonsburg site to these communities is nondetectable because the pollutant contribution, if any, from the Canonsburg site to Chartiers Creek is minimal with no degradation in surface-water quality and because water from Chartiers Creek is diluted at least a thousand fold after mixing with the Ohio River.

4.6.1.2 Burrell site

The Burrell site lies in the Conemaugh River basin, along the river's northern bank, directly upstream of Blairsville Borough. The river drains an area of about 1750 square miles. The Burrell site is located approximately 10 miles upstream from the Conemaugh River Dam, which is used to store up to 273,600 acre-feet of water for flood control. Downstream of the dam, the Conemaugh River combines with the Loyalhanna to become the Kiskiminetas River, a tributary of the Allegheny River which in turn joins the Monongahela River to form the Ohio River at Pittsburgh. Other important tributaries of the Conemaugh River are Two Lick, Black Lick, and Yellow Creeks, which join the river between the Burrell site and the Conemaugh Dam. During a storm, flood waters could be retained behind the dam to form a flood pool having a maximum elevation of 975.0 feet, at which point the flood pool would extend 13 miles upstream of the dam and would inundate the Burrell site to an elevation of 975 feet above mean sea level (Figure D.1-3).

Some excavation could occur within the flood plain at the Burrell site under Alternative 2 or 4. Stabilization activities under Alternative 3 or 5 would occur partially below the maximum pool elevation.

River stages past the Burrell site for actual storms during recent years have been less than the maximum flood-pool elevation (Table 4-2).

Table 4-2. River stages during storms -- Burrell sitė

Storm date	Pool elevation (feet above mean sea level)
June 1972	969.45
March 1964	968.23
April 1960	959.90
March 1967	959.59
July 1977	958.00

The June 1972 storm (Hurricane Agnes) is considered a 1000-year storm, and the elevation of 969.45 feet recorded at the Burrell site at that time is probably the highest that will be realized under natural conditions. No stream realignments or flood-plain shifts resulted from this storm in the vicinity of the Burrell site. The Conemaugh River Dam could impound the river to a higher stage at the Burrell site (975.00 feet), however, this would be pooled water and have little force to change the river's course.

Rainfall draining off the Burrell site discharges either directly into the river or into one of three onsite ponds and subsequently flows to the river through a culvert at the western end of the Burrell site. Of the 49 acres that make up the Burrell site, 16.4 acres drain directly to the river and 32.6 acres drain to the onsite ponds. The soil at the Burrell site is mostly a porous manmade fill that is interspersed with openings and underground voids; runoff from the 32.6 acres infiltrates ground-water supplies before reaching the onsite ponds. The result is that runoff percolates through the soil and becomes ground water; a portion subsequently discharges to the onsite ponds (see subsection 4.6.2). The total amount of runoff available for direct discharge to the river and for ground-water recharge was computed for several storm events (Table D.1-6). The Burrell site is isolated from runoff from the adjacent area north of the Burrell site by the berm created by the ConRail tracks.

The reach of the Conemaugh River adjacent to the Burrell site is severely polluted by acid drainage from active and abandoned mines, and by industrial and municipal waste-water discharges (Table D.1-7). The Pennsylvania water-quality limits (25 PA Code 93) for fecal coliforms, iron, sulfates, and manganese in the river have been exceeded on a regular basis both up- and downstream of the Burrell site. The pH measurements indicate that river water quality conditions are more acidic at local recording stations than is permissible. This is due to the acid mine drainage and is responsible for iron, manganese, and sulfates leaching above permissible limits (25 PA Code 93). Elevated levels of fecal coliforms are a result of the discharge of untreated or partially treated industrial and municipal waste water into the river. In the Conemaugh Basin some improvement in waste-water treatment is projected (U.S. EPA, 1979). The average fecal coliform levels in Chartiers Creek near the Canonsburg site have decreased five-fold between 1978 and 1982. Conversely, average fecal coliform levels recorded downstream of the Canonsburg site at Carnegie have increased slightly from 1978 - 1982 (Table D.1-3). There are no statewide plans to alleviate acid drainage from abandoned mines, which is the most significant source of pollution, and overwhelms any effects of the effluents leaving the Burrell site.

Currently, 98 percent of the Burrell site area's public-water use is supplied from protected surface waters, usually from reservoirs on tributaries to the Conemaugh River. There are numerous water plants located on the streams between the Burrell site and the Ohio River. The first public water supply below the Burrell site is located on the Conemaugh River at Saltsburg. This intake is approximately 6.3 miles below the Conemaugh Dam. Shortly below this intake the Kiskiminetas River is formed by the junction of the Conemaugh River and Loyalhanna Creek. From the point where the Kiskiminetas River enters the Allegheny River above the Borough of Freeport to Pittsburgh, there are ten public water supplies drawing water from the Allegheny River (Table D.1-8) (Chnupa, 1983). Public water supplies within 3 miles of the Burrell site are listed in Table D.1-5. In addition, Torrance State Hospital has an impounding dam on Shirey Run and a water treatment plant and open finished-water reservoir on the hospital grounds (Chnupa, 1983). Only after the waters of the Conemaugh reach the Ohio River do they become a direct source of drinking water for some localities. Water-year flows in the Ohio River average over 12 times the flow estimated past the Burrell site, an indication of the dilution rate before use.

The Burrell site's pond waters are characterized by sulfate-ion concentrations above the Pennsylvania surface-water quality criteria (25 PA Code 93) for the Conemaugh River (Table D.1-9). All other nonradiological parameters tested were generally within these criteria, except lead. No lead was detected; however, the detection limit was greater than the criterion.

4.6.1.3 Hanover site

The Hanover site lies in the Harmon Creek Basin, which drains an area of approximately 33 square miles in Pennsylvania and West Virginia before discharging into the Ohio River, about 7 miles west of the Hanover site. Approximately 5 square miles of this area is upstream of the Hanover site. The Hanover site is located north of Harmon Creek on the top of a ridge that divides the area into two subbasins of the creek; i.e., Ward Run on the west and an unnamed tributary of Harmon Creek on the east. The area of these subbasins that is directly affected by surface-water runoff is approximately 425 acres. In the absence of USGS water-data-collection stations, it is estimated that the average flow in Harmon Creek to the Ohio River is 68 cubic feet per second, but only an average of 10 cubic feet per second flow past the Hanover site. The Hanover site is located on a ridge top at an average elevation of approximately 100 feet above the nearby streams; extreme flood events, i.e., the probable maximum flood, would not inundate the Hanover site.

Rain falling on the Hanover site runs off in three directions; to Harmon Creek to the south, to an unnamed tributary to the east, and to Ward Run to the west. Runoff volumes for the entire subbasin for several storms were computed (Table D.1-10).

Onsite inspections conducted by the EPA (Downie and Petrone, 1980) in May 1980 during a surface-water sampling program concluded that both Ward Run and the unnamed tributary to Harmon Creek that lies east of the Hanover site are polluted with acid mine drainage (Table D.1-11). Analyses of the runoff in the vicinity of the chemical seep on the Hanover site revealed toxic conditions and a severely depressed pH of 3.2. A sampling program conducted by the owners of the Hanover site during the course of a landfill permit-application process showed high concentrations of iron and dissolved solids, and a high chemical oxygen demand, as well as depressed pH levels at various locations on the property (Figure D.1-4, Table D.1-12).

Because the chemical quality of Ward Run and Harmon Creek is poor, aquatic life is not present and public or industrial uses are either nonexistent (Depmer, 1968) or limited to tributaries isolated from the main stream of Harmon Creek by dams. One such dam (spillway elevation 998) is located upstream of the Hanover site on Harmon Creek, and forms a water-supply reservoir for Smith Township (Table D.1-5). The Dinsmore Dam, which is owned and operated by the Smith Township Municipal Authority, provides water for the

Authority's water treatment plant. The watershed is independent of the Hanover site drainage patterns. The Hanover site is located approximately 1.4 miles northwest of this water supply dam and does not drain into the dam via surface waters. The Authority also utilizes a well that is located below the breast of the dam, it is reported to be a 120-foot deep artesian well (Chnupa, 1983). The Burgettstown Borough receives its drinking water from the Western Pennsylvania Water Company system. Another water distribution system in the Hanover site area is the Paris-Florence Area Water Association that receives its drinking water from Weirton, West Virginia (Chnupa, 1983). The only downstream uses identified are from the Ohio River. As is true for the water from the Canonsburg and Burrell sites, the impact of pollution from the Hanover site on communities using Ohio River water is minimal. The average annual flow in the Ohio River at the closest station to the inflow of Harmon Creek is 32,000 cubic feet per second, indicating a dilution factor of at least 1000.

4.6.2 Ground water

Nonradiological ground-water quality data are presented here. Radiological ground-water quality data are presented in Section 4.8.

4.6.2.1 Canonsburg site

The hydrogeochemical characterization of the ground water is based on field programs conducted from 1979 to 1983. The methods and results of these field programs are presented in Appendix D.2, Figures D.2-1 and D.2-2, and Table D.2-1. Some of the earlier wells were not used in the later studies due to vandalism (plugging wells with stones, soda cans, etc.), but none of the wells have been officially abandoned. Official well abandonment and plugging will be part of the remedial action plan. Ground water at the expanded Canonsburg site occurs in a water-table condition in the unconsolidated (unconfined) material (fill, soil, and alluvium) and in a semi-confined condition in the underlying bedrock (Figure D.2-3).

The piezometic surface contours and permeability and percolation rates for various dates from 1979 to 1983 (Figures D.2-4 through D.2-8) imply that recharge to the unconsolidated material is from direct infiltration of precipitation and from ground-water flow onto the expanded Canonsburg site from the south. The primary recharge area on the Canonsburg site exists over Area A as a result of the presence of permeable fill that allows rapid infiltration of available precipitation (37 inches per year) into the water table.

The dominant boundary condition for the water-table ground-water system is Chartiers Creek, which surrounds the expanded Canonsburg site on the western, northern, and eastern sides, and is the discharge zone for the water-table system. The cross-section on Figure C.2-1 shows that, the unconsolidated material is not continuous across Chartiers Creek; ground-water flow in this system is radial from Area A into Chartiers Creek, as shown on Figure D.2-4.

This information, combined with the pump test results from well 303R and well 26, confirm that Chartiers Creek is a boundary to flow in the water-table system and shallow bedrock. The ground-water flow rates in the water-table have been estimated at 0.00018 centimeter per second in Areas A and B, and 0.0000018 centimeter per second in Area C. Transmissivity rates for the water-table system are presented in Table 4-3.

Ground water in the bedrock is under semi-confined conditions. Water elevations in the bedrock wells are generally above the screened interval (water intake part of the well) and above the bedrock surface. The relationships between water elevations in paired wells in the unconsolidated material and the shallow bedrock show that with few exceptions there is a vertical gradient downward, indicating that there is communication between the water-table system and the bedrock system. It has been observed that under stressed conditions (pumping), leakage occurs from the upper fill materials toward the shallow bedrock when the bedrock wells are pumped. The term "semi-confined" has been applied to the deep ground-water system on the basis of these data. The fill that lies between the water table and semi-confined systems restricts the downward flow of water, but does not eliminate leakage from the water-table system to the semi-confined system.

The piezometic surface of the semi-confined system (Figures D.2-9 through D.2-13) generally conforms to the slope of the bedrock surface (Figure C.2-9). The main source of recharge to the semi-confined system is from the upland area south of the expanded Canonsburg site. Ground water in the shallow bedrock discharges to Chartiers Creek through the bedrock in the creek bottom. However, the primary direction of ground-water flow in the semi-confined system is across the creek to the northeastern side of the expanded Canonsburg site. The aquifer parameters for the ground-water systems are shown in Table 4-3.

Ground-water quality at the expanded Canonsburg site was determined from samples collected from April 1979 to March 1983 from selected wells. The analysis results are presented in Table D.2-2. The ground-water quality is variable from well-to-well. Concentrations of chloride, sulfate, selenium, and calcium are high in both onsite and upgradient wells, but not in excess of the EPA National Interim Primary Drinking Water Standards (40 CFR 141) or the EPA National Secondary Drinking Water Guidelines (40 CFR 143). The radiological ground-water quality is discussed in subsection 4.8.1.

The major water-supply source in Washington County is surface water, not ground water. Over 80 percent of the county is served by public facilities that obtain 94 percent of their water from surface supplies (Table D.1-5). Data on local ground-water use were collected during the September 1979 socioeconomic survey (Appendix G). This survey sampled 15.2 percent of the households within a one-mile radius of the Canonsburg site, concentrating on

Table 4-3. Aquifer parameters, expanded Canonsburg site

Well number/type	Testing method	Transmissivity sq cm/sec	Storage coefficient
19 - Screened above bedrock	Pump test	1.28	1.5×10^{-2}
302S - Screened above bedrock	Pump test	3.74	---
26 - Screened above bedrock	Pump test	2.60 - 3.83	1.9×10^{-4} 2.3×10^{-4}
16A - Bedrock	Pump test	1.76	1.3×10^{-3}
302R - Bedrock	Pump test	0.76 - 0.295	---
5A - Bedrock	Pump test	1.79	1.9×10^{-4}
305R - Bedrock	Pump test	0.99 - 1.05	1.6×10^{-4} ---
306R - Bedrock	Pump test	0.178 - 1.03	---
303R - Bedrock	Pump test	0.167 - 3.94	---
305 - Screened above bedrock	Slug test	0.244	---
302S - Screened above bedrock	Slug test	0.78	---
306S - Screened above bedrock	Slug test	0.027	
411 - Screened above bedrock	Slug test	0.0165	

Source: Weston 1979-1983 field programs. Data analysis was performed by Weston and TAC.

the Village of Strabane. Of the 302 questionnaires completed, 13 respondents indicated that they had wells on their property (Table D.2-3; the table was updated in 1983 (Chnupa, 1983)). This method of data collection was used because there are virtually no records available regarding wells installed before 1965. None of the respondents to the survey reported that the well water was used for drinking purposes. Newport (1975) lists 176 wells located in Washington County, but does not include any wells within a 1-mile radius of the Canonsburg site. Chnupa (Lash, 1983) stated that all houses within a 1-mile radius of the Canonsburg site are supplied with public water.

4.6.2.2 Burrell site

The hydrologic regime at the Burrell site is directly related to the site's historic use (Figure C.2-3). Before 1949 the Burrell site was established as a Burrell borrow pit for alluvial and colluvial sand and gravel deposits. During the Burrell borrow operations a berm of alluvium was retained along the river's edge (the site's southern boundary). The area between this berm and the railroad right-of-way was then excavated to river bed elevation. When the property was obtained by the Pennsylvania Railroad in the 1950's, the land was filled inward from the elevated edges. This resulted in the Burrell site's present subsurface bowl-like configuration, with the railroad and industrial debris as well as the Canonsburg site's radioactively contaminated materials contained within a hollow lined with alluvial and colluvial material. High permeability fill overlies low-permeability colluvium, alluvium, and bedrock.

Information on the Burrell site's current hydrologic regime was obtained through a ground-water-monitoring program that involved installation of 6 wells into bedrock and 22 into the fill or alluvium and colluvium (Figure D.2-13). The Burrell site is a discharge area, with the ground water flowing into two discharge zones: the onsite ponds and the river bank. The majority of the site has a gentle ground-water gradient except for two relatively steep areas along the river edge and along the northern perimeter adjacent to the bluff.

Permeability and transmissivity were determined by pump testing wells 21 and 27. The transmissivities of the fill and of the alluvium and colluvium were determined to be 52.47 and 0.37 square centimeters per second, respectively. The hydraulic conductivity of the fill and the alluvium and colluvium were determined to be 8.7 and 0.045 centimeters per second, respectively. The difference in hydraulic conductivity between the fill and the underlying alluvium and colluvium indicates that there is no recharge of ground water from the fill into the underlying material into bedrock. The ground water from the fill exits the Burrell site directly and not by way of the bedrock. Ground water exits the Burrell site as effluent to both the onsite ponds and the Conemaugh River. It is estimated that 557 gallons per minute flow through the Burrell site with 200 gallons per minute discharging from the ponds and 357 gallons per minute discharging into the river (Table

D.2-4). The fill's porosity and depth and the rate of ground-water flow through the fill suggest that 2.9 x 10^8 gallons of water pass through the Burrell site annually. It takes seven months for ground water to completely pass through the fill, which means that since the 1957 disposal, the ground water at the Burrell site has been replaced 40 times.

The ground-water-flow patterns at the Burrell site are based on a complex interaction between ground-water springs and storm-water runoff flowing from the bluff onto the Burrell site, precipitation falling on the Burrell site, and the Burrell site's fill material (Figure D.2-15). The water from the bluff (north of the Burrell site) is characterized by a very acid pH (Figure D.2-16), with a high concentration of dissolved sulfate ions (Figure D.2-17), a high oxidation-reduction potential (ORP), a low concentration of dissolved chloride ions, and a low to nondetectable radionuclide concentration. The ground water at the Burrell site is a pH-buffered water in the mildly alkaline range, with a mildly reduced ORP, low concentrations of soluble chloride and sulfate ions, and very low concentrations of radionuclides (Table D.2-5).

The ground water at the Burrell site is only mildly degraded. Sulfate-ion concentrations exceed the EPA National Interim Primary Drinking-Water Standards (40 CFR 141), but this is a natural condition of the regional geologic makeup. The chloride-ion concentrations are, with one exception, well within the EPA National Secondary Drinking-Water Guidelines (40 CFR 143). The water pH is also generally within the same guidelines. The areas of low pH are most likely a result of the coal-containing bedrock. All other dissolved nonradiological elements analyzed were within the EPA National Interim Primary Drinking-Water Standards (40 CFR 141), except for lead and iron. No lead was actually detected; however, the detection limit was greater than the EPA National Interim Primary Drinking-Water Standards (40 CFR 141). The EPA National Interim Primary Drinking-Water Standard (40 CFR 141) for iron was exceeded in three of the samples, but this is a natural condition for this region.

4.6.2.3 Hanover site

Ground-water hydrology of the Hanover site is closely tied to its topography (Figure C.1-3). Depth to ground water in the sampled wells (Figure D.2-18) varies over the site in relation to topographic differences. In the trench bottom the depth to ground water is less than 10 feet, while alongside it can be as much as 70 feet below the surface. There is 5 feet of relief on the piezometric surface area over a distance of 4000 feet (Figure D.2-19).

The major component of ground-water flow at the Hanover site is from north to south along the length of the disposal trench. Flow into the Hanover site is primarily from the uplands along the north and east. Based on topography and the location of the streams (Figure 1-9), there is apparently a ground-water divide along the western side of the trench so that the major ground-water flow there is away from the Hanover site.

During drilling, water was encountered at or near the interface between the mine-rubble fill and the bedrock surface, and the mine rubble at the southern Hanover site edge was saturated. Ground water in the bedrock occurs in fractures in the rock. Transmissivity in the bedrock was determined to be 5.3 square centimeters per second. The Hanover site is not a recharge area as evidenced by the increased heads with depth displayed in most of the Hanover site wells.

Ground-water quality at the Hanover site is not within the EPA National Interim Primary Drinking-Water Standards (40 CFR 141) (Table D.2-6). This is partially attributable to past activities in the vicinity and to the high concentration of some pollutants that would be expected in a coal strip mine (Figures D.2-20 through D.2-22). The presence and distribution of excessive concentrations of some pollutants indicates that there is a source of contamination south of the Hanover site, in addition to the most obvious disposal area north of the site. Sulfate-ion concentrations are well above the EPA National Secondary Drinking-Water Guideline (40 CFR 143) of 250 milligrams per liter for all wells, with a high of 3030 milligrams per liter. Analysis for priority pollutants in one of the site's wells showed three contaminants above detection limits:

Butyl benzyl phthalate - 61.2 micrograms per liter
Methylene chloride - 23.5 micrograms per liter
4, 4' DDT - 21.6 micrograms per liter

Private wells within 1 mile of the Hanover site are listed in Table D.2-7.

4.7 ECOSYSTEMS

4.7.1 Terrestrial vegetation

4.7.1.1 Canonsburg site

Site-survey information and a vegetation map of the Canonsburg site are presented in Appendix E.1 and on Figure E.1-1. Mature trees line both the banks of Chartiers Creek along Areas B and C, and between the rail line and George Street south of Area A. These strip woodlands consist mainly of elm, box elder, cherry, hickory, and willows characteristic of the region (Kuchler, 1964; Bailey, 1976, 1980). Common early successional tree species such as quaking aspen, black locust, sumac, and cherry are found along the edge of these woodlands, along fences within the Canonsburg site areas, and scattered throughout the Canonsburg site (Table E.1-1).

Areas B and C contain successional old fields. Grasses, mosses, and wildflowers are the dominant ground cover of Areas A, B, and C. Within the fenced part of Area A, broomsedge sparsely covers the tile field (the area north of Building 18), and another thick clump of grass is found along the fence.

The flat top of the dredge fill part of Area B is sparsely covered with various tall grasses and dense patches of clover, while the perimeter slopes of Area B are thickly covered with bunch grass and dense tangles of brambles. Bulrushes also occur in water lenses on top of the dredge fill area and seeps on the slopes. Runoff ditches along the roadways contain small stands of cattail and bulrush.

Area C has a sparse cover of grasses and wildflowers. An examination of soil test pits in the area indicates that grass roots do not penetrate through the red-dog layer covering Area C. There are places in Area C that are entirely devoid of vegetation. These vegetation patterns may be the result of variable species growth on the red-dog fill, fill placement, former maintenance of this area as a ballfield, or geological or radiological survey efforts.

4.7.1.2 Burrell site

Most of the Burrell site is vegetated (Appendix E.1, Figure E.1-2). The vegetation consists primarily of grasses and other herbaceous species. Woody growth is limited to a fringe of intermediate-sized trees along the Conemaugh River bank and along the bluff to the north of the rail lines. Individual trees, approximately 15 years old, are also located randomly over the plateau area. The ravines containing the onsite ponds are largely brush-covered, and reed grass occurs in the wetter ravine areas and along the river bank.

The Burrell site is an old-field habitat type. The herbaceous vegetation includes teasel, burdock, goldenrod, common mullein, and Queen Anne's lace, in addition to numerous grasses (Table E.1-1). Raspberries and other brambles are also present. The trees on the Burrell site are typically early-colonizing species such as sumac, birch, quaking aspen, hawthorn, and black locust. Taller trees include maples, oaks, hickories, and sycamores.

Although many of the trees occurring at the Burrell site typically grow in dense groupings, there are no well-defined stands on the flat areas. This may be a result of the scarcity of soils.

4.7.1.3 Hanover site

The Hanover site conditions are typical of a recently-reclaimed strip mine (Appendix E.1). Its substrate is primarily shale fragments and other rocky rubble. Some areas of the Hanover site, particularly on the steeper slopes, have no vegetation, thereby exposing bare rocky material. The vegetation over most of the Hanover site is limited to low-growing perennial species, mainly clover and grasses (Table E.1-1). There are also cattails growing in low-lying sections of the Hanover site.

There are no trees within the Hanover site area. Early successional species such as sumac and birch occur immediately outside the site boundaries, and stands of trees typical of the region (oaks, maples, hickories, aspens, and conifers) are located in nearby areas that have not been strip mined.

4.7.2 Terrestrial wildlife

4.7.2.1 Canonsburg site

The primary habitat type at the Canonsburg site is old field (Appendix E.1). This habitat exists in most of Areas B and C and the undeveloped portion of Area A. A narrow strip, no more than 20 feet wide, of riparian habitat stretches along Chartiers Creek for the entire length of Areas B and C.

The Canonsburg site's open fields are primarily inhabited by mice, voles, and shrews (Table E.1-2). The field's surfaces are honeycombed with tunnels, runways, and nests. Edge areas surrounding the fields (usually associated with site fences, drainage ditches, and sloped surfaces) provide habitat for rabbits, groundhogs, and opossums whose burrows can be observed along undisturbed areas. Wooded areas on the Canonsburg site provide suitable habitat for passerine birds, while older trees along the creek are used as den trees for raccoons and squirrels. Kestrels have been observed successfully hunting at the Canonsburg site, and it is likely that other carnivores such as screech owls and redtail hawks hunt in the Canonsburg site area.

Muskrats are commonly associated with Chartiers Creek and its tributaries in this area. Migrating waterfowl, such as mallards and wood ducks, also use the creek to a minor extent during spring and fall.

The riparian woodland has the greatest value for wildlife because it represents an undisturbed area in an urban setting. The reach of Chartiers Creek along the Canonsburg site is the one of the few creek segments in the area that has not been channelized for flood control.

4.7.2.2 Burrell site

The Burrell site, an old field habitat type, is used as a feeding and nesting area for a variety of wildlife. The irregular substrate is well suited for burrow- and den-dwelling animals, as evidenced by the numerous den openings and well-worn runs traversing the site (Appendix E.1). Typical site animals include rabbits, opossum, mice, voles, shrews, groundhogs, and possibly fox. A variety of songbirds also inhabit the site (Table E.1-2).

Some forest animals include the Burrell site as part of their range. There is evidence (tracks, droppings, and paths) that deer regularly traverse the area. Kestrels have been observed hunting at the Burrell site, and it is likely that other hawks, as well as owls, also hunt there. Mallards have been seen on the Burrell site, and it is likely that other waterfowl make some use of the Burrell site during spring and fall.

4.7.2.3 Hanover site

The Hanover site is inhabited by a variety of field-dwelling, burrowing animals such as mice, voles, shrews, groundhogs, and rabbits (Appendix E.1, Table E.1-2). There is insufficient cover at the Hanover site to provide nesting or bedding areas for passerine birds or larger animals. Nevertheless, the Hanover site is used as a feeding area by deer and a number of bird species from nearby wooded areas.

4.7.3 Aquatic biota

4.7.3.1 Canonsburg site

Chartiers Creek is a moderately low-flowing (90 to 130 cubic feet per second) tributary of the Ohio River. Its natural substrate consists primarily of a thin layer of rubble and silt overlying shale bedrock, and its banks are muddy with some bedrock outcroppings. A relatively steep gradient (10 to 20 feet per mile) in the area creates swift currents and numerous riffles. At the Canonsburg site, the stream is tree-lined and shady, and undercut banks are common.

The physical setting of Chartiers Creek along the Canonsburg site provides adequate habitat to support a variety of aquatic organisms (Table E.2-2). The water quality in this reach, however, is poor as a result of upstream discharges from strip- and deep-coal mines, and by sewage and industrial waste waters that contribute high concentrations of iron, sulfates, dissolved solids, and fecal-coliform bacteria. The iron and sulfates and the sewage discharges (organic matter and bacteria) lead to conditions of low pH and low dissolved oxygen, respectively, in the creek, thereby reducing its usefulness as an aquatic habitat.

Biological surveys of Chartiers Creek (Appendix E.2) verified the stream's low habitat potential. No fish were observed near the Canonsburg site; however, carp and white suckers are known to be present (Table E.2-3). The benthic macroinvertebrate community was dominated by oligochaetes (segmented worms), chironomid (midge) larvae, nematodes (thread worms), and physid snails. These species are all tolerant of low pH and low oxygen conditions.

The aquatic vegetation of Chartiers Creek in the Canonsburg site area consists primarily of mats of filamentous algae (green algae), diatoms, and sewage fungi (green and blue-green algae). Like the animals surveyed, these algae are also typical of streams with degraded water quality.

Chartiers Creek is presently classified by the Pennsylvania Fish Commission as a cold water fishery (Weirich, 1982). This is strictly a designation, based mainly on the stream's thermal conditions. Because of its poor water quality, Chartiers Creek in the Canonsburg site vicinity is not stocked with trout or managed as a fishery.

The lack of adequate sewage treatment (although recently improved), and the numerous discharges from abandoned coal mines in its watershed, are the major deterrents to upgrading water quality in this area. Eliminating mine discharges, especially from deep mines, will require complex, expensive restoration. Although the Pennsylvania State Bureau of Mines (within the Pennsylvania Department of Environmental Resources) has implemented programs to control discharges from active mining, the contamination from abandoned mines will be a long-term problem in this area.

4.7.3.2 Burrell site

The Conemaugh River is the major surface-water feature near the Burrell site. There are three onsite ponds, within the 25- to 30-foot-deep ravine, in the western part of the Burrell site, and a shallower pond is located north of the rail lines against the bluff, outside the Burrell site boundaries.

Although the Pennsylvania Fish Commission has classified the Conemaugh River as a warm-water fishery (Weirich, 1982), the segment of the river at the Burrell site is severely polluted by acid-mine drainage, as well as industrial and municipal discharges. The levels of pH, iron, manganese, fecal coliforms, and occasionally sulfates, seriously violate state water-quality standards for this area. Because of the poor water quality, biological productivity and diversity in this segment of the Conemaugh River are very low.

Acid-mine drainage is a prevalent problem in western Pennsylvania. Although new management practices and environmental controls are being implemented at active mine sites, inactive (abandoned) deep-mine discharges are difficult to correct, both from a technical, as well as financial, standpoint. Therefore, it is not expected that contaminant levels in the Conemaugh River resulting from mine drainage will change significantly in the near future.

The Burrell site's ponds have not been surveyed for aquatic biology. No visible signs of aquatic life were noted during the Burrell site visits.

4.7.3.3 Hanover site

The Hanover site does not contain any creeks within its defined boundaries. There are two areas of periodic standing water, one in the northern part of the Hanover site and one in the southern part. These are formed as the result of the collection of runoff from the low areas, and support no aquatic ecosystems. These areas eventually drain northward into a tributary of Ward Run (which drains into Harmon Creek) or southward to a tributary of Harmon Creek.

The entire area within a 1-1/2-mile radius of the Hanover site has been heavily strip mined. As a result, all of the local waterways are highly contaminated by acid-mine drainage. In addition, leachate from industrial wastes dumped within this area contributes to the pollution of this part of the Harmon Creek network. Water-quality samples taken in the vicinity of the Hanover site are high in chlorides, iron, and dissolved solids, with generally low pH values.

Observations of the Harmon Creek tributaries revealed few aquatic animals. Snapping turtles and frogs were the only organisms observed. Much of the drainage water on the Hanover site was dark red, indicating the presence of iron oxides. No recreationally important fish species (trout, bass, etc.) are known to be in the extremely poor-quality waters in the Harmon Creek system near the Hanover site.

4.7.4 Endangered species

No evidence of Federal or state endangered or threatened species (U.S. DOI, 1982; 47 FR 27616, June 25, 1982) was found during the survey of the three sites. The Pennsylvania Fish Commission, the Pennsylvania Game Commission, and the U.S. Fish and Wildlife Service were contacted regarding endangered or threatened animal species, and the Pennsylvania Bureau of Forestry was contacted, and Wiegman (1979) was reviewed in regard to endangered plant species. Appendix E.3 contains letters from these agencies verifying the absence of such species from the three site areas.

4.8 RADIATION

Radiological surveys of the Canonsburg and Burrell sites were performed by the ORNL (Leggett et al., 1979a, 1979b), Weston, and Bendix Field Engineering Corporation (U.S. DOE, 1982c). These surveys analyzed air, water, soil, and other materials for the levels of radioactivity present. The radiological units used to express concentrations are microcuries (μCi) and picocuries (pCi) per gram or liter and disintegrations per minute (dpm) per area for radionuclide concentrations. The units used to express the radiological exposure rates are microroentgens per hour (μR/hr) and milliroentgens per hour (mR/hr). Units used to express dose are microrads (μr) and millirads (mr), and microrems (μrem) and millirems (mrem). For the purposes of this Canonsburg EIS these units (roentgen, rad, and rem) are used interchangeably.

The pertinent regulatory guidelines and standards referred to in this subsection are found in Table F.1-1. These guidelines and standards have been developed to protect the public from radioactive contamination. In addition to the comparisons made throughout this Canonsburg FEIS to the EPA standards (40 CFR 192), there are numerous comparisons between levels of radioactivity at the Canonsburg and Burrell sites and NRC standards (10 CFR 20) and NRC surface contamination guidelines (U.S. NRC, 1976). It should be noted that these NRC standards and NRC guidelines apply to only licensed facilities and, as a matter of law, do not apply to the Canonsburg or Burrell sites. However, these standards and guidelines have been utilized in this Canonsburg FEIS as a basis for identifying levels of contamination that may or may not be allowable in other contexts, e.g., for licensed facilities. Table F.1-1 also lists the maximum values found at the Canonsburg and Burrell sites.

The approximate normal or naturally occurring background radiation levels at the Canonsburg, Burrell, and Hanover site areas are as follows:

1. 10 microroentgens per hour for external gamma radiation at 1 meter above the ground.

2. 0.01 to 0.02 millirad per hour for beta-gamma dose rates at 1 centimeter above the ground.

3. 0.3 picocurie per liter for radon-222 (Rn-222) in air.

4. 1 to 2 picocuries per gram in soil for uranium-238 (U-238), radium-226 (Ra-226), thorium-230 (Th-230), and lead-210 (Pb-210).

5. 0.9 to 2 picocuries per liter of water for uranium-238, radium-226, thorium-230, and lead-210.

4.8.1 Canonsburg site

Surveys at the Canonsburg site indicate that within Area A large quantities of the residual radioactive materials generated during the radium- and uranium-recovery operations still remain on the Canonsburg site. Radium-bearing radioactively contaminated materials are present in the soil beneath and adjacent to many of the buildings, as well as in the top few feet of soil over much of the area. Surface contamination levels (alpha and beta concentrates and beta-gamma dose rates) in some areas of the buildings and outdoors in Area A are above NRC surface contamination guidelines (U.S. NRC, 1976). Under certain circumstances (i.e., continuous exposure for a period of years) external gamma radiation levels in some areas of the Canonsburg site could result in an individual receiving a radiation dose in excess of the recommended levels indicated in the NRC standards (10 CFR 20). Radon-222, radon-daughter products, and thorium-230 levels in some air samples collected in buildings were also above NRC standards (10 CFR 20).

Alpha and beta-gamma levels in Area B are also above the levels recommended in the NRC standards (10 CFR 20); however, they are lower than in Area A. Radium-226 in soil exceeds the EPA standard (40 CFR 192), and radium-226 in some of the ground-water samples taken in Area B is above the NRC standard (10 CFR 20). There appears to be a 2- to 6-foot layer of contaminated soil under approximately 8 to 9 feet of clean fill in this area, a condition that has led to lower radiation levels at the surface of this area than in Area A.

Area C, the former swamp area, was used as a depository for liquid wastes during the uranium- and radium-recovery operations as well as for the disposal of solid wastes during the transfer of the stockpiled contaminated materials from Area A to Area C in 1965. The surface and subsurface soils are more contaminated than those in Areas A and B. A semi-fluid material remains beneath the surface. The concentrations of radium-226 in some ground-water samples are above the NRC standard (10 CFR 20), and the concentration of radium-226 in soil samples from some areas of Area C exceed the EPA standard (40 CFR 192). External gamma radiation levels in Area C are such that under certain use conditions, individuals on the site could receive radiation doses in excess of those recommended by the NRC standard (10 CFR 20).

Radon-222 concentrations have been measured in some offsite buildings in excess of the NRC standard (10 CFR 20). In 1977, the ORNL (Leggett et al., 1979b), measured these concentrations at four locations off the expanded Canonsburg site. At the closest of these locations to the expanded Canonsburg site, just across the ConRail tracks to the south of the expanded Canonsburg site, 72 measurements averaged 8.6 picocuries per liter of radon-222. This elevated level may have been caused by radioactively contaminated materials located on this property rather than by radon emanation from the Canonsburg site. The other three locations had averages below the NRC maximum permissible concentration (10 CFR 20) for radon-222 in air in unrestricted areas (pertaining to unrestricted access and use) of 3 picocuries per liter. This value was exceeded, however, in all of the onsite buildings. Daytime average radon-222 concentrations ranged from 2.6 to 106.5 picocuries per liter, while maximum radon-222 concentrations ranged from 6.5 to 227 picocuries per liter. Measurements of radon daughters in the onsite buildings also exceeded the EPA standard (40 CFR 192) of 0.03 working level, with an average daytime concentration from 0.01 to 0.43 working level.

Building 7 had the highest average external-gamma-radiation value, based on a one-time series of measurements, of 80 microroentgens per hour. The maximum value, found at one spot in Building 10, was 310 microroentgens per hour. These values could result in an individual receiving a radiation dose of 160 millirems per year and 620 millirems per year, respectively, assuming a 2000-hour work year. The latter exceeds the NRC standard (10 CFR 20) limiting any individual from receiving a dose to the whole body in any period of one calendar year to no more than 500 millirems.

All onsite buildings have extensive areas with gross-alpha, gross-beta-gamma, and transferable-alpha and beta contamination exceeding NRC surface contamination guidelines (U.S. NRC, 1976).

Results of radon-222 measurements outdoors in Area A at several locations ranged from 0.80 to 2.7 picocuries per liter. At one location, the measurements ranged from 2.5 to 10 picocuries per liter. At another location, the average was 17 picocuries per liter with a maximum of 69 picocuries per liter.

Over 90 percent of the maximum beta-gamma dose-rate measurements at a 1-centimeter height in Area A exceed the NRC surface contamination guideline (U.S. NRC, 1976) of 0.2 millirad per hour, with some as high as 25 millirads per hour. Virtually all external-gamma levels measured at 1 meter in Area A were greater than 100 microroentgens per hour. Values along the eastern portion of Area A ranged from 300 to 500 microroentgens per hour, with a maximum of 1600 microroentgens per hour. Values for beta-gamma radiation also exceeded the NRC surface contamination guidelines (U.S. NRC, 1976) at many locations in Areas B and C.

Concentrations of radium-226 in surface- and subsurface-soil samples collected by Weston from all three areas were found to be significantly greater than allowed under the EPA standards (40 CFR 192) (Table F.1-2). Radium-226 concentrations in soil samples ranged up to 21,800 picocuries per gram with over half the samples exceeding 5 picocuries per gram. Concentrations of uranium-238 were usually greater than 10 picocuries per gram, with values as high as 51,000 picocuries per gram.

Samples of Chartiers Creek water and streambed sediments were taken at locations near the Canonsburg site by ORNL (Leggett et al., 1979b). All water samples taken by ORNL showed very low concentrations of radium-226; the highest level reported was 4 picocuries per liter. The highest sediment sample reported measured 36 picocuries per gram of radium-226. All other sediment samples taken by ORNL measured 5 picocuries per gram of radium-226 or lower. The 36 picocuries per gram value was at the downstream corner of Area C, the farthest downstream of any of the sampling locations. Table F.1-3 presents only Weston-collected results on the Chartiers Creek sediments.

Radiological ground-water at the expanded Canonsburg site has been determined on the basis of analyses performed on samples collected by Weston from selected onsite and offsite wells. (Radioactivity measured in the ground water was the dissolved (soluble) fraction unless otherwise noted.) Due to low vanadium concentrations in the ground water, uranium is expected to be the most mobile radionuclide in the ground water at the expanded Canonsburg site. Neutral pH conditions and an apparent abundance of bicarbonate as a complexing agent also aid the mobility of uranium and allow uranium to migrate at the fastest rate in the Canonsburg site environment. Uranium is considered the key indicator of contaminant migration. The results of these analyses are shown in Table F.1-4. Radium-226 and uranium-238 are the isotopes that are present in the highest concentrations. The highest concentrations of radionuclides appear in well 205, which is located in the portion of Area C that was used as a waste-disposal lagoon during the periods when the Canonsburg site was in operation. With the exception of wells 407 and 502, all offsite wells show background concentrations of all radionuclides. Wells

407 and 502 are adjacent to each other and immediately north of the expanded Canonsburg site across Chartiers Creek. Well 407 is a shallow bedrock well and well 502 is a deep bedrock well. The location of the screen in well 407 is above the level of Chartiers Creek, and the water elevation in well 407 is slightly above the creek level, showing that the piezometric surface is toward the creek from the east, as expected.

The vicinity properties on the northern side of the creek may be contributing to a slight elevation in radionuclide concentration in ground water. The radionuclide concentration in well 502 (6 parts per billion) could be the result of migration in the ground water from the expanded Canonsburg site since well 502 is downgradient of the expanded Canonsburg site, but this possibility is unlikely. The concentration of radium-226 in both wells 407 and 502 are within the EPA National Interim Primary Drinking Water Standards (40 CFR 141). Assuming that all alpha activity is the result of uranium-238 and radium-226, gross alpha activity would also be within the EPA National Interim Primary Drinking Water Standards (40 CFR 141).

The Illinois State Water Survey Finite Difference Hydrodynamic Flow Model (Prickett and Lonquist, 1971) and the equations developed by Prakash (1982) were used to describe the present steady-state water table and shallow bedrock systems at the expanded Canonsburg site, and to predict post-encapsulation conditions. These calculations show that for a maximum concentration of uranium to originate at well 205 (Area C), the highest concentration of uranium approaching Chartiers Creek would be downgradient from this source. These concentrations were 0.12, 0.06, and 0.003 milligram per liter at distances of 40, 20, and 1 foot west of the creek, respectively. For the shallow bedrock system a source area at wells 306R and 5A was used. The model simulation predicts a uranium concentration of 0.01 milligram per liter 200 feet west of the creek and downgradient of the source. The actual analysis result at well 302R, the nearest shallow bedrock well to the simulation point, was 0.0037 milligram per liter.

4.8.2 Burrell site

Radioactively contaminated materials containing an estimated 6 tons of uranium oxide (approximately 1.5 curies of uranium-238) were transferred from the Canonsburg site to the Burrell site in 1956-1957. Analyses by the ORNL (Leggett et al., 1979a) of subsurface-soil samples from 76 holes drilled on the Burrell site to depths of up to 50 feet revealed the general location of radioactively contaminated materials containing an estimated above-background total uranium-238 activity of 1.3 curies, and an estimated total radium-226 activity of 4 curies. It appeared at that time that more than 75 percent of the radioactively contaminated materials lay at least 10 feet beneath the surface. Some radioactively contaminated materials were also scattered on the surface. At some points the following values were measured in the surface soils:

1. Radium-226 concentrations of several thousand picocuries per gram.

2. Uranium-238 concentrations of 360 picocuries per gram.

3. External-gamma radiation levels at 1 meter above the surface in excess of 600 microroentgens per hour.

4. Beta-gamma dose rates at 1 centimeter above the surface in excess of 5 millirads per hour.

These measurements were not representative of the entire Burrell site area; at most sampling points radionuclide concentrations in the surface soils and radiation levels at the surface and at 1 meter above the surface were less than ten times background levels.

Grid-point measurements of gamma-radiation levels at 1 meter above the surface indicated a maximum gamma-radiation level of 630 microroentgens per hour. Several external-gamma measurements exceeding 300 microroentgens per hour were observed in the western portion of the Burrell site. Many measurements, particularly in the western portion of the Burrell site, were at background levels. The maximum beta-gamma dose rate at 1 centimeter from the surface on this site was 5.4 millirads per hour. The majority of the beta-gamma dose-rate measurements were at background levels.

Concentrations of radium-226 and uranium-238 in surface-soil samples were as high as 5000 picocuries per gram and 360 picocuries per gram, respectively. Radium-226 concentrations in the area that showed general surface contamination averaged 10 picocuries per gram; the EPA standard (40 CFR 192) allows 5 picocuries per gram. The average uranium-238 concentration in this same area was 3.9 picocuries per gram, the NRC guideline (46 FR 52061-52063, October 23, 1981) allows 200 picocuries per gram.

Subsurface-soil contamination was determined by drilling wells to depths of up to 50 feet, measuring in-situ radiation levels with a gamma probe, and analyzing soil samples. The radioactively contaminated materials were widely scattered and were found at depths ranging from the surface to 36 feet deep. No meaningful estimates of maximum or average radium-226 or uranium-238 concentrations could be made because of the sampling method and the heterogeneity of the results. However, this technique did permit an estimation of the total amount of radioactivity present above background levels. It was estimated that 4 curies of radium-226 and 1.3 curies of uranium-238 are buried at this site. According to historical records, approximately 1.5 curies of uranium-238 were transported to the Burrell site for disposal. This agreement indicated that nearly all of the radioactively contaminated materials were dumped in the region surveyed.

Analyses of sediments filtered from some of the water samples taken in drainage areas on and near the Burrell site revealed elevated concentrations of lead-210, and in some samples, thorium-230. However, in all water samples taken on and near the Burrell site, concentrations of radium-226, thorium-230, uranium-238, and lead-210 were below the NRC standards (10 CFR 20).

Concentrations of radium-226, thorium-230, and uranium-238 were measured in ground-water samples taken from the Burrell site wells. The maximum values found were 370 picocuries per liter for thorium-230, 10 picocuries per liter for radium-226, and 403 picocuries per liter for uranium-238. These results are below the NRC standards (10 CFR 20). Analyses of water samples taken from drainage ditches to the Conemaugh River noted lead-210, thorium-230, radium-226, and uranium-238 concentrations below the NRC standards (10 CFR 20); however, the results for lead-210 and uranium-238 were slightly above background levels. Analyses of sediments from these water samples showed similar results.

Average radon-222 levels in air at the Burrell site were at background levels with one exception. The one elevated reading of 1.82 picocuries per liter was below the NRC standard (10 CFR 20) of 3 picocuries per liter. The radon-daughter-product levels in air were all at background levels.

It appeared from these data that there is no significant ground-water or atmospheric transport of radioactivity from the Burrell site.

Subsequent to the surveys just reported, Weston made additional surveys of the Burrell site in 1981 and 1982 (U.S. DOE, 1982c), including measurements of uranium-238 and radium-226 in ground water at 26 wells and gamma-radiation levels at various depths in 28 wells drilled on the Burrell site (Figure F.1-2).

The highest ground-water uranium-238 concentrations were about 12 picocuries per liter in two wells; one in the known dump area and the other 1500 feet east of the dump area (Table F.1-5). Resampling and analysis of ground water from these same wells several months later found uranium-238 activities below 10 picocuries per liter, with the majority of the results at background levels. Radium-226 concentrations were at background levels for all wells tested.

Gamma-radiation levels in 7 of 28 wells sampled were above background activity. One well was contaminated at a depth of 21 feet, another was contaminated at a depth of 11 feet, and the remaining five wells were contaminated at depths of less than 7 feet.

The results found by Weston were confirmed in a separate survey by Bendix in 1982 (U.S. DOE, 1982c). The Bendix surveys consisted of gamma logs in 22 wells and estimations of radium-226 concentrations in the soil around these wells by gamma-spectral analysis. Above-background radioactivity was found in eight wells, at a depth of 12 feet in one and at depths less than 8 feet in the remaining 7 wells. Estimates of the radium-226 content ranged from less than 1 picocurie per gram up to 800 picocuries per gram. The average radium-226 concentration was less than 5 picocuries per gram across the Burrell site.

The ORNL, Weston, and Bendix surveys of the Burrell site identify different levels of radioactive contamination on the Burrell site. The Weston and Bendix surveys in 1981 and 1982, respectively, suggest that the Burrell site presently contains substantially less radioactive material than the 1977 ORNL survey indicated. The results of the Bendix survey agreed with the Weston data and are considered to be the conditions that currently exist on the Burrell site (U.S. DOE, 1982c). Based on these more recent and more extensive data it is believed that only one-third to one-tenth of the radiological activity originally placed on the Burrell site remains there, and that most of this radiological activity occurs at depths of less than 12 feet.

It is assumed that the reduction in the amount of radioactively contaminated materials existing on the Burrell site between the ORNL 1977 survey (Leggett et al., 1979a) and the Weston and Bendix 1981-1982 surveys (U.S. DOE, 1982c) was caused by leaching by ground water or by a redistribution of the radioactively contaminated materials on the Burrell site. Therefore, the Burrell site currently meets the EPA standard (40 CFR 192) except in a few small areas. This in turn, could imply that a much smaller remedial-action plan is necessary than originally envisioned (i.e., acquiring the Burrell site, covering the radioactively contaminated portion of the Burrell site with a minimum soil cover, and designating that portion of the Burrell site as a disposal site as described in Appendix A.2). The Burrell site is currently classified as a vicinity property, but the DOE is proposing to redesignate the Burrell site as a disposal site. The Burrell site's use is currently restricted by the COE as a flood-control easement for the Conemaugh Dam.

4.9 LAND USE

A socioeconomic survey of the Canonsburg site area was conducted in 1979 (Appendix G, subsection G.2). This survey consisted of an interview of residents within a 1-mile radius of the Canonsburg site, and a drive-through of the Canonsburg site vicinity to update the available land-use information. Surveys were also performed in the Burrell and Hanover site areas in January 1982, but because of their more open settings, these surveys relied on drive-throughs of their respective 1-mile radius areas, and extensive agency contacts.

4.9.1 Canonsburg site

The area within a 1-mile radius of the Canonsburg site includes portions of four municipalities: Canonsburg and Houston Boroughs, and Chartiers and North Strabane Townships. Residential use covers nearly 27 percent of this area, and is concentrated primarily in Canonsburg and Houston Boroughs and in the Village of Strabane (a residential development of North Strabane Township). The 1-mile-radius area also includes the commercial centers of Canonsburg and Houston, and a number of industrial establishments (Appendix G; Figure G-1 and Table G-1).

The Canonsburg site is located in the light-industrial zoning district of the Borough of Canonsburg. Other zoning designations for that part of the Borough within a 1-mile radius of the Canonsburg site include the following:

1. High-density residential in the eastern portion of the Borough.

2. Light-industrial, general commercial, and low-density residential in the northern and northwestern portions.

The sections of the Borough of Houston and North Strabane Township located within a 1-mile radius of the site are zoned primarily for residential use (Figure G-2). The portion of Chartiers Township included in this area is zoned primarily for medium-density residential use, most of which is currently in open space. The composite land-use plan (Figure G-3) for these boroughs and townships specifies development generally in accordance with local zoning designations (Kendree and Shepard Planning Consultants, 1970; Canonsburg Borough Planning Commission, 1971; Selck Minnerly Group, 1974; Houston Borough Zoning Board, 1982).

4.9.2 Burrell site

The area within a 1-mile radius of the Burrell site includes portions of Burrell Township and Blairsville Borough in Indiana County, and Derry Township in Westmoreland County. The major land use in this 1-mile radius area is open space (agriculture, woods, flood plains, and miscellaneous uses such as the Burrell site). Residential areas are primarily in Blairsville Borough and along major highways in Burrell Township; however, there are residential uses close to the Burrell site such as the community of Strangford 1 mile east of the Burrell site, and a small development along the northern edge of the Burrell site on old Route 22 (Appendix G, Figure G-4, and Table G-2).

Burrell Township has no land-use plans, zoning ordinances, or subdivision regulations. The Indiana County Comprehensive Plan places the Burrell site vicinity within the multiple-use flood-control district (Bellante and Clauss, Inc., 1967). The Derry Township section within the 1-mile radius of the Burrell site is in public or semi-public use; primarily the Torrance State Hospital. Blairsville Borough has a zoning ordinance; however, the details of the ordinance are unavailable. Development within the 1-mile radius area in Indiana County is controlled by the County's 1973 Special Recreation and Conservation Ordinance.

4.9.3 Hanover site

The entire 1-mile radius area of the Hanover site is within Hanover Township, except for a very small section in Jefferson Township (Figure G-5). Most of this area is in industrial land use, mainly mining activity. The Hanover site area is currently zoned for rural-residential use (Hanover Township, 1970) (Table G-3), which allows the following:

1. Agriculture.
2. Residences.
3. Community services.
4. Recreation.
5. Planned-residential developments.
6. Mineral extraction.
7. Community facilities and accessory uses.

There are no official land-use plans developed for Hanover Township; hence, the future use of the Hanover site will be guided primarily by the land uses permitted by its zoning designation.

4.10 NOISE

4.10.1 Canonsburg site

An acoustical survey conducted in 1979 by the Franklin Research Center (Hargens, 1979) (Appendix H) revealed that the Canonsburg site and the surrounding community are generally quiet. Nearly all sounds are steady and have very little diurnal variation. The immediate Canonsburg site area has only a few outstanding sound sources, since most of the industrial activities on the Canonsburg site have been shut down. Except for passing aircraft and land vehicles, the background sound levels around the Canonsburg site perimeter range from 45 to 57 dBA. Sounds emanating from Areas B and C are natural in origin, primarily insect and water sounds.

Sound sources off the Canonsburg site that contribute to background levels on the Canonsburg site include nearby roadways, railroads, and residences. West Pike Street runs roughly parallel to the Canonsburg site's northern boundary. This roadway connects the boroughs of Houston and Canonsburg and carries heavy traffic. Residences are located directly across the ConRail tracks in the Village of Strabane (as close as 250 feet to the expanded Canonsburg site) and along Chartiers Creek on Wilson Avenue, and may make minor occasional contributions to sound levels.

4.10.2 Burrell site

The Burrell site is in an open area and is very quiet. Background-sound sources are primarily natural, with irregular rail traffic and aircraft overflights.

4.10.3 Hanover site

The Hanover site is also an open, quiet area. It is 2 miles away from any developed area and transportation routes.

4.11 SCENIC, HISTORICAL, AND CULTURAL RESOURCES

4.11.1 General appearance

The Canonsburg site is located within the general Canonsburg community. The immediate vicinity is largely developed and contains no significant features to distinguish it from other small western Pennsylvania towns. Although the Burrell and Hanover sites are located in more open areas, they exhibit no significant scenic or aesthetic features. Much of the open area surrounding the Burrell site is a wooded flood plain, while the site itself is a former industrial landfill. The Hanover site, like much of its surroundings, is a former strip-mining area.

4.11.2 History

Western Pennsylvania supported numerous American Indian tribes before settlement by Europeans. The movement of settlers into this area was limited until secure passes through the Appalachian ridges were established. As a result traffic was channeled along a limited number of westward routes, and communities subsequently developed along these routes.

The major impetus to the development of western Pennsylvania came with the demand for coal during the industrial age. The availability of coal and other mineral resources attracted industrial development. Industry was also supported by the connection of the Ohio River system with the Mississippi River, allowing products and supplies to be transported and distributed over a much wider area. The Pennsylvania Canal System was developed to provide a waterway connection between the Ohio River and eastern river systems such as the Susquehanna and the Delaware. This system was initially designed to operate in conjunction with some rail lines; however, it was eventually replaced by a complete cross-state rail system connecting Philadelphia, Harrisburg, and Pittsburgh. (The western division of the canal system passed within one mile of the Burrell site.)

The industrial development of western Pennsylvania created an extensive demand for labor. This demand coincided with the periods of heavy immigration from eastern Europe, and many of the immigrants settled in western Pennsylvania.

4.11.3 Places of archaeological, historical, or cultural interest

Many of the significant archaeological resources near the three sites have been disrupted by mining and other development activity. No places of special interest are known to be in the immediate vicinity of the three sites, although several are reported within a 1-mile radius of the Canonsburg, Burrell, and Hanover sites (Table G-4) (Washington County Planning Commission, 1979; Philpott, 1980; Kent, 1982; and Ramsey, 1982).

Within a 1-mile radius of the Canonsburg site are two places that are listed in the National Register: Dr. McMillan's Log School, and the Robert's House, a half Georgian house built in 1805. Other structures of historical interest and significance include several houses and churches.

There are a number of historical findings located within a 1-mile radius of the Burrell site. These include several Indian sites and the remnants of the western division canal.

The Hanover site area includes several covered bridges, such as the remnants of the Doc Hanlin Covered Bridge, which is listed in the National Register, and several other structures of historical significance.

4.12 SOCIOECONOMIC CHARACTERISTICS

Information for subsections 4.12.1 through 4.12.7 was obtained from the 1979 socioeconomic survey of the Canonsburg site area, the 1982 socioeconomic surveys of the Burrell and Hanover site areas, and through contacts with municipal and county agencies. Detailed data from these surveys are contained in Appendix G.

4.12.1 Population

The Canonsburg site is situated within a populated area. Both the Burrell and Hanover sites are situated in rural areas. The population within a 1-mile radius of the Canonsburg site was 7938 in 1980 (Figure G-6, Table G-5). This total is broken down by age and sex on Table G-6. Historical and projected populations of the Canonsburg site area municipalities are given in Table G-7. Using the percent share of the 1980 population within these municipalities and the area's development potential, it is estimated that the population within 1 mile of the Canonsburg site will decrease slightly to 7929 by the year 2000 (Table G-8). There were only 2312 persons living within 1 mile of the Burrell site in 1980 (Figure G-7, Table G-9). The majority of these people live in Blairsville, west of the site. An increase of 338 people within 1 mile of the Burrell site over the 1980 population is expected by the year 2000 (Table G-10). Hanover Township had 78 people living within 1 mile of the site in 1980 (Table G-11), and this number is expected to increase by only 2 people by the year 2000 (Table G-12). (Projections for the Burrell and Hanover site areas were developed using the percent share of the 1980 population within the associated municipalities, the year 2000 population projections, and the areas' development potential.)

4.12.2 Social structure

The communities within southwestern Pennsylvania have rich ethnic traditions and are bound together by tight family structures. The population centers are old and stable with a small number of transients. There are many civic, social, and religious organizations that serve the population. There are a number of cultural organizations within the Canonsburg site vicinity that serve the Slovenian community in the area. No dominant ethnic culture is present in either the Burrell or Hanover site vicinities.

4.12.3 Economic structure

The mining industry is a strong economic force in southwestern Pennsylvania (Appendix G, subsection G.3). Washington and Indiana Counties are the two largest coal-producing areas in the region. In addition to the mining industry, the manufacture of primary metals, glass-producing machinery, electrical machinery, and food preparation and distribution equipment plays an important role in the regional and local economies. Agriculture provides another major source of income for the region. Dairy products, poultry, meat, field crops, and maple syrup make up the bulk of the agricultural production. The forest industry provides an additional source of income in the more rural areas.

The economic structure of the Hanover site is influenced by its proximity to the steel and titanium industries in West Virginia and Ohio.

4.12.4 Work force

The December 1981 statistics show an unemployment rate of approximately 8-1/2 percent in both Washington and Indiana Counties (Appendix G, subsections G.4.1 and G.4.2). The major losses of employment were in the primary metals, fabricated metals, machinery, and transportation-related industries. Total employment in December 1981 was 87,700 and 32,200 persons in Washington and Indiana Counties, respectively. Approximately one-half of all employed persons who reside within the 1-mile radius area of the Canonsburg site work within 2 miles of their homes. Employed persons living within the 1-mile radius areas of the Burrell and Hanover sites work at greater distances from their homes, with some Hanover residents working in Weirton, West Virginia.

4.12.5 Housing

The Canonsburg site is situated within an area of dense residential development. The Canonsburg site has been expanded to include seven nearby residences. The closest residence to the Canonsburg site is on Wilson Avenue, about 85 feet from the Canon Industrial Park property line. The closest houses to the expanded Canonsburg site are those in the Village of Strabane immediately across the railline to the south, with some of these houses as close as 250 feet. The Burrell site has fewer houses in its immediate area, with the closest homes being situated along the ridge to the north of the site (over 500 feet away). The Hanover site is situated in an area with very few houses; the nearest one is about 2000 feet away.

The houses in the Canonsburg site area are relatively old but in good condition. Most of the houses are owner-occupied with infrequent turnover. There are only a few rental units available within a 1-mile radius of the Canonsburg site, located mostly in Canonsburg. Historical data on housing stock in the area municipalities are given in Table G-20. Newer housing units are located in the northwestern section of Canonsburg and the Oak Spring Cemetery section of Chartiers Township. Based on a 2-percent vacancy rate, approximately 210 single-family houses are available in the site vicinity. Multifamily housing is limited in the area.

Current property assessments for developed properties near the Canonsburg site range from $1,927 to $6,392 per property; this represents about 9 percent of the actual property value. The 1981 assessed value of the properties composing the Canon Industrial Park was $55,698, representing an approximate market value of about $619,000. The newer homes in the Canonsburg site vicinity have an average assessed value of $5,000 (assessed at 9 percent of market value). The asking prices of some houses in the Canonsburg site vicinity, as obtained from local realtors, are presented in Table G-21.

Housing activity in the Burrell site area, and particularly in Burrell and Derry Townships, has expanded rapidly in recent years, particularly in new subdivisions (Table G-20). There is a total of nine houses located within one-quarter mile of the Burrell site, with the nearest one 500 feet from the site. Approximately 550 houses of the 1980 housing stock of the area municipalities are currently vacant, based on the vacancy rates in Indiana and Westmoreland Counties. The cost of vacant land in the vicinity of the Burrell site ranges from $300 to $400 per acre. Average home prices are in the $40,000 to $45,000 range.

There are only 78 people occupying 26 houses within the 1-mile radius area of the Hanover site (Table G-11), with the nearest house about 2000 feet from the site. Over the last decade, the number of houses in the area municipalities (Hanover, Burgettstown, Jefferson, and Smith Townships) has increased by 13 percent. At a 2-percent vacancy rate, there are about 85 vacant houses in these municipalities. The cost of vacant land in Hanover Township ranges from $300 per acre for deep-strip-mined land with only minimal use, to as much as $10,000 per acre for lands suitable for occupiable development (accessible and favorable for sewers) and for development as landfills (mined areas with deep-cut walls).

4.12.6 Tax and assessment structure

Canonsburg is the largest borough in Washington County in terms of population, ranking only behind Monongahela and Washington, both third-class cities. The revenue of Canonsburg and its surrounding communities was more than $3.5 million in 1978 (Table G-22). The majority of the revenue came from real-estate and Act 511 taxes, with lesser amounts coming from Federal and state grants, state highway taxes, and sanitary sewer charges. The revenue was used primarily to provide local services and was approximately 15 percent of the County's government-service outlays. Washington County was reassessed in 1980; the current tax rate is 25 mills. The current property assessment is 9 percent of the market value. Current assessed values, market values, and tax rates for the area municipalities are given in Table G-23.

Revenues for 1978 for both Burrell Township and the Borough of Blairsville, Indiana County, totalled more than $1 million (Table G-24). The 1980 and 1981 tax rates for these municipalities are given in Table G-25.

Based on population size, Hanover Township represented an average second-class township, while its fiscal statistics (Table G-26) for 1979 were substantially less than average for its size. The rural character of this township accounts for its small-scale revenue needs and expenditures.

4.12.7 Community structure

Community services such as schools, hospitals, fire and police protection, public utilities, and recreational facilities within the site area municipalities are described in Appendix G, section G.4. A school is located within one-quarter mile of the Canonsburg site. No schools are near the Burrell site, and the school closest to the Hanover site is over 2 miles away.

The Canonsburg site also has a number of hospitals and recreational facilities in its general area. Burrell and Hanover Townships rely on regional facilities, parks, and open areas for recreation. This trend affects all of the community services offered at each site; i.e., the services provided near the Canonsburg site are closer and more comprehensive than those near the Burrell or Hanover sites.

4.12.8 Transportation network

A transportation survey of the three site areas was performed to assess the various alternative routes (Transportation and Distribution Associates, Inc., 1982). This survey is presented as Appendix I.

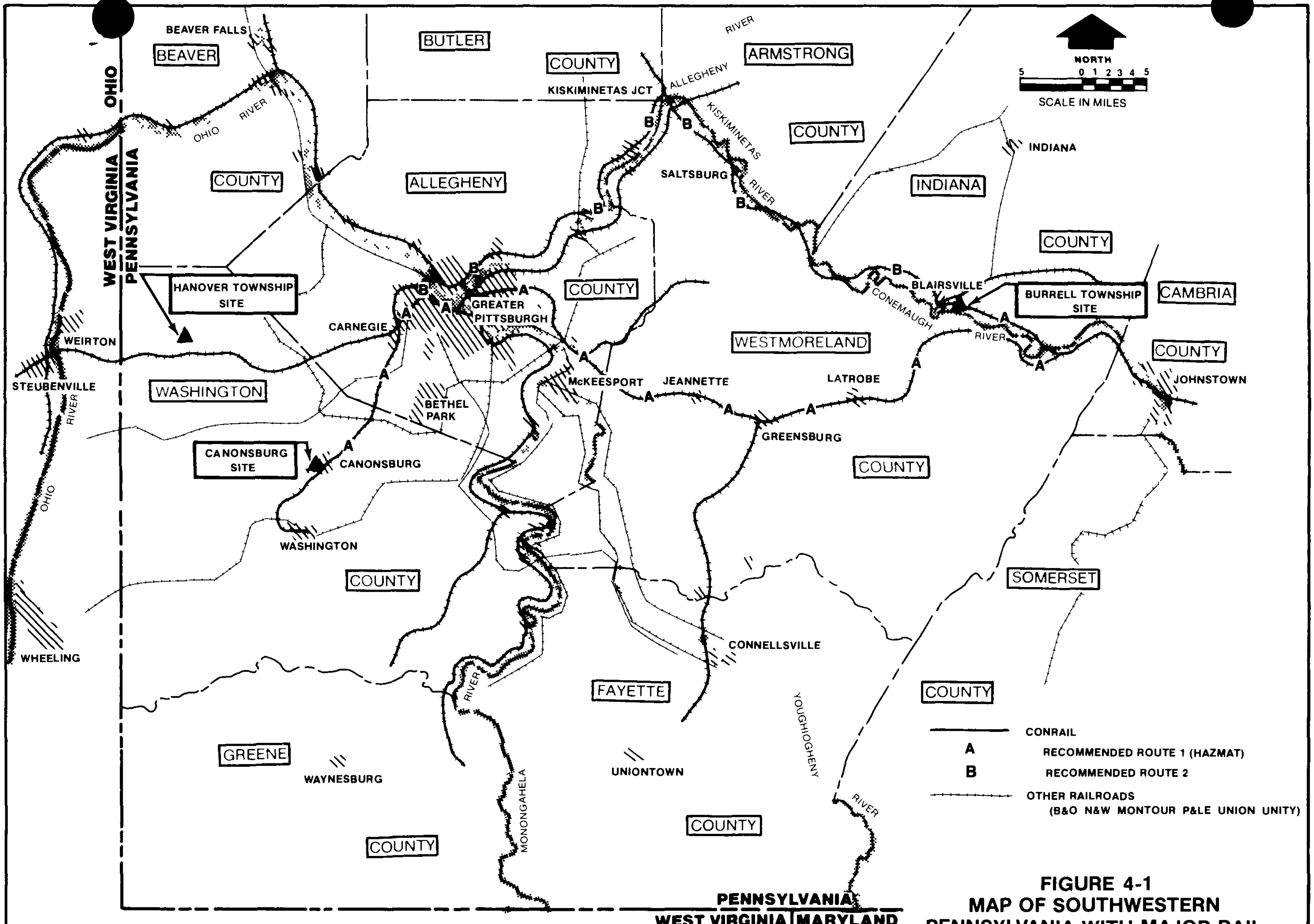
Interstate Highways 70 and 79 are the major highways in the vicinity of the Canonsburg site (Figure 1-1). The principal arterial roads near the Canonsburg site are U.S. Routes 19 and 40 and State Routes (SR) 980, 519, 50, 18, and 88. The main access road to the Canonsburg site is Strabane Avenue. This street becomes Chartiers Street south of the Canonsburg site and joins Pike Street north of the Canonsburg site. Other major roads near the Canonsburg site include North Main Street and Oak Spring Road in Chartiers Township and Boone Avenue and SR 519 in North Strabane Township. The most recent traffic counts on these roads are given in Table G-29. Most of the local streets are narrow, poorly paved, and congested. No major improvements are planned for any of the routes. There are four major railroads serving Canonsburg: the ConRail, the Montour, the Baltimore and Ohio, and the Norfolk and Western (Figure 4-1).

The major roads in Burrell Township are U.S. 22 and 119, SR 217, and several legislative roads (LR). The 1980 traffic counts on the major roads in this area are given in Table G-29. There is currently no major access road to the Burrell site. The only available public road that could be used to connect the Burrell site with the major arterial roads in the region is LR 32006 (Strangford Road; see Figure 1-4). It presently has a 15-ton load limit and is 12 to 15 feet wide. The other closest road to the Burrell site is LR 32179, which intersects LR 32006 nearly 3000 feet northeast of the Burrell site. A ConRail route runs along the northern edge of the Burrell site.

Major highways near the Hanover site include old U.S. 22, new U.S. 22, SR 18, and LRs 62017 and 62122. Access to the Hanover site is through LR 62017 either from old U.S. 22 or from SR 18 and LR 62122. Traffic counts (1980) on these routes are presented in Table G-29.

The Canonsburg and Burrell sites are accessible by railroad mainly through the ConRail lines connecting these two sites via Pittsburgh (Figure 4-1). From Canonsburg one route travels north to Carnegie and Pittsburgh, northeast to Kiskiminetas Junction and to the southeast through Vandergrift, Saltsburg, and Blairsville to the Burrell site. This route is a designated ConRail Hazardous Material (HAZMAT) route. Another route travels from Canonsburg north to Pittsburgh, then basically south and east through Greensburg, Latrobe, and Blairsville to the Burrell site. The Canonsburg-Burrell routes pass through a number of urban centers including about 2.5 miles through the City of Pittsburgh. The Canonsburg-Burrell routes pass through Indiana, Westmoreland, Armstrong, Allegheny, and Washington Counties.

There is no direct railroad line to the Hanover site. A siding to the Hanover site could be provided from the ConRail line south of the Hanover site running between Carnegie, Pennsylvania, and Weirton, West Virginia. This line



SOURCE PENNDOT OFFICIAL MAP OF PENNSYLVANIA 1980
COUNTY MAPS (WASHINGTON ALLEGHENY INDIANA & WESTMORELAND) 1976 AND CONRAIL MAPS 1978

FIGURE 4-1
MAP OF SOUTHWESTERN PENNSYLVANIA WITH MAJOR RAIL TRANSPORTATION ROUTES

is also part of the ConRail HAZMAT route. However, ConRail may be abandoning this section by 1983 in the interest of cost control. This route passes through mostly rural communities.

4.12.9 Public reactions to the remedial-action project

Major public involvement in the remedial action plans at the Canonsburg and Burrell sites began during the identification of potential disposal sites for the radioactively-contaminated material (U.S. DOE, 1981a, b). After two possible disposal areas in Hanover Township, Washington County, were selected, a remedial-action-concept paper (RACP) was written in April 1981. This paper was published and widely distributed in the project area to inform participating agencies and the public of the tentative project plans. The Burgettstown Enterprise printed the entire RACP in its April 22, 1981 issue. (A later version of the RACP has since been published by the DOE (U.S. DOE, 1982b).) Preliminary public meetings on the tentative plans were held in Canonsburg Borough and Hanover Township in April 1981 and in Burrell Township in May 1981.

The notice of intent to prepare an EIS and hold public scoping meetings was published in the Federal Register (46 FR 26807-26810, May 15, 1980). This notice was also given wide publicity by the DOE and appeared in numerous local papers such as the Washington, Pennsylvania Observer Reporter on May 26, 1981, and in television and radio announcements.

Scoping meetings were held on June 3, 1981 in Black Lick (Burrell Township) and Canonsburg, and on June 4, 1981 in Hanover Township.

At these meetings the public was given an opportunity to express any concerns about the tentative project plans. The DOE also requested that those persons wishing to submit written comments do so by June 30, 1981.

The types of concerns expressed by the public include the following:

1. What is the extent of the exposure to radiation that the public and the project workers will receive from the project activities? What levels are expected and what are their health effects? What protective measures and monitoring will be performed and by whom?

2. What is the extent of the exposure to radiation from possible accidents? Who will clean up an accident, and how? What are the possible radiation doses and the subsequent health impacts that could result?

3. What changes in air quality will occur because of dust and other airborne pollutants during the project activities?

4. What will be the effects of the project on the soils and mineral resources in Hanover Township? The soils at this site may be too porous, and the bedrock may be fractured or weakened by mining activities. Disposal of contaminated materials in Hanover Township may eliminate the future use of geologic resources in the immediate vicinity of the site.

5. What will be the effects on surface and ground water? Radioactive contaminants may enter water supplies at the Canonsburg and Burrell sites and at the disposal site. The volumes of runoff from the disposal site(s) will be increased because of the impermeable cover.

6. What will be the effects on plants and animals? The ecological resources of Hanover Township are already seriously degraded from mining and industrial activities.

7. What will be the changes in land use? The disposal of radioactive material at a site will eliminate any future use of that site and make the surrounding area unattractive for further development. Property values will also decrease. Disposal at a site may interfere with the use of nearby institutions (schools, medical facilities), as well as community services.

8. How much will noise levels increase during the project activities?

9. How will the transportation networks be affected? Local roadways and railways may not be able to handle all of the traffic associated with moving the contaminated materials. Transporting the radioactive and construction materials will seriously increase local traffic volumes.

10. What will be the effect of storms during the project activities?

11. What impact will the proposed disposal site at Hanover have on a nearby hunting and fishing area?

12. Will the chemicals associated with the radioactive residues or sulfur and mine acids adversely affect the liners used for the disposal area(s)?

13. What is the possibility of unearthing toxic chemicals at the former Canonsburg lagoon (Area C)?

14. Can the Canonsburg residues be disposed of in shielded containers above ground so that they can be inspected for leakage?

15. Can the residues at the sites be stabilized in place?

The following questions were also asked during the public meetings:

1. Would other radioactive wastes, such as from Three Mile Island, also be disposed of in Hanover Township? Answer: no.

2. In light of the general antagonism toward the nuclear industry, will stopping this project be seen as an attempt to halt nuclear arms production? Answer: no.

3. Will this project halt the current illegal dumping of chemical wastes at the Hanover site? Answer: no.

Following the publication and distribution of the Canonsburg DEIS (U.S. DOE, 1982a) in early December 1982, notice of its availability was published in the Federal Register on December 8, 1982 (47 FR 55305). The notice also announced the date for closing the comment period as January 24, 1983. Inserted in the Canonsburg DEIS (U.S. DOE, 1982a) was the notice of the public hearings to be held in Black Lick (Burrell Township) and Hanover Township on January 11, 1983, and in North Strabane (the Canonsburg area) on January 12, 1983. The Canonsburg DEIS (U.S. DOE, 1982a) was sent to approximately 60 individuals, as well as to Federal and state agencies, elected officials, organizations, and public libraries. Included in the list of individuals were many representatives of the local media. News releases were also disseminated announcing the dates and locations of the public hearings.

In preparation for the public hearings, a public meeting was announced and held on December 16, 1982 in the Canonsburg area (in the North Strabane Township Hall).

All comments received on the Canonsburg DEIS (U.S. DOE, 1982a) are summarized and answered in Chapter 6.

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5 Environmental Consequences

5.1 INTRODUCTION

In assessing the impacts of each alternative, the following principles are basic to all alternatives except Alternative 1:

1. All of the alternatives would limit the release of radioactively contaminated materials from any of the three sites to within the EPA standards (40 CFR 192).

2. All of the alternatives would effectively isolate the radioactively contaminated materials over the long term.

3. All of the alternatives would improve the existing situation at both the Canonsburg and Burrell sites. The potential health and environmental hazards that are a result of the present configuration of the radioactively contaminated materials at both the Canonsburg and Burrell sites would be eliminated.

4. This study addressed the maximum realistic impacts; it is expected that the actual impacts would be less.

5.2 IMPACTS OF RELEASES OF RADIATION

This section assesses the radiological impacts resulting from each of the alternatives. The methods used to perform the assessments are given in Appendices F.2 and F.3. The data used in the impact assessments were collected by ORNL in 1977 (Leggett et al., 1979a, b), by Weston in 1981, and by Bendix in 1982 (U.S. DOE, 1982d). The impact assessment includes estimates of the resulting organ-specific radiation doses and health effects. The general population considered is that within 6.2 miles (10 kilometers) of the Canonsburg site, and 1.24 miles (2 kilometers) of the Burrell and Hanover sites. Predictions are also made for exposures to the remedial-action workers assigned to each site. Radiation doses and health effects resulting from transporting the radioactively contaminated materials under Alternatives 2, 4, and 5 are also estimated for the general population. In performing the dose and health effects calculations as described in Appendix F.3, no credit was taken for any of the mitigating measures that could be employed.

The Canonsburg DEIS (U.S. DOE, 1982a) was issued in November 1982. Public and government comments on the Canonsburg DEIS (U.S. DOE, 1982a) were solicited through a notice in the Federal Register (47 FR 55305, December 8, 1982) and through a series of local public hearings held in January 1983 (see Chapter 6). The Canonsburg FEIS includes several changes from the Canonsburg

DEIS (U.S. DOE, 1982a). These changes pertaining to radiological impacts are summarized in the paragraphs that follow, and are discussed in subsequent sections of the Canonsburg FEIS.

1. The EPA published final standards (40 CFR 192) for remedial actions at inactive uranium-processing sites (48 FR 590-606, January 5, 1983; effective March 7, 1983). These final standards contain several less stringent standards compared to the proposed standards (40 CFR 192 (proposed)) (45 FR 27370-27375, April 22, 1980 and 46 FR 2556-2563, January 9, 1981). The EPA published an EIS (U.S. EPA, 1982) on the development and impacts of the standards. The promulgation of these standards (40 CFR 192) resulted in design changes for the remedial-action program, such as a reduction in the overall cover thickness at the expanded Canonsburg site. One of the main differences between the proposed EPA standards (40 CFR 192 (proposed)) and the final EPA standards (40 CFR 192) is that the amount of radon-222 that may be released from the surface of a disposal site has been increased by a factor of 10 (i.e., from 2 to 20 picocuries per square meter per second).

2. The description of the present (no action) radiological conditions was revised to more accurately reflect the existing situation at the Canonsburg site. The Canonsburg DEIS (U.S. DOE, 1982a) took a worst-case approach and considered the radioactively contaminated materials present on the Canonsburg site to be essentially uncovered and directly exposed to the biosphere. The Canonsburg FEIS considers the existing soil cover over these radioactively contaminated materials. This revision results in a reduction by a factor of 15 in the estimated level of radiological impacts resulting from the current condition (no action) of the Canonsburg site compared with that given in the Canonsburg DEIS (U.S. DOE, 1982a). This revision does not change the actual amounts of radioactively contaminated materials present on the Canonsburg site nor the actual radiological impacts either during or after the remedial action. The revision results only in a revised estimate of the present radiological situation on the Canonsburg site against which the potential radiological impacts during and after remedial action are compared. In other words, the physical impacts do not change, but the estimates of these impacts are more accurate.

   The Canonsburg DEIS (U.S. DOE, 1982a) estimated that Alternative 2 or 3 would reduce the potential radiological impacts at the Canonsburg site by a factor of 700 compared with the no action alternative. Because of the changes described in the first two items, the Canonsburg FEIS estimates that Alternative 2 or 3 would reduce the potential radiological impacts at the Canonsburg site by a factor of 4, compared with no action.

   The Canonsburg DEIS (U.S. DOE, 1982a) estimated a slight increase in the level of potential radiological impacts during the 96-week remedial-action period at the expanded Canonsburg site, compared with no action. Because the estimate of the potential radiological impacts under no action has been reduced, as described in this item, the Canonsburg FEIS estimates that these potential radiological impacts under Alternative 2 or 3 would be about twice those of the no action alternative during the 96-week remedial-action period.

3. The geographical area considered in the radiological impact evaluation of the Canonsburg site was increased from 1.24 miles (2 kilometers) to 6.2 miles (10 kilometers). This change permitted a more extensive assessment of the potential environmental impacts resulting from any of the alternative remedial actions.

5.2.1 Impacts of remedial actions

Radiological

The radiation doses for the general population and remedial-action workers under each of the alternatives are presented in Tables F.3-1 to F.3-13. The calculational methods used are described in Appendix F.2. The estimated excess lung cancer deaths among the population of 68,602 people living within 6.2 miles (10 kilometers) of the Canonsburg site, and within 1.24 miles (2 kilometers) of the Burrell and Hanover sites and among the 43 to 75 remedial-action workers (depending on the alternative), are presented in Tables 5-1 through 5-7. The single most important exposure pathway to the general public and the remedial-action workers would be the inhalation of radon-daughter products and the subsequent irradiation of the tracheobronchial system. In addition, the remedial-action workers would have an important secondary pathway through working in close association with the radioactively contaminated materials, direct external exposure of the whole body. In order to put these results in perspective, Table 5-8 presents the estimated background-radiation doses, the EPA standards (40 CFR 192), and the normal cancer-death expectations for the exposed populations.

The population dose calculations indicate that the most exposed resident near the Canonsburg site is currently receiving an excess bronchial dose of about 393 millirems per year (Table F.3-1). This is equivalent to a 1 in 4000 additional chance of that individual dying from lung cancer because of exposure to radon-222 daughter products from the radioactively contaminated materials at the Canonsburg site. Remedial-action Alternative 2 or 3 would reduce this additional exposure to 100 millirems per year (Table F.3-5) or a 1 in 15,000 additional chance of that individual dying from lung cancer. The normal expectation of an individual dying from lung cancer is approximately a 1 in 33 chance (National Academy of Sciences, 1980).

At the Burrell site, the most exposed persons are across the Conemaugh River to the southwest. They currently receive an excess bronchial dose of 134 millirems per year (Table F.3-6), which would be reduced to 30 millirems per year by the remedial action (Table F.3-9). The former dose implies a chance of 1 in 11,000 of that individual dying from lung cancer because of

Table 5-1. Excess annual cancer deaths for the general public within 10 kilometers (6.2 miles) of the Canonsburg site (63,942 people) before and after remedial action

Alternative	Whole body dose (man-rems)[a]	Bronchial dose (man-rems)[b]	Lung cancer deaths	All other cancer deaths	Total deaths
1 (before)	11	530	0.0106	0.0013	0.0119
2 and 3 (after)	0.254	151	0.00302	0.0000305	0.00305

[a]Mainly exposure to gamma radiation.
[b]Mainly inhalation of radon-daughter products.

Table 5-2. Excess annual cancer deaths for the general public within 2 kilometers (1.24 miles) of the Burrell site (4,546 people) before and after remedial action

Alternative	Whole body dose (man-rems)[a]	Bronchial dose (man-rems)[b]	Lung cancer deaths	All other cancer deaths	Total deaths
1 (before)	0.0864	47.8	0.000956	0.0000104	0.000966
3 and 5 (after)	0.0233	11.5	0.00023	0.0000028	0.000233

[a]Mainly exposure to gamma radiation.
[b]Mainly inhalation of radon-daughter products.

Table 5-3. Excess annual cancer deaths for the general public within 2 kilometers (1.24 miles) of the Hanover site (114 people) before and after remedial action

Alternative	Whole body dose (man-rems)[a]	Bronchial dose (man-rems)[b]	Lung cancer deaths	All other cancer deaths	Total deaths
1 (before)	0	0	0	0	0
4 and 5 (after)	0.000116	0.152	0.00000304	0.0000000139	0.00000305

[a]Mainly exposure to gamma radiation.
[b]Mainly inhalation of radon-daughter products.

Table 5-4. Excess total cancer deaths for the general public within 10 kilometers (6.2 miles) of the Canonsburg site (63,942 people) due to radiation exposure during remedial action

Alternative	Whole body dose (man-rems)[a]	Bronchial dose (man-rems)[b]	Lung cancer deaths	All other cancer deaths	Total deaths
2	22	1858	0.0372	0.00264	0.0398
3	22	1860	0.0372	0.00264	0.0398
4	18	1720	0.0344	0.00216	0.0366
5	18	1720	0.0344	0.00216	0.0366

[a]Mainly exposure to gamma radiation.
[b]Mainly inhalation of radon-daughter products.

Table 5-5. Excess total cancer deaths for the general public within 2 kilometers (1.24 miles) of the Burrell site (4546 people) due to radiation exposure during remedial action

Alternative	Whole body dose (man-rems)[a]	Bronchial dose (man-rems)[b]	Lung cancer deaths	All other cancer deaths	Total deaths
2	0.0934	29.9	0.000598	0.0000112	0.000609
3	0.0311	9.97	0.000199	0.00000373	0.000203
4	0.0934	29.9	0.000598	0.0000112	0.000609
5	0.0311	9.97	0.000199	0.00000373	0.000203

[a]Mainly exposure to gamma radiation.

[b]Mainly inhalation of radon-daughter products.

Table 5-6. Excess total cancer deaths for the general public within 2 kilometers (1.24 miles) of the Hanover site (114 people) due to radiation exposure during remedial action

Alternative	Whole body dose (man-rems)[a]	Bronchial dose (man-rems)[b]	Lung cancer deaths	All other cancer deaths	Total deaths
2	0	0	0	0	0
3	0	0	0	0	0
4	0.00889	10.3	0.000206	0.00000107	0.000207
5	0.00457	4.88	0.0000976	0.000000548	0.0000981

[a]Mainly exposure to gamma radiation.
[b]Mainly inhalation of radon-daughter products.

Table 5-7. Excess total cancer deaths among the remedial-action workers at the Canonsburg and Burrell sites due to radiation exposure during remedial action

Alternative	No. of workers	Whole body dose (man-rems)[a]	Bronchial dose (man-rems)[b]	Lung cancer deaths[b]	All other cancer deaths[a]	Total deaths
2	47	13.7	52.6	0.0011	0.0016	0.0027
3	43	13.6	51.1	0.0010	0.0016	0.0026
4	75	14.9	63.7	0.0013	0.0018	0.0031
5	72	14.4	55.3	0.0011	0.0017	0.0028

[a]Mainly exposure to gamma radiation.

[b]Mainly inhalation of radon-daughter products.

Table 5-8. General radiological parameters

Parameter	General public[a]	Remedial action workers[b]
Background external whole body dose (man-rems per year)[c]	6,040	3.8 - 6.6
Background bronchial dose (man-rems per year)[d]	76,900	48 - 84
EPA standard (40 CFR 192) for whole body dose (man-rems per year)[e]	18,000	---
EPA standard (40 CFR 192) for bronchial dose (man-rems per year)[f]	549,000	---
Normal expectation of lung cancer deaths per year (3 percent)[g]	63	0.04 - 0.07
Normal expectation of total cancer deaths per year (16 percent)[g]	338	0.21 - 0.37

[a]The 63,942 people within 10 kilometers of the Canonsburg site, plus the 4,546 people within 2 kilometers of the Burrell site, plus the 114 people within 2 kilometers of the Hanover site.

[b]43 to 75 in number depending on the alternative.

[c]Resulting from a gamma background of 88 millirems per year.

[d]Resulting from the gamma background plus a radon-daughter background of 0.004 working level.

[e]Calculated from the EPA standard (40 CFR 192) of 20 microroentgens per hour, plus the natural background, assuming all members of the population are exposed at that rate.

[f]Calculated from the EPA standard (40 CFR 192) in item e, plus the dose from the EPA standard (40 CFR 192) for radon-daughters of 0.03 working level, assuming all members of the population are exposed at that rate.

[g]National Academy of Sciences, 1980.

exposure to radon-222 daughter products from the radioactively contaminated materials at the Burrell site, while the latter dose implies an additional chance of 1 in 50,000.

At the Hanover site, there is no present exposure to radioactively contaminated materials. If either Alternative 4 or 5 is carried out, the most exposed person would be in a house about one-half mile to the northeast. That person would receive an excess bronchial dose of 1.4 millirems per year (Table F.3-12), implying an additional chance of 1 in 1,000,000 of dying from lung cancer.

The current radon emissions from the Canonsburg and Burrell sites have a very minor effect on populations greater than 10 or 2 kilometers away, respectively. There are no major population centers located downwind at any reasonable distance from either the Canonsburg or Burrell site; thus, the incremental population radiation doses given would be unaffected. The largest population center downwind that could be affected by radon emissions from the Canonsburg and Burrell sites is the New York-Philadelphia-Baltimore-Washington, DC complex with a population of about 30 million at a distance of 200 miles or greater from the Canonsburg or Burrell site. At this distance the radiation doses are reduced by at least an additional factor of 1000.

Although no MILDOS calculations were made at distances greater than 10 kilometers, scaling calculations indicate that the dose rate for the no action alternative to the New York-Philadelphia-Boston-Washington, DC corridor is approximately 0.001 millirem per year for a person exposed at these locations or about 30 person-rems per year for the population of 30 million. Using the risk factors given in Appendix F.3, the risk incurred for this population for this exposure would be 0.0006 lung cancer cases per year. This risk is miniscule (less than 1 chance in 1000 of a single case of lung cancer per year in the 30 million people exposed). This same population normally experiences approximately 30,000 deaths per year from lung cancer.

Under Alternative 1, the no-action alternative, additional radiation doses to the bronchial epithelium of the general population (Table F.3-1) will average 0.69 percent of background levels, and 0.097 percent of the EPA standard (40 CFR 192) on an annual basis. This could result in 0.012 additional lung cancer deaths per year among the 68,488 people living near the Canonsburg and Burrell sites (Tables 5-1 and 5-2). This represents an increase of 0.02 percent above the normally expected 63 lung cancer deaths per year. With no action, this rate of excess lung cancer deaths will continue into the future.

The population dose commitments for the estimated 96-week exposure periods would be similar for any of the proposed remedial actions (Alternatives 2 through 5), and about twice the doses for the same period in Alternative 1. These doses would range from 1736 to 1888 man-rems to the bronchial epithelium and from 18 to 22 man-rems for whole body irradiation (Tables F.3-2 to F.3-11). These doses would be due to radioactive particulates and radon-222 and its daughters. On an annual basis, these doses would range from 940 to 1023 man-rems to the bronchial epithelium and 9.8 to 12 man-rems for whole body irradiation. These doses imply an additional 0.037 to 0.040 total cancer deaths in the exposed populations over their lifetimes due to radioactivity released during the remedial action (Tables 5-4 to 5-6). The radiological impacts under each alternative would be essentially similar, thus there is no reason from a radiological health effects point-of-view to prefer any specific alternative.

Health impacts and doses would decrease significantly once any of the remedial actions are completed. At that time, the bronchial epithelium doses would become 0.21 percent of background levels, and 0.03 percent of the EPA standard (40 CFR 192) on an annual basis. This could result in a total increased cancer death rate of approximately 0.005 percent or 0.003 additional lung cancer deaths per year in the exposed populations. After any remedial-action alternative, the health effects on the exposed populations would be reduced by a factor of about 4. Thus, a decrease in potential cancer deaths should occur as a result of completing any remedial action alternative.

Impacts on the remedial-action workers would be essentially the same under each alternative, but would be higher, on an individual basis, than impacts on the general population. The incremental whole body radiation doses would be approximately twice natural background levels while the tracheobronchial doses would be approximately background with approximately 15 percent of the airborne dose due to fugitive dust, and this would increase the health risk by 0.06 to 0.08 percent of the normally expected lung cancer-death rate of 0.04 to 0.07 deaths per year over the remaining lifetimes of the remedial action workers. These estimates are based on not using radiation-protection procedures for the workers during the remedial-action activities; however, comprehensive radiation-protection practices would be used during any remedial-action activities. These practices would include training programs, contamination-control procedures, personnel-monitoring procedures, and, as necessary, respiratory-protective devices and protective clothing. (See Appendix F.5 of this Canonsburg FEIS.) Thus, the actual impacts on the workers would be lower than has been calculated.

Impacts on the general public and remedial-action workers from transporting the radioactively contaminated materials off the Canonsburg and Burrell sites would occur under Alternatives 2, 4, and 5. It has been estimated that 4600 miles would be traveled while carrying the radioactively contaminated materials in relocating them from the Canonsburg site to the Hanover site. The radiation dose commitment due to radioactively contaminated materials transportation under these alternatives would be 0.00005 man-rem to the general public and 0.1 man-rem to the truck drivers. These doses would be small compared to background and would present no serious impacts on either the general public or the remedial-action workers.

5.2.2 Radiological impacts of transportation accidents

The most probable accident would occur if a truck overturned and spilled radioactively contaminated materials onto the street.

This type of accident could expose nearby people to low levels of gamma radiation, radon gas, and radon daughters associated with these radioactively contaminated materials for a short time (U.S. NRC, 1972). This exposure rate, however, would not exceed that delivered to nearby people during the remedial action because simple steps, taken immediately, would effectively reduce the exposure. Ribbons, flags, and radiation signs would be used at the accident scene to control people. The remedial-action crews would stop their activities, go to the accident scene, and reload the radioactively contaminated spilled materials. The final cleanup would consist of sweeping, and possibly vacuuming, any radioactively contaminated material, with guidance from the safety team who would locate radioactively contaminated materials with their instruments. If the accident occurred during rainy weather, the cleanup work would probably be more difficult because the radioactively contaminated materials might be washed away by runoff. The cleanup procedure would be the same, however, and the extent and risk of public exposure would be minor.

This type of accident would take a few hours at most to clean up. The dose to the cleanup crew and the public would be insignificant. A person standing 1 meter from the spill for 15 minutes would receive a dose of 0.06 millirem. Workers cleaning up this spill would be irradiated at 0.2 millirem per hour; in a 2-hour cleanup a worker's total dose would be 0.4 millirem.

5.2.3 Comparison of radon-222 emissions with the EPA standards (40 CFR 192)

The EPA standard (40 CFR 192) for limiting radon-222 flux from the surface of a stabilized disposal site is 20 picocuries per square meter per second.

Radon-222 is a gas; its daughter products are all solids. As a gas it would diffuse upward through the cover material, decaying en route with a half life of 3.8 days. The solid daughter products would not diffuse upward. Effectively, then, the radon-222 flux would decrease exponentially according to the formula (U.S. NRC, 1979, Appendix P):

$$F = F_o \exp\left(- \sum_{i=1}^{n} X_i(\lambda P_i/D_i)^{1/2}\right)$$

Where

F = Radon-222 flux from the surface after attenuation with various cover materials (picocuries per square meter per second).

F_o = Radon flux at the base surface of the contaminated material (picocuries per square meter per second).

λ = Decay constant for radon-222 (2.1×10^{-6} s^{-1}).

s = Seconds.

P_i = Porosity or void fraction of the ith layer of the cover (dimensionless).

D_i = Effective diffusion constant for radon in the ith layer (square centimeters per second).

X_i = Thickness of the ith layer (centimeters).

Analyses were made of the effects of various cover configurations on radon-222 flux rates using a computer model developed by Rogers et al. (1981). These analyses showed that the current radon-222 flux would be reduced to well below the EPA standard (40 CFR 192) by the proposed cover (see Appendix A.1, U.S. DOE, 1982b).

Similar calculations have shown that at the Canonsburg site the radon flux from the radioactively contaminated materials not encapsulated (i.e., the material either radioactively contaminated to levels no greater than 100 picocuries per gram or that material radioactively contaminated to levels above 100 picocuries per gram and contained in small amounts) would also be controlled to below the EPA standard (40 CFR 192) with the proposed cover material.

The EPA standards (40 CFR 192) also contain a longevity requirement; i.e., that there is a reasonable expectation that the disposal configuration used will meet the EPA standard (40 CFR 192) for at least 200 years, and to the extent practicable, 1000 years. At the Canonsburg site, longevity would be ensured by two cover characteristics. First, the clay component of the layered cover would stay wet and therefore not crack because it would be in a wet environment and the overlying soil and drain layer would smooth out seasonal changes in rainfall. Second, the cover would be revegetated at the beginning by seeding and later by natural successional processes; it would thus resist erosion.

The amount of erosion can be estimated by using the Universal Soil Loss Equation. This equation predicts an annual loss of soil from the expanded Canonsburg site during construction activities when no soil stabilization techniques can be employed of 12.75 tons per acre (Table A.5-2), or at a density of 100 pounds per cubic foot, an annual loss of soil of 0.006 foot per year. Appendix A.5 also presents estimates of potential soil losses from each site following stabilization with vegetation. These estimates show that at the expanded Canonsburg site the soil lost over 1000 years would be about 0.12 inch (Table A.5-4).

At the Burrell site, the radon-222 flux is already less than 20 picocuries per square meter per second; therefore no additional measures are required under Alternative 3 or 5 to meet the EPA standard (40 CFR 192). The grading and cover proposed at the Burrell site would keep the thickness of soil removed by erosion down to 0.56 inch in 1000 years (Table A.5-4) (U.S. DOE, 1982c).

If the Hanover site is used (Alternative 4 or 5), a burial plan equivalent to the one just analyzed for the expanded Canonsburg site would ensure adherence to the EPA radon-222 flux standard (40 CFR 192). In this case the potential erosion loss during 1000 years would be about 1 inch (Table A.5-4).

5.3 IMPACTS ON AIR QUALITY

Each of Alternatives 2 through 5 would generate the following nonradiological pollutants:

1. Suspended particulates.

2. Nitrogen oxides (NO_x).

3. Sulfur oxides (SO_2).

4. Carbon monoxide (CO).

5. Hydrocarbons (HC). (Although the EPA has revoked the primary and secondary NAAQS (40 CFR 50) for hydrocarbons (48 FR 628-629, January 5, 1983), the revoked hydrocarbons standard is still included for completeness.)

Gaseous pollutants (NO_x, SO_2, CO, HC) would be generated by tailpipe emissions from the construction vehicles and equipment on the site and from the trucks used to haul fill and radioactively contaminated materials on and off the site. Total suspended-particulate emissions would be generated by a variety of activities, including the following:

1. General construction activities (demolition and earth moving).
2. Storage-pile stacking.
3. Wind erosion from storage piles.
4. Fugitive roadway emissions from hauling.
5. Exhaust emissions from construction vehicles and trucks.

The emissions from all of these activities have been included in calculations of the emission rate for each period, alternative, and site. Appendix B.2 describes the methods used to calculate these emission rates and to estimate the maximum emission rate for each pollutant. Because a conservative approach was used to calculate the emission rates, the results presented in Appendix B.2 are the maximum potential emission rates that the proposed remedial-action activities could produce. For gaseous pollutants, no mitigation procedures were assumed. For particulate emissions the following mitigation measures were assumed:

1. All unpaved roadways would be sprayed at least four times per year during the remedial action with a surfactant based on the frequency of dry periods (Cowherd et al., 1979).

2. All storage piles would be sprayed with water during dry periods.

3. Construction areas would be sprayed with water during dry periods (defined as any 7-day period when precipitation is less than 0.02 inch for all one-hour intervals within the 7 days).

Another assumption, based on an evaluation of fugitive emissions by the EPA (Cowherd et al., 1979), is that the recommended mitigation measures would reduce total suspended-particulate emissions by 90 percent.

The controlled emission rates were used to calculate the ambient air-quality impacts of the alternatives. The first step in modeling the pollutant dispersion used an EPA-approved area-source-screening model, the Climatological Dispersion Model (Busse and Zimmerman, 1977), to calculate the maximum potential offsite impact of the activities in each alternative. This analysis indicated that for some alternatives at some sites, an exceedance of the total suspended particulates standard might occur. Therefore, a more refined modeling approach was used to better quantify the impacts. The EPA-approved Industrial Source Complex Model (Bowers et al., 1979), was used to predict the 1-hour, 3-hour, 8-hour, 24-hour, and annual impacts of the proposed actions. For the short-term impacts, it was assumed that the winds were constant at 6.56 (2 meters) per second and from the same 10-degree sector for 24 hours and that the atmosphere was slightly stable. These conditions occur approximately 5 percent of the time in the area based on the onsite meteorological data collected at the Canonsburg site and the meteorological data from the Pittsburgh Airport (i.e., Hanover site information). For the annual average concentration, the measured meteorological conditions for 1979-1980 were used in the model.

For the Canonsburg site, meteorological data collected on the site were used for the analysis. The Canonsburg site data were corrected for the local topography at the Burrell site, and were used for the Burrell site analysis. Pittsburgh International Airport data were used for the Hanover site. The details of the modeling analysis are found in Appendix B.2. The predicted concentrations are the maximum potential ambient concentrations; they are summarized in Table 5-9. Also included in Table 5-9 are measured background concentrations for each pollutant and the National (40 CFR 50) and State (25 PA Code 131) Ambient Air Quality Standards.

Alternative 3, stabilization of the radioactively contaminated materials in place at both the Canonsburg and Burrell sites, should result in the minimum incremental air-quality impact in the Canonsburg site area. Alternative 2, stabilization of all radioactively contaminated materials at the Canonsburg site, should result in a slightly higher incremental air-quality impact than Alternative 3. The total ambient air-pollutant concentration (incremental plus background) for all pollutants for both the Canonsburg and Burrell sites under either Alternative 2 or 3 is predicted to be below the NAAQS (40 CFR 50).

Table 5-9. Maximum predicted ambient air-quality impacts due to remedial action[a]

Alternative	Site	TSP[b] ($\mu g/m^3$) Annual[c]	TSP[b] ($\mu g/m^3$) 24-hour	SO_2 ($\mu g/m^3$) Annual[c]	SO_2 ($\mu g/m^3$) 3-hour	SO_2 ($\mu g/m^3$) 24-hour	CO (mg/m^3) 1-hour	CO (mg/m^3) 8-hour	NO_x ($\mu g/m^3$) Annual	HC ($\mu g/m^3$) 3-hour	Settleable particulates (tons/sq mi-month)
2	Canonsburg	5.9	53	4.9	124	41	1.90	1.86	54	50	0.33
	Burrell	2.1	24	3.1	92	30	2.68	2.60	32	44	0.11
3	Canonsburg	4.4	43	4.6	96	31	1.93	1.89	50	28	0.24
	Burrell	2.8	22	3.3	62	20	1.85	1.80	35	20	0.15
4	Canonsburg	8.9	65	6.2	127	42	2.16	2.11	66	48	0.50
	Burrell	2.1	24	3.1	92	30	2.68	2.60	32	44	0.11
	Hanover	9.0	147	3.2	215	68	1.97	1.81	33	123	3.15
5	Canonsburg	8.9	65	6.2	127	42	2.16	2.11	66	48	0.50
	Burrell	2.8	22	3.3	62	20	1.85	1.80	35	20	0.15
	Hanover	8.3	156	3.2	215	68	1.97	1.87	33	123	2.86
Background concentration		67[e]	74[e]	47[e]			1.14[f]		20[f]		18[e]
National primary standard (40 CFR 50)		75	260	80		365	40	10	100	160	
National secondary standard (guideline) (40 CFR 50)		60[g]	150		1,300		40	10	100		
Pennsylvania standards (25 PA Code 131) (same as National Primary and Secondary Ambient Air Quality Standards (40 CFR 50))											43

[a]Incremental levels must be added to background to determine exceedance of standards.

[b]Assumes reduction of TSP by 90 percent due to mitigation measures.

[c]Assumes an 8-hour per day, 5-day per week, 50-week per year work schedule.

[d]Secondary-standard exceedance.

[e]Measured background; TSP and settleable particulates from 1981 data collected at Washington, Pennsylvania; SO_2 from 1981 data collected at Florence, Pennsylvania.

[f]Estimated background based on suggested rural background concentrations (U.S. EPA, 1978).

[g]This value is a guide to be used in assessing implementation plans for achieving the annual maximum 24-hour standard.

At the Hanover site, under both Alternatives 4 and 5, the estimated 24-hour incremental total-suspended-particulate concentrations, when added to the assumed background, are predicted to be greater than the nonhealth-related, secondary NAAQS (40 CFR 50) by 47 to 53 percent. In addition, the predicted annual ambient air pollutant concentration at the Hanover site due to the remedial activities, when added to background, is predicted to exceed the primary NAAQS (40 CFR 50) for total suspended particulates by 1 percent.

It should be noted that the significance of the predicted exceedances is not great for the following reasons:

1. The location of the highest total-suspended-particulate concentrations at the Hanover site would be at the property line; the concentrations would be significantly reduced farther from the property line.

2. The Hanover site area is sparsely populated; the nearest residence to the Hanover site is located approximately 0.65 kilometer from the property line.

3. The project duration would be relatively short (approximately 2 to 3 years).

4. Fugitive emissions from unpaved roadways would be the primary source of particulate emissions during extended dry periods.

All pollutant concentrations, including background, other than total suspended particulates, are predicted to be less than NAAQS (40 CFR 50) at all sites for all alternatives.

This evaluation did not include ozone because ozone modeling has not been developed for this type of project. It is not possible at this time to address ozone concentrations quantitatively. The effect of the remedial-action alternatives on ozone levels is not expected to be significant because the nitrogen oxide and hydrocarbon emissions are not great. Both nitrogen oxides and hydrocarbons for all remedial-action alternatives would be below the NAAQS (40 CFR 50), and the period of activity would be short; therefore, it is not likely that they would have a significant impact on air quality.

The air quality impacts from radioactively contaminated materials movement would be primarily related to total suspended particulates. Effects on transportation routes would not be significant because the high total suspended-particulate concentrations would only be associated with onsite construction and transportation activities. Fugitive-dust emissions are caused by reentrainment of dust deposited on roadways during hauling activities. Covering the trucks would prevent large amounts of dust from reaching the roadways, thereby minimizing the generation of fugitive dust.

Material movement during any of the remedial-action alternatives would have negligible offsite visibility impacts. Most of the particles generated by the activities would be very large and they would settle out quickly. The fugitive particles would be larger than the most effective light-scattering diameter; therefore, while there would be a high concentration of particles in the immediate site-construction area, any effects on visibility should not extend off the site.

The duration of air-quality impacts (Table 5-10) experienced at each site would be equal to the period of construction and earth-moving.

Table 5-10. Duration of air quality impacts at each site for each alternative

Alternative	Site	Impact duration (months)
2	Canonsburg	23
	Burrell	21
3	Canonsburg	22
	Burrell	7
4	Canonsburg	25
	Burrell	21
	Hanover	30
5	Canonsburg	25
	Burrell	7
	Hanover	26

It should also be noted that the air emissions would not be constant during these periods. The concentrations of airborne materials would be reduced at the close of workdays and during those days when no work was in progress. Because the impacts on air quality would be caused by earth-moving and equipment operation, only the time intervals during which these activities would occur are considered the impact duration (i.e., the actual time frame for air emissions from the sites would be shorter than the entire project duration).

5.4 IMPACTS ON TOPOGRAPHY, SOILS, AND GEOLOGICAL STABILITY

5.4.1 Impacts on topography

The no-action alternative would not alter the topography at any of the three sites.

Alternative 2 would affect both the Burrell and Canonsburg sites. The removal of 80,000 cubic yards of radioactively contaminated materials from the Burrell site and its subsequent replacement with 16,000 cubic yards of fill would lower the overall elevation of the project area. Depending on the final grading plan, to be specified in the final design, the reduction in elevation could increase the extent and frequency of flooding at the Burrell site in areas below the maximum flood-pool elevation. However, the site would have been decontaminated and no radioactively contaminated material could mix with the flood waters to be carried off the Burrell site.

Alternative 2 activities at the Canonsburg site would raise the elevation of Areas A and B. To minimize elevation changes, Area C would be filled with the same amount of material that is excavated. The elevation of Area A would be raised 10 to 20 feet to a maximum of approximately 1006 feet above mean sea level, and the topography of Area B would be changed similarly. The low area along Ward Street between Areas A and B would be eliminated. The final grade would be a smooth slope from Area A and the encapsulation area that would fill Ward Street. Since those residences situated along Wilson Avenue will be demolished, the filling of Ward Street would be economical, and the resultant grade would minimize runoff.

Alternative 3 would have much the same impact as Alternative 2 at the Canonsburg site. At the Burrell site the major change from the present topography would be grading the cover material and smoothing out the present irregular surface.

Alternative 4 would affect all three sites. The impact of this alternative on the Burrell site would be the same as for Alternative 2. The radioactively contaminated materials removed from the Canonsburg site would be replaced by approximately the same amount of fill to pre-project elevations. The impact of Alternative 4 would be significant at the Hanover site. The southern half of the trench along the ridge top would be filled to slightly above the existing trench walls. The northern half of the trench would be untouched; the northern wall of the fill would slope toward the trench floor. Therefore, the northern half of the trench would become a semi-enclosed depression.

The impacts of Alternative 5 at the Canonsburg and Hanover sites would be the same as for Alternative 4. At the Burrell site the impacts would be the same as for Alternative 3.

5.4.2 Impacts on soils

In all of the alternatives but the no-action alternative, soils would be imported from local commercial sources and stockpiled for construction and stabilization. The stockpiles would be surrounded by collection trenches to eliminate soil loss. The amount of materials to be imported are given in Table 1-3. All of the in-situ soil at the Canonsburg and Burrell sites with radium-226 concentrations of less than 100 picocuries per gram would remain on the sites under stabilization. Because of the presence of large amounts of fill material at all three sites, the soils are not considered productive. The materials needed for covers are readily available, except in the area of the Burrell site (Appendix A.6). The project would not affect the local availability or supplies of these cover materials.

5.4.3 Geological stability

As indicated in subsection 4.5.3.1, there has been extensive mining of the Pittsburgh coal seam that occurs in the general Canonsburg site area. The coal seam originally situated at the Canonsburg site was eroded away by the natural forces creating the Chartiers Creek valley. This has resulted in the Canonsburg site area being situated both topographically and stratigraphically lower than the surrounding coal-bearing areas. Because the Canonsburg site has not been mined and local mining activities have occurred at elevations higher than the Canonsburg site, mine subsidence, where it would occur, could not affect the Canonsburg site. The topographical and stratigraphical differences between the Canonsburg site and the surrounding area should continue to prevent any secondary recovery of Pittsburgh coal in the area from affecting the Canonsburg site.

The next lowest coal seam in the Canonsburg site area is the Freeport, which is about 900 feet below the surface. The risk of subsidence affecting the surface decreases markedly with depth; there is little or no surface hazard at depths greater than 500 feet. Therefore, the possibility of mining the Freeport coal in the Canonsburg site area should not present any subsidence risk to the Canonsburg site. The DOE would acquire the mineral rights under the disposal site.

Another concern over the Canonsburg site's geological stability pertained to the extensive amounts of landfilling that has occurred on the Canonsburg site. Well drilling and bore-hole logs were examined for the Canonsburg site area where the encapsulation cell would be located. These logs revealed a well-packed substrate that should not present any problems under the proposed vertical loading. (Lateral loading by flooding would be prevented by positioning the encapsulation area above the 100-year flood plain.)

The Canonsburg site soils are medium stiff to stiff clays and medium dense to dense sands and silty sands. The clays would settle due to placement of the encapsulation cell. However, as cell construction would be progressive, settlement would also be progressive (to a limit). The settlement should be virtually complete at the close of the encapsulation cell construction. Landslides would not occur because of the construction sequencing and flat slopes. The stability of the banks of Chartiers Creek would be ensured by the placement of rip-rap.

The Burrell site, like the Canonsburg site, contains a large amount of fill material. Unlike the Canonsburg site, the fill material at the Burrell site is not well compacted. This condition has been taken into account in the design of the remedial action plan for the Burrell site, which would include very little vertical loading. Additionally, the Burrell site disposal area would not be situated in a flood-prone area.

The major geological stability issue for the Hanover site concerns the fact that past mining operations have created a high porosity substrate at the Hanover site. This should be of little concern, however, since the proposed encapsulation cell structure would completely enclose the radioactively contaminated materials within a low permeability cover and liner. This procedure would significantly reduce both the infiltration of precipitation, as well as the possibility of radioactively contaminated materials leaching into the Hanover site's environment.

5.5 IMPACTS ON MINERAL RESOURCES

The Pittsburgh coal seam does not occur at the Canonsburg site because it has been eroded away in past geologic time. It is also absent from the Burrell site, and it has been removed from the Hanover site by strip mining. No deeper layers at the Hanover site are thick enough to be mined economically with present mining methods. Thus, there would be no impact on coal resources at any of the three sites. Oil and gas could still be recovered by directional drilling if they are present at any of the sites. The DOE would acquire the mineral rights under the disposal site(s).

5.6 IMPACTS ON WATER

5.6.1 Impacts on surface water

The no-action alternative would have little effect on surface-water quantities or use of the surface-water systems associated with the Canonsburg, Burrell, or Hanover sites. Chartiers Creek will continue to receive sediment and ground-water discharges from the Canonsburg site. The discharge of ground water has had no detectable effect on surface-water quality to date (see subsection 5.6.2), and would not be expected to have a detectable effect in the future if the current rate and quality of discharge continues. The discharge of radioactively contaminated soil to the creek as sediment resulting from scouring in Area C would be expected during a 500-year flood event. In addition, continued surface erosion of Area C during lesser storm events would contribute radioactively contaminated sediment in runoff because of the elevated levels of radioactivity in the soil on and near the surface of Area C.

The Burrell site would continue to discharge ground water and sediment to the Conemaugh River. The quality of the soil and ground water at the Burrell site is mildly degraded; however, this discharge would have no detectable effect on the Conemaugh River because of the existing poor quality of the river water.

Under Alternative 2 waste waters generated by construction activities would be treated and discharged into Chartiers Creek and the Conemaugh River at the Canonsburg and Burrell sites, respectively. These wastes include process wastes, as well as precipitation collected in and around the work areas. Before discharge, these waste waters would be treated by temporary facilities located at the two sites. Both facilities would be operated under National Pollutant Discharge Elimination System (NPDES) permits, and the discharges would meet all applicable water-quality criteria (40 CFR 124). Further water-quality protection at both sites would be provided by the installation of erosion-control measures including dikes around work areas and along the length of Chartiers Creek at the Canonsburg site. Erosion during normal rains (nonflooding) is not a concern at the Burrell site because the extremely high permeability of the landfill material minimizes any runoff or erosion from the Burrell site.

The expanded Canonsburg site is partially contained within the 100-and 500-year flood plains of Chartiers Creek. During excavation and construction activities within these flood plains, in Area C in particular and in Area B to a lesser degree, some radioactively contaminated soil and fill could be discharged into the creek during flooding or heavy rains. In order to prevent such discharges from occurring, erosion control and flood protection would be provided during the earth-moving activities.

Remedial activities at the expanded Canonsburg site and the Burrell site would have no effect on surface-water quantities at either the expanded Canonsburg site or the Burrell site. The consumptive water use is expected to be less than 20 gallons per minute for any of the remedial actions at any site. This would not place a heavy demand on local water systems. Process water would not be taken from surface-water systems, but would be supplied from the local water system. Discharges at each site would be less than 1 cubic foot per second, which is insignificant in comparison to flows in either Chartiers Creek or the Conemaugh River.

Over the long term, Alternative 2 would have beneficial impacts on surface-water conditions at the expanded Canonsburg site. The current erosion from the expanded Canonsburg site and associated sediment and contaminant loading of Chartiers Creek would be reduced by stabilization of the expanded Canonsburg site and the improved site drainage. Installation of the encapsulation cell and final site grading would divert precipitation from the radioactively contaminated materials and would prevent the radioactively contaminated materials from getting into suspension. Alternative 2 would not cause any change in the water use of Chartiers Creek.

As described in Appendix A.1, the encapsulation cell at the expanded Canonsburg site would be located above the 100-year flood plain and would be protected against erosion from changes in the creek alignment under Alternatives 2 and 3. Two mitigation measures to protect against active streambank erosion and possible changes in the creek bed would be proposed. First, the area of the abandoned street railway berm would be graded to a much lower level. This would eliminate the constriction of creek flows and reduction of water velocity during flood events. Secondly, a buried wall of rip-rap would be placed along the eastern side of the expanded Canonsburg site. Thus, if the creek bed should spread onto the expanded Canonsburg site, the rip-rap wall would provide a protective barrier against further encroachment.

There would be no changes in the overall site-drainage patterns at the Burrell site following Alternative 2. Precipitation falling onto the Burrell site would continue to percolate into the ground. Any runoff from the filled excavation area would infiltrate the surrounding landfill area. Removing the radioactively contaminated materials from the Burrell site would eliminate any indirect contaminant loading caused by leaching water through the remaining residues. Alternative 2 would not cause any changes in the water uses of the Conemaugh River.

Alternative 3 would have the same short- and long-term effects on the expanded Canonsburg site's surface waters as Alternative 2. The potential for short-term water-quality impacts at the Burrell site would be significantly less in Alternative 3 than in Alternative 2 because there would be no excavation or exposure of the radioactively contaminated materials. As a result, stabilization of the Burrell site would not require a waste-water treatment facility, nor would there be any process water discharge to the Conemaugh River. Standard erosion-control measures would be used to prevent the erosion of stockpiled construction materials during heavy rains.

Alternative 3 could result in an increase in runoff from the stabilized area at the Burrell site due to the cover. As at the expanded Canonsburg site, final site grading would be designed to divert runoff. The permeability of the remaining landfill materials would allow infiltration of this water. The stabilization of the small amount of radioactively-contaminated materials remaining on the Burrell site would have a beneficial impact on the Burrell site area's surface-water system because the cover would reduce the amount of water infiltrating the radioactively contaminated materials and leaching the contaminants. This alternative would have no effect on long-term surface-water usage at either the expanded Canonsburg site or the Burrell site.

Alternative 4 would have the same short-term surface-water impacts at the Canonsburg site as Alternatives 2 and 3, and would include the same protective measures. After this alternative is completed, the radioactively contaminated materials would be eliminated as a possible source of surface-water contamination. As in the other alternatives, the Canonsburg site would be graded to provide improved site drainage and flood protection.

Both the short- and the long-term surface-water impacts at the Burrell site would be the same as for Alternative 2.

Under Alternative 4, the potential for degrading surface-water quality at the Hanover site during construction activities would be offset by the same kind of protective provisions employed during stabilization at the Canonsburg site. An onsite waste-water treatment facility would be operated under an NPDES permit (40 CFR 124) during the project activities. Unlike the Canonsburg site, the Hanover site is not subject to flooding. Protection against erosion from storm-water runoff, including dikes around the work areas, would still be used. There would be no changes in surface-water quantities at the Hanover site during project activities. Water would not be supplied from surface-water systems, and the waste-water treatment facility would discharge less than 1 cubic foot per second.

The remedial actions at the Hanover site would have a long-term beneficial impact on the surface-water system. The final site grading would be a major improvement in site drainage, thereby reducing erosion and contaminant loading into the local watershed. The radioactively contaminated materials would be hydrologically isolated by the encapsulation cell and would not be subject to leaching. The semi-enclosed depression that would be created at the north end of the Hanover site would drain to an adjacent unnamed tributary to Harmon Creek outside the western side of the Hanover site.

Overall, this alternative would have no long-term effect on surface-water use at any of the three sites.

Short- and long-term surface-water impacts at the Canonsburg and Hanover sites under Alternative 5 would be the same as for Alternative 4, while at the Burrell site they would be the same as for Alternative 3.

Thus, in all of the remedial-action alternatives, little, if any, of the sites' radioactively contaminated materials would enter the surface-water systems because rain and flood water would be prevented from entering the radioactively contaminated materials.

5.6.2 Impacts on ground water

The types of ground-water impacts to be considered include changes in quantity and quality. None of the alternatives would affect ground-water use since there is no significant ground-water use in the areas around the three sites, and the three sites' ground-water systems are not tied into major regional aquifers.

Additional ground-water data at the expanded Canonsburg site have been obtained since publication of the Canonsburg DEIS (U.S. DOE, 1982a). These data were collected at both onsite wells on the expanded Canonsburg site and offsite wells both upstream and downstream of the expanded Canonsburg site. These studies provided a better characterization of the hydrological and geological conditions of the expanded Canonsburg site. A computer-modeling study of the groundwater regime at the expanded Canonsburg site has also been completed.

Under Alternative 1 the hydrogeological regimes at the Burrell and Canonsburg sites would remain unaltered. At the Burrell site, only two ground-water samples had appreciable radiation levels (Table F.1-5), one for radium-226 and one for gross alpha. Most of the ground water passing through the Burrell site exits the subsurface system as discharge into the onsite ponds and the Conemaugh River, where it is not detectable because of dilution.

Under Alternative 2, the removal of radioactively contaminated materials from the Burrell site would have a negligible impact on the Burrell site's ground-water quality. The intakes for the Blairsville Borough Water Company are located south of the Burrell site on top of a mountain. This water supply would not be impacted by any leaching occurring at the Burrell site. This is also true of the water supply of the Central Pennsylvania Water Company (High Ridge). The Lower Indiana County Water Authority is a distribution system, and does not operate a water-treatment plant. This Authority obtains finished water from the Central Pennsylvania Water Company (Chnupa, 1983). The Burrell site's radioactively contaminated materials would not act as an additional source of appreciable offsite radiological contamination at the Canonsburg site.

Although none of the alternatives would affect the contaminants presently in the ground water, stabilization of the expanded Canonsburg site would have a beneficial long-term effect on the ground-water quality. Encapsulation of the Canonsburg site's radioactively contaminated materials would largely eliminate this material as a source of potential long-term contamination by greatly retarding further movement of radioactively contaminated materials into the ground water. Regrading the expanded Canonsburg site, adding a low-permeability cover material, and placing the encapsulated area over Ward Street would have an effect on local ground-water-flow patterns. The present ground-water mound in Area A would be reduced since the ground-water mound is largely the result of direct infiltration of precipitation. The low-permeability cover over the whole Canonsburg site and the construction of the encapsulation cell in Areas A and B would reduce the infiltration of precipitation, and therefore, reduce the ground-water mound in Area A, the hydraulic gradients, and the amount of outflow. The effect of such local changes would not be detectable at the expanded Canonsburg site boundary, and would not have a negative effect within the expanded Canonsburg site. The bottom of the encapsulation cell at the expanded Canonsburg site would be located so that it is not resting in ground water. The final encapsulation cell placement at the expanded Canonsburg site would ensure that there is no direct contact between the encapsulated radioactively contaminated materials and the ground water.

For Alternatives 2 and 3, ground-water levels at the expanded Canonsburg site would decline due to reduced infiltration of precipitation. Post-encapsulation water elevations in the water-table system were simulated (Gilbert et al., 1983) using an infiltration rate of 1.5 inches per year through the encapsulation cell and a 50 percent reduction in infiltration over the rest of the expanded Canonsburg site. The calculated decline in water elevation ranges from 1 to 7 feet around the encapsulation cell.

During construction under Alternatives 2 through 5, the water table in Area C of the Canonsburg site would be temporarily lowered to dewater Area C for removal of the radioactively contaminated materials. Pumping would cease when the excavation is complete.

Equations from Gilbert et al. (1983) were used to predict the post-encapsulation transport of uranium from the encapsulated area of the expanded Canonsburg site into the water-table system under Alternatives 2 and 3. The simulation was conducted using both probable and worst-case conditions. Under the probable conditions it was calculated that uranium would not begin leaching from the encapsulated area for 46,000 years, and that the leaching would last for 150,000 years. The uranium concentration in the leachate would be 0.009 milligram per liter. The uranium concentration in the receiving ground water would be lower due to dilution. Under worst-case conditions, uranium would begin leaching after 1100 years and continue to leach for 3775 years. The concentration of uranium in the leachate would be 0.37 milligram per liter. Again, the concentrations in ground water would be lower due to dilution.

The post-encapsulation-uranium migration in the water-table system was calculated for the sources remaining outside the encapsulation area. The source in Area C (source 1) would be reduced by 90 percent due to the absence of the radioactively contaminated materials removed to the encapsulated cell. The source simulated at well 404 (source 4) would remain unchanged. The other two sources (sources 2 and 3) would be removed during the remedial-action program. The predicted concentrations from source 1 are 0.012 milligram per liter and 0.006 milligram per liter, 40 feet and 20 feet upgradient of Chartiers Creek, respectively. Concentrations predicted for source 4 are 0.006 milligram per liter and 0.003 milligram per liter, 40 and 20 feet upgradient of Chartiers Creek, respectively. These releases would occur under Alternatives 2 through 5.

The ground-water impacts under Alternative 3 would be similar to those for Alternative 2 for the expanded Canonsburg site and Alternative 1 for the Burrell site.

The ground-water impacts under Alternative 4 at the Burrell site would be similar to Alternative 2. At the expanded Canonsburg site the removal of the radioactively contaminated materials would have a long-term beneficial effect on water quality. Contamination of the ground water at the Hanover site should not occur because the radioactively contaminated materials disposed of at the Hanover site would be encapsulated.

The ground-water impacts under Alternative 5 would be similar to those under Alternative 4 for the expanded Canonsburg site and the Hanover site and Alternative 1 for the Burrell site.

Acid seeps are not anticipated to occur for the following reasons:

1. At the Canonsburg site, both surface and ground water are neutral to alkaline (Tables D.1-3 and D.2-2). Infiltration of precipitation would be reduced. Therefore, acid seeps are not expected.

2. At the Burrell site, both surface and ground water are acid to neutral (Tables D.1-8 and D.2-6). The acidity can be attributed to the water flowing into the Burrell site from upgradient areas. Infiltration of precipitation would be reduced. New acid seeps are not expected.

3. At the Hanover site, both surface and ground water are acid to neutral (Tables D.1-12, D.1-13, and D.2-7). The acidity can be attributed to the fact that the Hanover site is a reclaimed surface coal mine. Infiltration of precipitation would be reduced. Therefore, new acid seeps are not expected (and in any case, the radioactively contaminated material would be isolated from any acid ground water).

Thus, the remedial-action design would promote neutralization of any acid from pyritic materials by substantially increasing the partial pressure of carbon dioxide under the cover, and preventing fresh influxes of oxygen-carrying water.

The stabilization of radioactively contaminated materials at the expanded Canonsburg site or at the Hanover site would reduce the infiltration of precipitation and isolate the more radioactively contaminated materials from ground water. The part of the ground water that is fed from upgradient ground water would not be affected and would continue to flow laterally under the expanded Canonsburg site and the Hanover site. The net effect would be a lowered ground-water mound, smaller hydraulic gradients, and smaller shallow ground-water velocities.

Almost every water sample analyzed in the three site areas, whether surface or ground water, was high in sulfates. This is a property of the region, not something caused by the radioactively contaminated materials. Note, for instance, the similar sulfate concentrations upstream and downstream of the Canonsburg site in Chartiers Creek (Table D.1-4).

The measured pH values show both surface and ground water at the Canonsburg site to be neutral to alkaline (Tables D.1-3 and D.2-2). At the Burrell and Hanover sites the measured pH values are acid to neutral (Tables D.1-7, D.1-11, D.1-12, D.2-5, and D.2-6). At the Hanover site the acidity of the ground water can be attributed to the fact that the Hanover site is a reclaimed surface coal mine. However, should the Hanover site be used for disposal of radioactively contaminated materials, the radioactively contaminated materials would be isolated from ground water in two respects:

1. The radioactively contaminated materials would be above the water table, which is just above the undisturbed bedrock.

2. The radioactively contaminated materials would be encapsulated with impermeable material completely surrounding it.

In summary, acid seeps are not expected to result at any of the three sites as a result of radioactively contaminated materials handling or stabilization. In addition, at the Hanover site, where there is acid ground water independent of the radioactively contaminated materials, the radioactively contaminated materials would not be in contact with ground water.

The preferred alternative, with respect to ground-water quality and quantity, is Alternative 3 for the following reasons:

1. The major amount (± 90 percent) of radioactively contaminated materials at the Canonsburg site would be removed and encapsulated above the ground-water table and would be protected from infiltration of precipitation.

2. Additional radioactively contaminated materials would not be disposed of at the Burrell site. It would be extremely difficult to ensure the integrity of an encapsulation cell at the Burrell site unless the fill were removed. At present the ground water at the Burrell site is only slightly contaminated.

3. Radioactively contaminated materials would not be disposed of at a currently nonradioactively contaminated site.

5.7 IMPACTS ON PLANTS AND ANIMALS

5.7.1 Impacts on terrestrial biota

Under the no-action alternative all of the Burrell and Hanover site areas, and the majority of the expanded Canonsburg site, would remain in open use. Since the succession of these three sites to wooded areas appears to have been arrested by their substrate conditions, these sites would probably remain as old field habitats.

Alternatives 2 through 5 would have the same short-term impacts on the terrestrial biota at all three sites. Both stabilization and decontamination would disrupt terrestrial habitat to the same degree because of the earth-moving activities. The major difference between these alternatives would be the length of time that the sites are disrupted and the number of sites involved. Over the short-term nearly all of the terrestrial vegetation and associated habitat would be disrupted at the project sites. The riparian vegetation along Chartiers Creek may be disturbed, depending on the extent of earth moving required on the expanded Canonsburg site.

All three sites are inhabited primarily by old-field animals (small mammals and some passerine birds). Individual animals could be lost either through road kills or competition when they try to relocate in other areas. The mortality of these individual animals would not threaten the continued survival of any species, since all of the three sites' inhabitants are common throughout the region. Larger animals that feed at the Burrell and Hanover sites would avoid these areas until the construction was completed.

Long-term impacts would not be different for any of the three sites following any of the alternatives. Stabilization at the expanded Canonsburg site, or at the Burrell or Hanover site would mean that the three sites would become perpetual old field habitats since tree growth would be prevented. Once the vegetation has been stabilized, small animals would move back into either of the three sites from the surrounding areas.

Decontamination of the Burrell and Canonsburg sites would also leave portions of these two sites in open space because of the Burrell site's land-use controls and because a portion of the Canonsburg site is within the flood plain of Chartiers Creek. These undeveloped areas could eventually become wooded habitats.

5.7.2 Impacts on aquatic biota

The potential short-term impacts (those occurring during project implementation) on aquatic biota at any of the three sites would be the same during all of the alternatives since each alternative would involve similar earth-moving activities. The only differences between the alternatives would be in the length of time over which the short-term impacts could arise, and the number of sites involved.

All of the alternatives except stabilization at the Burrell site would involve the discharge of process waste waters into nearby watercourses. These discharges would be treated by onsite facilities to meet NPDES requirements (40 CFR 124) before discharge. The average quantity of discharge would be less than 1 cubic foot per second, which would not alter natural flow conditions.

Unplanned releases of radioactively contaminated materials into any of the three surface-water systems could arise from flooding of disturbed areas at the Canonsburg or Burrell sites, or from large-scale runoff from any of the three sites during a high-intensity rainfall. To reduce the possibility of radioactively contaminated materials eroding from the three sites during these situations, flood- and erosion-control structures would be implemented to isolate disturbed areas from surface-water systems. The primary result of an unplanned discharge would be an increase in turbidity. Increases in turbidity are commonly experienced during high-water situations; however, disturbed sites contribute greater than normal quantities of material. Because the surface-water systems associated with the three sites are not closed systems (i.e., they are free-flowing), the suspended soil material would not remain in one place for a long time; it would settle in areas of lower water velocity.

The erosion of disturbed material from the three sites could also carry both radioactively and nonradioactively contaminated materials into the watercourses. The radioactively contaminated materials would remain temporarily suspended in the water column with some possible uptake by aquatic plants and animals. It would eventually settle in the stream beds over a wide area. The radioactively contaminanted materials could become incorporated into the substrate, become resuspended and transported downstream, or be assimilated into organisms.

Alternatives 2 through 5 are designed for long-term isolation of the radioactively contaminated materials from surface-water systems. There would be no discharges of radioactively contaminated materials into any of the three sites' associated aquatic ecosystems. Particularly at the Canonsburg and Hanover sites, the remedial actions would increase soil-material stabilization and decrease erosion. The sediment and contaminant loadings from the Canonsburg and Burrell sites would be reduced from the present levels.

5.7.3 Impacts on endangered species

As discussed in subsection 4.7.4, there are no known endangered or threatened species or critical habitats located near any of the three sites (Appendix E.3).

5.8 IMPACTS ON LAND USE

The long-term direct impacts of Alternatives 2 through 5 on the existing and future uses of the three sites are summarized in Table 5-11. The major change in land use at the expanded Canonsburg site under Alternatives 2 and 3 would be the conversion of the 18.5-acre Canonsburg site to controlled (limited use or unusable) open space owned by the Federal government. Alternatives 2 and 3 would also eliminate the residential use of the six houses on Wilson Avenue and one house on George Street and the use of the former Georges Pottery property since these properties would be included in the expanded Canonsburg site because of their proximity to the Canonsburg site. Under Alternatives 4 and 5, depending on the degree of decontamination implemented, the Canonsburg site would either be converted to controlled open space or would be made available for use in accordance with the Borough's land-use controls. Alternative 1 would leave the Canonsburg site in its present condition with its future use questionable because the property has been condemned by the Commonwealth and businesses will be vacated by October 1983. The economic impacts of moving the Canonsburg site's businesses under all alternatives would be minimal because they are entitled to relocation assistance.

Table 5-11. Long-term land-use changes associated with the alternatives

Location	Changes in land use: From (existing use)	Changes in land use: To (use after remedial action)
Canonsburg site (30 acres)		
Alternative 1	Industrial[a]	Industrial
Alternative 2	Industrial[a]	Unusable or limited-use open space
Alternative 3	Industrial[a]	Unusable or limited-use open space
Alternative 4	Industrial[a]	Usable open space [b]
Alternative 5	Industrial[a]	Usable open space [b]
Burrell site (49 acres)[c]		
Alternative 1	Unusable open space[b]	Limited-use open space
Alternative 2	Unusable open space[b]	Usable open space[b]
Alternative 3	Unusable open space[b]	Unusable or limited-use open space
Alternative 4	Unusable open space[b]	Usable open space[b]
Alternative 5	Unusable open space[b]	Unusable or limited-use open space
Hanover site (50 acres)		
Alternative 1	Strip mine (industrial)	Strip mine (industrial)
Alternative 2	Strip mine (industrial)	Strip mine (industrial)
Alternative 3	Strip mine (industrial)	Strip mine (industrial)
Alternative 4	Strip mine (industrial)	Unusable or limited-use open space
Alternative 5	Strip mine (industrial)	Unusable or limited-use open space

[a]The industrial use is being phased out.

[b]Under Alternatives 4 and 5 for the Canonsburg site, and Alternatives 2 and 4 for the Burrell site, after the decontamination process is completed, the Canonsburg and Burrell sites would be released for any use allowed by the local planning and zoning regulations.

[c]The use of the Burrell site is affected by a combination of factors: a portion of the Burrell site is subject to a perpetual easement from the U.S. Army Corps of Engineers because the Burrell site is situated in the full flood pool of the Conemaugh River Dam. This fact and the Burrell site's inaccessibility limit its possible use and development.

The Burrell site is currently a 49-acre limited-use open space, and would remain that way under Alternative 1. Under Alternatives 3 and 5 it would be unusable or limited-use open space owned by the Federal government. Under Alternatives 2 and 4, after the decontamination process is completed, the Burrell site would be usable as open space or for any other use permitted within the multiple-use flood-control district of Indiana County.

The Hanover site would be affected only by Alternatives 4 and 5, in which radioactively contaminated materials from the Canonsburg and Burrell sites would be brought to and stabilized at the Hanover site. The site is part of a large stretch of strip-mine area south of U.S. Route 22. Under Alternatives 4 and 5, this 50-acre portion of the worked-out strip mine would be separated and controlled as unusable or limited-use open space owned by the Federal government.

All of the remedial actions except Alternative 1 would have direct short-term impacts on land uses in the immediate vicinity of the expanded Canonsburg site. The families on Wilson Avenue and George Street would be relocated during all of the remedial activities. Under Alternatives 2 and 3 these families would be relocated permanently. Other local residents would experience the effects of earth-moving operations, such as increased noise and activity. Users of local streets by the public would be inconvenienced by the temporary closing of Strabane Avenue during all of the alternatives, and Wilson Avenue, George Street, and Ward Street during Alternatives 4 and 5. Ward Street, Wilson Avenue, and George Street would be closed permanently under Alternatives 2 and 3. The temporary closing of Strabane Avenue would necessitate rerouting school buses for the Canon-McMillan School District, thus increasing travel times. Although this closure would not eliminate the accessibility of any area residence or business, it would make travel between Canonsburg and the Village of Strabane more difficult.

The Burrell site is separated from the closest developed land use (residential) by more than 500 feet. Any remedial action at the Burrell site would only have a minor impact on the surrounding land uses. The short-term adverse impact on land uses from Alternatives 2 through 5 would be limited to the inconvenience created by heavy equipment and trucks moving along local streets.

Alternatives 4 and 5 would only have a minor impact on the surrounding land uses at the Hanover site. The few homes along the probable access road (LR 62017) to the site would be inconvenienced by the movement of heavy equipment and trucks for the duration of the project.

Once the remedial work under Alternative 4 or 5 was complete, the Canonsburg site could be developed for use in accordance with the Borough's zoning ordinance and future land-use plans. Under Alternative 1, no action, the Canonsburg site would remain in its present condition with its future use questionable. Alternatives 2 and 3 would dictate that the expanded Canonsburg site would have to remain as a controlled open space, which would not be in conformance with the Canonsburg Borough's current land-use plans and controls for the expanded Canonsburg site area.

The future uses of the Burrell site under Alternatives 2 and 4 would have to conform to the Comprehensive Plan of Indiana County. Under Alternative 1, the Burrell site would remain as limited-use open space, mainly because of its physical instability (from the previous landfill operations) and its poor accessibility. Alternatives 3 and 5 would also leave the Burrell site as unusable or limited-use open space because of the restrictions imposed by the presence of the stabilized radioactively contaminated materials.

Alternatives 4 and 5 would be the only alternatives affecting the Hanover site. As a disposal location, the Hanover site would remain unusable or limited-use open space, which would not be in accordance with the Hanover site's current rural-residential zoning designation.

5.9 IMPACTS ON NOISE LEVELS

The performance of any of the remedial-action alternatives would result in noise from the construction equipment and from the trucks transporting excavated radioactively contaminated and fill materials. All of the alternatives would require roughly the same types of equipment.

The sound levels at 50 feet for the equipment types that would be used for the remedial action range from 65 to 116 dBA (Table 5-12). The operation of several pieces of equipment at one time could increase these noise levels.

The Canonsburg site would be very sensitive to increased noise levels. Offsite residences are within 250 feet of the expanded Canonsburg site, and truck traffic into and out of the Canonsburg site would have to pass through populated residential areas. It has been estimated (Appendix H) that nearby residences could experience occasional noise levels of 60 to 84 dBA indoors. This is in excess of acceptable levels in residences. The Burrell and Hanover sites would be less sensitive since both are located in less densely developed areas with the closest residences at least 500 and 2000 feet from the Burrell or Hanover site, respectively. Also, the associated truck traffic would not pass through an area as heavily developed as that area near the Canonsburg site.

Alternative 3 would generate the minimum noise impacts. At the Burrell site the stabilization alternative would involve short-term activities with minimal equipment use. In-situ stabilization of the Canonsburg site's radioactively contaminated materials would have only minimum impacts since this alternative would require the least amount of truck traffic to and from the Canonsburg site.

Equipment noise levels would be controlled by the use of mufflers and by scheduling activities for daytime work hours only. Through the use of these control measures, the increased noise levels, particularly in the vicinity of the Canonsburg site, should be less of a problem, and public annoyance should

Table 5-12. Noise levels of typical construction equipment

Equipment	Noise level (dBA) at 50 feet
Pneumatic tools	86
Trucks	91
Pile drivers	101
Bulldozers	80
Cranes with wrecking balls-	
derrick	88
mobile	83
Mobile cranes without wrecking balls	83
Power saws	78
Wood chipping equipment	88
Scrapers	88
Wagon drills	98
Jackhammers	88
Graders	85
Rollers	74
Compactors	116
Power shovels	82
Backhoes	85
Gradalls	85
Concrete mixers	
mixer	85
pump	82
vibrator	76
Paving machine	89
Trench diggers	89
Post hole digger	79
Post driver	79
Snow plow and sander	79
Sandblasting	81
Air compressors	81
Small airplane	90
Mowers	65

Source: U.S. Environmental Protection Agency, 1971a, b.

be minimal. Also, since the project activities would occur only during daylight work hours, there would be no impact on the community noise levels during nights.

The local municipalities in the vicinity of the Canonsburg site do not have ordinances on noise levels; however, sections of their zoning ordinances include noise as one of the considerations in land development. For example, the Zoning Ordinance for Chartiers Township, Section 805.1, contains performance standards for commercial districts where sound pressure in excess of 60 decibels is considered as noise and this level is not to be exceeded for a sustained time. This level could be exceeded for short periods during the remedial action, but not in a manner that would be different from other construction sites. There are no ordinances on noise levels for either Burrell or Hanover Township.

5.10 IMPACTS ON SCENIC, HISTORICAL, AND CULTURAL RESOURCES

The Division of Planning and Protection, Bureau for Historic Preservation of the Pennsylvania Historical and Museum Commission has reviewed the project proposed for the Canonsburg, Burrell, and Hanover sites in accordance with Section 106 of the National Historic Preservation Act of 1966, Executive Order 11593, and the regulations of the Advisory Council on Historic Preservation (36 CFR 800) (Appendix G). The Bureau has concluded that "there are no eligible or listed historic or archeological properties in the area(s) of this proposed project and therefore, this project should have no effect upon such resources" (Ramsey, 1982).

5.11 IMPACTS ON POPULATION AND WORK FORCE

The remedial-action alternatives would have no major impact on existing or projected populations in the vicinity of the three sites. The only appreciable effect on population would be the temporary relocation of the families occupying the six houses on Wilson Avenue and the one house on George Street at the Canonsburg site during Alternatives 4 and 5, and the permanent relocation of these families under Alternatives 2 and 3.

The peak employment at each site during any of the alternatives would not exceed 55 workers at one time, as shown in Table 5-13.

Table 5-13. Peak staffing requirements (number of persons) at each site for each alternative

Alternative	Canonsburg	Burrell	Hanover
1	0	0	0
2	55	35	0
3	50	30	0
4	50	35	50
5	50	30	50

Although several of the alternatives could require 26 to 30 months for completion, only the supervisory and administrative staff and environmental engineering and safety personnel would be expected to be on the site for this length of time. The requirements for other staff members would be shorter, ranging from two months to one year.

It is expected that all of the professional and skilled labor needs would be provided by specialized contractors from outside the site areas. The DOE's Remedial Action Contractor (RAC) would be responsible for the overall project coordination. Under his contract, the RAC would use either competitively bid, fixed-price construction contracts; or his own work force to accomplish the stabilization or decontamination work. It is expected that the first option would be used. The subcontractors could come from the Pittsburgh area, but the use of firms from other areas would be possible. At present, levels of unemployment in western Pennsylvania are high. Based on the low staffing requirements for each alternative, and the need for specialized contractors, the remedial-action work would have only a minimal, but beneficial, impact on the local work force. An effort would be made to hire local workers. In the event additional skills would be required, these services could probably be obtained from local labor markets, including mining, the construction trades, and related fields. Because of the short-term nature of the remedial-action alternatives (about 2 years), this could be considered only a temporary benefit.

Based on the estimated work-force requirements, the remedial-action alternatives would not have a significant impact on the local population in terms of people moving into the area or of the subsequent need for additional housing, school capacity, and utilities.

5.12 IMPACTS ON HOUSING, SOCIAL STRUCTURE, AND COMMUNITY SERVICES

Housing, social-structure, and community-service impacts could result directly from long-term (greater than one year) immigration of an outside work force, as well as from the indirect expansion of supporting services. Long-term involvement would be required of supervisory and administrative personnel, and environmental control and waste-water treatment specialists. Workers who would be employed at the sites for less than 1 year and live outside commuting distance, would require short-term housing accommodations. These requirements would be met by the rental of apartments and trailers. Outside workers brought to the sites for periods greater than 1 year would exert long-term housing requirements, which would probably be provided through leasing arrangements.

The peak housing accommodations for long- and short-term employees associated with the alternatives are presented in Table 5-14. These accommodations are based on the worst-case scenario with employees brought to the site areas by contracting firms. In the Canonsburg site vicinity, the implementation of Alternative 2 would require the maximum housing requirements. Under this alternative, 7 long-term and 48 short-term accommodations could be required. In the Burrell site vicinity, 5 long-term and 30 short-term housing accommodations would be needed under Alternatives 2 and 4. In the Hanover site vicinity, Alternatives 4 and 5 would require the same long-term (31), and short-term (19) accommodations.

Table 5-14. Peak housing requirements at each site for each alternative

	Number of housing units required					
	Canonsburg		Burrell		Hanover	
Alternative	Long term	Short term	Long term	Short term	Long term	Short term
1	0	0	0	0	0	0
2	7	48	5	30	0	0
3	7	43	0	30	0	0
4	6	44	5	30	31	19
5	6	44	0	30	31	19

Over 10,500 housing units were reported in the Canonsburg Borough area in 1980. With an estimated 2 percent vacancy, sufficient housing (210 units) would be available in the current housing stock. These units would provide the accommodations for the peak housing needs of Alternative 2. In 1980 the housing stock in the Burrell Township area was estimated at over 8700 units, with an estimated 6.3 percent vacancy (550 units). This vacancy level would adequately accommodate the peak needs in Alternatives 2 and 4. There were over 4200 housing units in the Hanover Township area in 1980. Based on the estimated 2 percent vacancy in the area, 85 units would be available to provide accommodations for the peak long- and short-term workers needed in Alternatives 4 and 5.

In the vicinity of the Burrell site there are no ethnic or social groups that dominate the cultural and social aspects of the general area. Since the Burrell site is not close to the area's major residential sections, there would be no direct impact on the community structure resulting from the project activities.

There are no identifiable cultural or ethnic groups living within a 1-mile radius of the Hanover site. Therefore, no impact on the social structure of the area would result by implementing either Alternative 4 or 5.

The only noticeable impact of the alternatives (except Alternative 1) on community services in the Canonsburg site vicinity would be traffic-related impacts on the SNPJ Hall and Bowling Alley on Latimer Avenue because of the movement of heavy equipment and trucks along local streets. This community facility caters to the cultural and recreational needs of the major ethnic group in the Village of Strabane, the Slovenian community. The Alexander Cooperative Store on Latimer Avenue would be directly affected by the activities at the Canonsburg site, especially by closing Strabane Avenue during the remedial action. The Alexander Cooperative Store is owned and operated by the local community, and serves a large number of the households in Strabane as well as in the Boroughs of Canonsburg and Houston.

There are no community facilities located near the Burrell or Hanover sites that would be disturbed by the proposed alternatives. However, the truck traffic generated by the remedial action on the probable access routes could impact such facilities. The few homes on these routes would be affected by noise, dust, and congestion.

5.13 IMPACTS ON ECONOMIC STRUCTURE

The money inflow into the project areas would be primarily from salaries, work-force-related living expenditures, and for purchases of materials and supplies. Since the majority of the firms that would be involved in the remedial action would not be located in the immediate project areas and would be expected to already possess the required equipment, only a small amount of money from operational expenses would filter into the three areas. The overall flow of money from the project would vary with each remedial action, because of the staffing levels and the project duration involved.

Estimates of the maximum total project-related wages and salaries for each alternative (Table 5-15) are based on the 1981 wages in the construction industry and the oil- and coal-products sectors of the Pittsburgh SMSA (between $1,600 and $2,300 per month). The maximum infusion of income, based on a monthly salary of $2,300, would be approximately $2.2 million for Alternative 4.

Table 5-15. Estimated 1981 average annual wages and salaries paid in each alternative

Alternative	Canonsburg	Burrell	Hanover	Total
1	$ 0	$ 0	$ 0	$ 0
2	$750,000	$490,000	$ 0	$1,240,000
3	$778,000	$246,000	$ 0	$1,024,000
4	$783,000	$490,000	$894,000	$2,167,000
5	$783,000	$246,000	$809,000	$1,838,000

Source: Washington County Board of County Commissioners (1980) for data on wages and salaries. These data were applied to the scheduling and staffing estimates for the various alternatives.

It is assumed that all project workers would be living in Washington and Indiana Counties during their employment. If these income totals are compared with the annual economic activity for Washington and Indiana Counties, the differences are insignificant. (For example, the average payrolls for deep- and strip-mining alone were over $80 million for 1976.) The actual inflow of the project-related wages and salaries into the economy of Washington and Indiana Counties would be lessened by those employees who maintain permanent residences outside Washington and Indiana Counties.

The indirect impacts of the wages and salaries generated by the project would be an increase in local business transactions of various types, such as for motor fuel, vehicle services, and restaurant, laundry, and other services. Since the period of employment for these individuals is estimated at only 2 years, it is unlikely that the imported workers would be making appreciable investments or durable-goods purchases. Since the project-related personal income levels would be insignificant in comparison with the total income levels in the three sites' region, the indirect impacts of this income on local economies would be minimal. In general, each of the remedial-action alternatives (Alternatives 2 through 5) would have a slightly beneficial short-term indirect impact on local economies. Also, Alternatives 4 and 5 would open the Canonsburg site for development, which could be considered a long-term beneficial impact.

Material purchases and supplies are the other major sources of project funds that would be put into the local economy (Table 5-16). At a maximum, the material purchases would be at $1 to $1.2 million (Alternatives 4 and 5). Although these material purchases could have a significant impact on individual firms, their impact on the local economy would be minimal.

Table 5-16. Estimated material purchases[a] (fill, crushed stone, clay, and topsoil) -- 1982 dollars

Alternative	Canonsburg	Burrell	Hanover	Total
1	$ 0	$ 0	$ 0	
2	$508,000	$ 32,000	$ 0	$ 540,000
3	$508,000	$138,000	$ 0	$ 646,000
4	$508,000	$ 32,000	$556,000	$1,096,000
5	$508,000	$138,000	$556,000	$1,202,000

[a]Weston engineering estimates. Estimates of supplies (i.e., concrete, steel, etc.) are not available for costing under each alternative.

5.13.1 Government structure

In 1978 the Borough of Canonsburg collected a total of $729,923 in taxes from real estate ($469,873) and Act 511 ($260,050) sources. All of the alternatives except Alternative 1 would reduce the amount of property taxes collected by closing the Canon Industrial Park (Alternatives 2 through 5), the seven residences (Alternatives 2 and 3), and the former Georges Pottery property (Alternatives 2 and 3).

The taxes lost would be dependent on the assessed value of the properties at the time of closure. In 1981 the assessed value of the industrial park was $55,698, and $2,300 in taxes was collected by the Borough. Seventeen nearby properties were assessed at an average value of $2,839, for a total assessed value of $48,263. Under Alternatives 2 and 3, it is assumed that the seven residences will be removed as Borough tax sources, without relocation within the Borough. At a tax rate of 41.25 mills, these properties contributed a total of approximately $820 in taxes in 1981. This would result in a combined tax loss of $2,300 per year for Alternatives 4 and 5 and $3,120 per year for Alternatives 2 and 3. Taxes under Act 511 that would be affected at the local, county, and state level include the following:

1. School-district tax of 99 mills ($99.00 per $1,000 assessed valuation).

2. County tax of 25 mills.

3. Earned-income tax (0.5 percent each for the borough and school district) from project-related incomes.

4. Revenues from the privilege tax of $5.00 each to the Borough and school district.

5. Canonsburg mercantile tax of 1 percent.

6. Pennsylvania state income tax of 2.2 percent.

7. Pennsylvania state sales tax of 6 percent.

The project impacts on these taxes would be minor. The possible increases in income- and sales-related taxes would probably be offset by the decline in taxes from the loss of employment associated with the Canon Industrial Park (the 1978 level of employment was about 200 employees; the April 1983 level is about 30). The Canonsburg Borough's involvement in traffic management during the remedial action could also have an impact on its finances. However, following Alternative 4 or 5, the possible development of the Canonsburg site could generate revenue for the Canonsburg Borough in terms of wages, sales, or property taxes.

In 1978 Burrell Township collected a total of $108,238 in local taxes. Real-estate taxes accounted for over $21,000, and the remaining $87,238 was obtained under Act 511. Alternative remedial actions would have little or no impact on property taxes because of the location of the Burrell site.

Based on the estimated average annual wages and salaries for the Burrell site area, which, at a maximum, would be $500,000, the associated income and other taxes at the local, county, and state levels would also be expected to be minimal.

The total taxes collected in Hanover Township in 1979 were $113,115. Real-estate taxes accounted for $25,686, and Act 511 taxes were the remaining $87,429. Based on the current idle use of the Hanover site, the loss in property taxes, if any, would be minor.

Based on the potential average annual wages and salaries (as much as $800,000) that could be produced by project personnel, Act 511 taxes in the Hanover Township area could be improved. Earned-income taxes would increase. The revenue from the tax imposed on mechanical devices by Hanover Township could also increase. The total change in the tax structure in Hanover Township would be insignificant, however.

5.13.2 Costs

The net costs for the several alternatives have been estimated (Table 5-17). These costs include excavation of the radioactively contaminated

Table 5-17. Order-of-magnitude costs of the remedial-action alternatives

Alternative	Net cost[a]
Alternative 1	0
Alternative 2	$21.7 million
Alternative 3	$13.4 million
Alternative 4	$39.0 million
Alternative 5	$31.5 million

[a]Costs in millions of 1982 dollars.

materials, transporting the radioactively contaminated materials to a final disposal site, preparation of that site, cover and closure of that site, reclamation of that site, and reclamation of the decontaminated site, including the importation of clean fill. These costs also include the costs of monitoring, radiation management, engineering and construction management, legal and administrative activities, and acquiring the needed land. They do not include the cost of cleaning up the Canonsburg vicinity properties other than the Burrell site. The individual cost estimates upon which this summary is based are presented in Appendix A.4.

Cost estimates were prepared on a feasibility level of engineering assumptions of quantities, distances, and characteristics. These costs have an internal contingency of 15 percent on quantities, and an external contingency of 15 percent on the total construction cost. The unit costs used in these estimates are given in Appendix A.4. Since a conceptual design study has not been performed, an additional "uncertainty factor" of plus or minus 25 to 30 percent should be applied to the net costs, as shown in Table 5-17.

The cost of transporting clean fill would be directly affected by its availability and proximity to the sites. As indicated in Appendix A.6, there are several existing clean fill sites within the Canonsburg area. Several contractors have also indicated that clean fill would be available when it is needed (i.e., give someone the contract and they would obtain the fill).

5.14 IMPACTS ON TRANSPORTATION NETWORKS

A study has been conducted to compare rail versus truck hauling of the radioactively contaminated and clean fill materials (Appendix I). The results indicate that trucks are the preferred method from the economic and engineering standpoints. The DOE has determined that rail haul is not feasible.

Except for the no-action alternative, all of the proposed project alternatives would have direct adverse impacts on the transportation networks in the vicinity of the Canonsburg and Burrell sites. The major impacts would come from the movement of heavy equipment and vehicles associated with stabilizing the radioactively contaminated materials at each of the sites, transporting the radioactively contaminated materials from one site to another site, and importing new fill material. The approximate total truck trips required for each alternative for each site are given in Table 5-18. A major impact under all alternatives would be caused by the importation of large amounts of clean fill or cover material. The quantity of fill material required at the three sites is given in Table 1-3 and in Chapter 3, with the descriptions of the alternatives. The effort to locate active borrow pits (Appendix A.6) identified several pits near the Canonsburg site, but none near the Burrell site. Adequate fill material would probably be available locally.

Table 5-18. Approximate total truck (20-ton capacity) trips required at each site for transporting fill and radioactively contaminated materials

Site	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Canonsburg	16,500	12,500	25,000	25,000
Burrell	4,800	3,500	4,800	3,500
Hanover	0	0	26,500	21,000

The roadways leading to the three sites and the regional routes connecting the sites have been evaluated in terms of their physical and structural settings, current speed limits, use limitations, and capacity to handle project-related truck trips. The results of this study are given in Appendix I.

At the Canonsburg site the existing traffic patterns would be affected by the closing of Strabane Avenue under Alternatives 2 through 5 during the construction period. The closing of Strabane Avenue under any of the alternatives would have little or no impact on the economic activities in the immediate vicinity of the Canonsburg site. The impacts on the local residents from the truck traffic generated by these alternatives would be from nuisance, noise, dust, and travel safety. Ward Street, Wilson Avenue, and George Street would be permanently closed under Alternatives 2 and 3, and temporarily closed under Alternatives 4 and 5. Most of the local streets that are currently congested because of their narrow width, would experience more congestion from the projected increase in truck traffic under Alternatives 2 through 5. In addition to disrupting the cross-traffic between Canonsburg and the Village of

Strabane, the closing of Strabane Avenue would require traffic to be detoured to the Jefferson or Central Avenue crossings of Chartiers Creek, about 3/4-mile downstream from Strabane Avenue, or to the Main Street crossing about 4/5-mile upstream (Figure 1-3).

The route via Strabane Avenue and West Pike Street, PA 519 to I-79, would be capable of supporting the projected truck traffic of approximately 12,500 total truck trips during Alternative 3 spread over 50 weeks, with minor improvements along the route for safe turning of trucks. On completion of the project, portions of the route could require resurfacing. However, since this route does not involve any municipal roads, the costs associated with the resurfacing work would not affect local municipalities fiscally.

Other alternative routes considered to avoid the truck traffic along West Pike Street are as follows (see Figure 1-3):

1. Via Strabane Avenue south to Latimer Avenue and west to PA 519.

2. Strabane Avenue, south to Boone Avenue, and then west to PA 519.

3. An access road that could be constructed south of and adjacent to the ConRail line from Strabane Avenue to PA 519.

Except for the third route, where the construction of a new approach road would be involved, these routes would have lesser impacts on community services and the local traffic than the route along West Pike Street.

The feasibility studies (U.S. DOE, 1982b, c) upon which the costs given were based considered the possibility of modifications to the implementation plans that would lower the expected costs. Since these modifications can be evaluated only during further stages of the work, the base case for costs should remain, at this time, the in-situ stabilization alternatives as described for the Canonsburg and Burrell sites.

Access to the Burrell site from nearby Strangford Road (LR 32006; see Figure 1-4) could be provided by the following:

1. Construction of a 1350-foot two-lane gravel and dirt road from the site proper to the ConRail right-of-way.

2. Rehabilitation of a two-lane private gravel grade crossing over the ConRail three-track mainline.

3. Rehabilitation of a two-lane 2800-foot cinder road adjacent to the ConRail tracks to a point of intersection with Strangford Road.

Strangford Road is currently inadequate to handle the volume of truck trips that would be generated by the project, at a rate of 4.6 trucks in each direction per hour for an 8-hour day, 5-days per week for 24 weeks, under Alternatives 2 and 4. Also, Strangford Road with its 12- to 15-foot wide asphalt paving, inadequate shoulders, and horizontal curves would not be suited for moving heavy equipment and vehicles.

The impacts of the project under Alternatives 4 and 5 on the transportation network in the vicinity of the Hanover site would be mainly from the congestion on the access route, LR 62017 (Figure 1-8). The use of LR 62122 that parallels the ConRail mainline and Harmon Creek westward from PA 18 would have minimum impact, except while passing through Burgettstown. The direct impacts on the few residences along this route would be from congestion, inconvenience, noise, and dust.

Alternatives 2, 4, and 5 would also require transporting the radioactively contaminated materials through regional arterial routes.

Under Alternative 2, the radioactively contaminated materials from the Burrell site would be transported to the Canonsburg site for stabilization at the Canonsburg site. The possible routes are as follows:

1. U.S. 22/119, U.S. 22 via Pittsburgh to I-376/U.S. 22, I-279/U.S. 22, and south on I-79 to Canonsburg.

2. U.S. 22/119, U.S. 119 via Greensburg, I-70 to Washington, and north on I-79 to Canonsburg.

In addition to the impacts on local residents in the vicinities of the Burrell and Canonsburg sites, the truck traffic along either alternative route would pass through very high density population centers, such as Pittsburgh, Greensburg and Washington. Using alternative route 1, trucks would have to pass through two tunnels, thereby creating a potentially hazardous situation if the trucks were involved in an accident.

The residents along the routes for the alternatives could be subjected to health hazards if a loaded truck overturned and spilled its contents. Alternative route 2 would also encounter a number of communities along its 77.5-mile stretch through hilly and winding sections of the arterial routes. The traffic is very heavy (49,200 average daily traffic count in 1980) near the I-79 interchange of I-70, and the truck activity during the project would create some additional congestion at this interchange.

For Alternative 4, the trucks originating at the Burrell site would follow alternative route 1 to I-79, and would then continue on U.S. 22 to Florence. The trucks originating at the Canonsburg site would use either I-79 north to U.S. 22 west to Florence, or a very congested route via PA 519, PA 50, PA 18 passing through Houston, Westland, Hickory, and Atlasburg, or via I-79 south, I-70 west to PA 18 north through builtup areas like downtown Washington, Pennsylvania (Figure 1-1). Transporting the radioactively contaminated materials to the Hanover site by truck would interfere with regional and community traffic patterns, and would create congestion and potential hazards to other road users and the residents of communities along the routes.

The impacts of Alternative 5, which would require transporting the Canonsburg site's radioactively contaminated materials to the Hanover site, would be the same as those under Alternative 4; i.e., creating additional traffic on I-79, U.S. 22, and other state and local routes.

Alternatives 2, 4, and 5 would require trucking the radioactively contaminated materials between sites, and thus would impact the regional and local traffic by the additional truck trips, and could create health hazards from overturned trucks and resulting spillage. Fiscal impacts on local municipalities along the regional routes would only be minimal; the restoration of road surfaces after the completion of the project would not be the responsibility of these municipalities since the transportation routes would not include any municipal roads. However, additional road-crossing guards could be required in communities along these routes where the route is near a school.

Alternative 3 would have the least adverse impact on the communities and the local and regional traffic network from the truck transportation perspective.

As addressed in Appendix I, from transportation, engineering, and cost standpoints, the use of trucks is the preferred mode of transportation when compared with railroad use. Adequate truck fleets would be available in the region to handle the quantities of radioactively contaminated materials involved, and the regional road network could connect the three sites with only a minimum capital investment. Conversely, to use the rail system, elaborate additions, and rehabilitation of existing railways would be needed, requiring additional costs and time.

Federal, state, and local ordinances covering the use of roads and the load limits of vehicles traveling on them would be adhered to in routing the traffic at each site during the remedial action.

5.15 USE OF ENERGY AND OTHER RESOURCES

Each of the remedial-action alternatives would require the use of electricity, fuel, water, manpower, and construction materials such as soil and concrete (Table 5-19).

Electricity would be required for personnel services, site lighting, and operation of the waste-water treatment facility. Fuel would be required for the earth-moving equipment and the construction machinery. Construction materials such as concrete would be needed on a long-term basis for constructing the waste-water treatment facility, the truck-washing stations, and the encapsulation basins for sludge from the waste-water treatment facility.

Each of these resources, as well as soil, water, and manpower, are readily available in the areas around the three sites.

Table 5-19. Energy and other resource requirements[a]

Alternative/ site	Electricity (kWh)	Engine fuel[b] (gal)	Concrete (cu yds)	Manpower (avg. man-weeks)	Soil and construction materials (cubic yards)	Water (gallons)
Alternative 2						
Canonsburg	222,000	232,000	5,000	2,688	250,000	2,120,000
Burrell	140,000	127,000	1,260	1,539	16,000	185,000
Total	362,000	359,000	6,260	4,227	266,000	2,305,000
Alternative 3						
Canonsburg	222,000	228,000	5,260	2,408	250,000	2,120,000
Burrell	8,500	82,000	0	480	70,000	125,000
Total	230,500	310,000	5,260	2,888	320,000	2,245,000
Alternative 4						
Canonsburg	270,000	640,000	7,760	2,912	250,000	5,350,000
Burrell	140,000	127,000	1,260	1,539	16,000	185,000
Hanover	280,000	503,000	4,510	3,360	200,000	4,000,000
Total	690,000	1,270,000	13,530	7,811	466,000	9,535,000
Alternative 5						
Canonsburg	270,000	640,000	7,760	2,912	250,000	5,350,000
Burrell	8,500	82,000	0	480	70,000	125,000
Hanover	280,000	383,000	3,510	1,363	170,000	4,000,000
Total	558,500	1,105,000	11,270	4,755	490,000	9,475,000

[a]The calculations used to derive these estimates are given in Appendix A.3.
[b]Gasoline and diesel.

5.16 ACCIDENTAL IMPACTS NOT ARISING FROM RELEASES OF RADIATION

Onsite accident possibilities would include those typically associated with construction sites, such as falling into excavated areas. Of particular concern would be the control of these situations during nonworking hours. Therefore, in addition to work place safety controls, off-hours protection would be provided, including restricted site access enforced by site security.

The major potential for offsite accidents would be the movement of trucks over local roadways. This potential would be reduced by careful scheduling to minimize truck traffic during school and rush hours. The DOE has determined that rail transport is not a reasonable alterntaive (Appendix I).

The expected transportation-related fatalities that would occur as a result of the cleanup activities range from 0.005 deaths for Alternative 3 to 0.07 deaths for Alternative 4 (Table 5-20). These deaths are of the same order of magnitude as the yearly fatalities expected from the presence of the radioactively contaminated materials before and during remedial action. The transportation-connected fatalities would cease when the cleanup is completed, however, the radiation-induced fatalities would continue, but at a lower rate (by a factor of 4 or more) after remedial action as compared to the no action alternative.

Table 5-20. Estimates of transportation-related deaths based on the use of each alternative

Alternative	Truck miles	Total fatalities[a]
2	400,000	0.03
3	70,000	0.005
4	992,000	0.07
5	590,000	0.04

[a]Based on 0.00000007 deaths per truck mile (U.S. DOE, 1980).

The Canonsburg site would require special precautions during the building demolition activities. These precautions would include isolating the Canonsburg site area from the public and disconnecting all utility service lines to the buildings. It would be particularly important to monitor the utility service lines during all Canonsburg site activities to prevent accidents connected with exposing live electric wires or rupturing gas lines.

At the Burrell site trucks would have to cross a railroad right-of-way containing three railroad tracks. Since these tracks are minor rail-traffic routes, safe crossings could be ensured by proper scheduling and the use of a railroad flagman.

Unlike the Canonsburg and Burrell sites, the Hanover site is situated in a remote area. The major offsite safety concern would be the condition of the local roadways. Proper road maintenance and careful routing would be necessary to minimize the possibility of trucks overturning.

None of the transportation activities would significantly impact traffic patterns or accident rates on the major arterial routes between the sites. There would be concern over transporting the Canonsburg and Burrell sites' radioactively contaminated materials through Pittsburgh and other urban communities. However, the volume of traffic that would be generated by the remedial-action alternatives would represent only a small portion of the total traffic on the roadways in question.

Alternative 3 would present the least potential for accidents since it would entail activity at only two sites and excavation of radioactively contaminated materials at only one. It also would involve the least amount of truck traffic through residential areas. Alternative 4 would have the greatest potential for both onsite and transportation-related accidents because it would entail excavation at three sites and removal of radioactively contaminated materials from two sites.

5.17 RELATIONSHIPS TO LAND-USE PLANS, POLICIES, AND CONTROLS

Currently the Canonsburg, Burrell, and Hanover sites are being used in accordance with their respective land-use plans and controls (see Section 4.9). Implementation of the stabilization or decontamination alternatives would interfere with current site uses and, at the Canonsburg site, would interrupt some land uses in the vicinity of the Canonsburg site.

Stabilization of the Canonsburg site (Alternatives 2 and 3) would permanently exclude 30 acres from industrial development and residential use, and it would close Strabane Avenue as a major connecting link between Canonsburg and the Village of Strabane for the duration of the work. Ward Street, George Street, and Wilson Avenue would be permanently closed.

Decontamination of the Canonsburg site (Alternatives 4 and 5) would temporarily disrupt its use, including the use of the Wilson Avenue and George Street residences and the use of Strabane Avenue and Ward Street.

Stabilization of the radioactively contaminated materials at the Burrell site (Alternatives 3 and 5) would exclude the Burrell site from any future major development. This would not represent a significant loss of usable open space since development of the Burrell site is already restricted by the flood-plain easement and its present unstable composition.

Decontamination of the Burrell site (Alternatives 2 and 4) could release the Burrell site for as much development as the easement would allow.

The disposal of radioactively contaminated materials at the Hanover site (Alternatives 4 and 5) would eliminate the Hanover site from future use in accordance with its current zoning designation. This would not affect land-use plans or controls in the vicinity of the Hanover site.

5.18 UNAVOIDABLE ADVERSE IMPACTS

This section presents only those adverse impacts that could not be offset by implementing the appropriate project controls (i.e., mitigating measures). The magnitude of the adverse impacts discussed in this section represent an upper bound (i.e., the worst-case situation).

5.18.1 Radiation

Under Alternative 1, 0.012 additional lung-cancer deaths per year above normal are predicted among the 68,488 people living within 10 kilometers (6.2 miles) of the expanded Canonsburg site and 2 kilometers (1.2 miles) of the Burrell site. Under the no action alternative excess deaths would continue at this rate into the future. During implementation of any of Alternatives 2 through 5 this population would receive about twice the radiation exposure as during a like period of time in Alternative 1.

After the remedial action was completed, the local populations would be subject to very low levels of radiation exposure under Alternatives 2 and 3 at the expanded Canonsburg site, under Alternatives 3 and 5 at the Burrell site, and under Alternatives 4 and 5 at the Hanover site. These exposures would result in approximately a 1 in 20,000,000 chance per year above normal of any one individual dying from lung cancer in the 68,602 people living near the Canonsburg, Burrell, and Hanover sites.

The overall radiological impacts on remedial-action workers would be the same for Alternatives 2 through 5; however, the radiation doses to an individual worker would be greater than for the local populace during the short-term exposure. The workers' exposures would be about three times greater than that for the local residents, and the workers' chances of lung cancer deaths would be increased by 0.06 to 0.08 percent above the normal.

5.18.2 Air quality

The implementation of Alternatives 2 through 5 would produce air contaminants, which would be released during the operation of construction equipment. For Alternatives 4 and 5 an exceedance of the annual and 24-hour total-suspended-particulate NAAQS (40 CFR 50) could occur. The predicted concentrations of all of the other pollutants for all alternatives would not result in an exceedance of the NAAQS (40 CFR 50). The concentrations predicted for particulates are based on a given set of engineering assumptions. It could be possible to modify these assumptions and lower the particulate emissions for Alternatives 4 and 5.

5.18.3 Ecology

The implementation of Alternatives 2 through 5 would result in the temporary loss of most of the involved sites' terrestrial habitat. None of these losses would affect any endangered or threatened species, or jeopardize the survival of any species in the sites' areas. After the project was completed, all sites would be revegetated.

5.18.4 Land use

Alternatives 2 through 5 would have virtually the same short-term effects on land use at each site. At the Canonsburg site, under Alternatives 4 and 5, the use of the Canon Industrial Park, the former Georges Pottery property, and the seven residences would be temporarily discontinued.

Under Alternatives 2 and 3 the long-term adverse impacts to land use in the Canonsburg site area would occur from the demolition of the seven adjacent residences and the loss of the former Georges Pottery and Canon Industrial Park properties. Stabilization at the Burrell site (Alternatives 3 and 5) and stabilization at the Hanover site (Alternatives 4 and 5) would eliminate these sites from future development.

5.18.5 Noise

All remedial-action alternatives, except Alternative 1, would raise noise levels in the project site areas. The greatest noise impact would be at the Canonsburg site because of its proximity to nearby residences. Noise generation could, at times, reach annoyance levels.

5.18.6 Transportation networks

All of the remedial-actions (Alternatives 2 through 5) would adversely affect local transportation systems during project implementation. The Canonsburg site area would be the most sensitive of the three sites since it is the most densely developed area. The movement of large dump trucks into and out of the Canonsburg site would create traffic and noise-related problems, increase safety concerns along the route through Canonsburg, and make accessibility to local residences more difficult. The greatest impact would be from Alternatives 4 and 5 since these would involve the heaviest volume of material transportation. Ward Street, Wilson Avenue, George Street, and Strabane Avenue would be closed during the implementation of all of the alternatives. Under Alternatives 2 and 3 all of these roads, except Strabane Avenue, would be closed permanently. Strabane Avenue is a major connecting artery between the Borough of Canonsburg and the Village of Strabane.

The Burrell and Hanover site areas would also experience increased traffic congestion and noise levels. However, the Burrell and Hanover sites would not be as sensitive as the Canonsburg site area because of their more open settings.

5.19 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

All of the remedial-action alternatives (except Alternative 1) would require the same types of resource inputs. These would include electricity, engine fuel, concrete, fill material, manpower, water, and land. Table 5-19 presents the resource requirements that would be required for these alternatives. Long-term monitoring would require the commitment of those resources necessary to accomplish this program.

5.20 RELATIONSHIP BETWEEN THE SHORT-TERM USE OF THE ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Under Alternative 1, no action, there would be no short-term or long-term changes in the environment. The existing radioactively contaminated materials would remain at both the Canonsburg and the Burrell sites, thereby continuing the present low productivity of both the Canonsburg and Burrell sites. The Canon Industrial Park has been acquired by the Commonwealth and is not available for any use. Development of the Burrell site would be restricted by a combination of factors; its land-use controls, the presence of radioactively contaminated materials, and its unstable substrate.

All of the other alternatives have impacts that would result in some long-term changes in productivity. These are summarized in Table 5-21.

Under Alternative 2 the expanded Canonsburg site and the Burrell site areas would experience short-term impacts. During project implementation, the expanded Canonsburg site and the Burrell site would be unavailable for any use. The access roads, Wilson Avenue, Ward and George Streets, along with Strabane Avenue, would be closed to public use. Earth-moving activities would affect other local roads in the expanded Canonsburg site area by increasing truck traffic and causing detours in travel between the Borough of Canonsburg and the Village of Strabane. Terrestrial habitats would also be temporarily disrupted.

Following the completion of Alternative 2, the future development and use of the expanded Canonsburg site would be limited. Wilson Avenue, George Street, and Ward Street would remain closed, but Strabane Avenue would be reopened. Radiological emissions from the Canonsburg site would be reduced from current levels to meet the EPA standards (40 CFR 192).

Table 5-21. Short-term uses and long-term productivity

Site	Alternative 1	2	3	4	5
Short term					
Canonsburg	NC	D	D	D	D
Burrell	NC	D	D	D	D
Hanover	NC	NC	NC	D	D
Long term					
Canonsburg	NC	S	S	R	R
Burrell	NC	R	S	R	S
Hanover	NC	NC	NC	C	C

NC = No change.
D = Short-term disruption with increased air emissions, noise, and traffic.
R = Improved by removal of radioactively contaminated materials.
S = Improved by stabilization of radioactively contaminated materials.
C = Commitment of a previously uninvolved site.

The long-term productivity and stability of the Burrell site would be enhanced by removing the radioactively contaminated materials and replacing the railroad ties with soil. The future development of the Burrell site would still be restricted by local land-use controls.

Under Alternative 3 the short- and long-term conditions at the expanded Canonsburg site would be identical to Alternative 2, except that the project length and the traffic impacts would be less because the Burrell site's radioactively contaminated material would not be moved to the expanded Canonsburg site.

The short-term impacts at the Burrell site would be significantly less than for Alternative 2 because the radioactively contaminated materials would not be excavated. Thus, air emissions would be insignificant and there would be very little truck traffic.

The long-term conditions of the Burrell site would be enhanced by stabilization of its radioactively contaminated materials. There would be no major change in the site's ecological productivity or substrate stability compared to preproject levels.

The short-term impacts at the Canonsburg site during Alternative 4 would be similar to Alternatives 2 and 3, but would be of a greater magnitude because of the increased amount of radioactively contaminated materials handling and the longer period of activity required.

The long-term productivity potential of the Canonsburg site would be enhanced as a result of removing the Canonsburg site's radioactively contaminated materials under Alternatives 4 and 5. This would release the property for unrestricted use and development. In addition, Wilson Avenue, George Street, and Ward Street, the adjacent residences and the former Georges Pottery buildings would be returned to their preproject uses. All of the offsite impacts would cease at the project's completion.

All short- and long-term impacts at the Burrell site under Alternative 4 would be identical to those for Alternative 2.

Under Alternative 4 the Hanover site would experience the same types of short-term impacts as during the stabilization activity at the Canonsburg site. There would be increased truck traffic, noise levels, and air emissions, and a disruption of terrestrial habitats.

The Hanover site would remain in restricted open use. This would not represent a significant change from the existing conditions, since the Hanover site's rocky substrate limits its future development.

Alternative 5 would create the same short- and long-term conditions for the Canonsburg and Burrell sites as Alternatives 4 and 3, respectively. The situation at the Hanover site would be approximately the same as for Alternative 4.

Over the long term, the decontaminated sites would experience a greater potential for human use than the stabilized sites. Environmental productivity after decontamination would be about the same as following stabilization, since both types of remedial action would eliminate the uncontrolled release of radiation and would meet all EPA standards (40 CFR 192).

An additional consideration is that Alternatives 4 and 5 would involve a previously nonradioactively contaminated property, and would commit it as a radioactively contaminated materials disposal site. This commitment would be counterbalanced by the accompanying release of the formerly radioactively contaminated sites for general use.

5.21 MITIGATION MEASURES DURING THE REMEDIAL ACTION

The DOE, with the concurrence of the NRC, would establish and operate a monitoring program throughout the remedial-action project. This would consist of routine field sampling and laboratory analysis, and comparison of the resulting data with both the rates predicted in the Canonsburg FEIS and the levels specified in the EPA standards (40 CFR 192), and in the NRC regulations (10 CFR 20) and guidelines. If any significant deviation were recorded, immediate action will be taken to eliminate the problem.

5.21.1 Mitigation of impacts from the release of radiation

The release of radioactively contaminated particulates would be reduced by dampening the radioactively contaminated materials when they were uncovered, by covering them with tarps or plastic sheeting when feasible, by stopping radioactively contaminated material-handling operations during adverse weather conditions, and by using trucks with tight-fitting tailgates and covers when the radioactively contaminated materials were moved off the site.

The offsite transportation of radioactively contaminated materials would be controlled by the use of decontamination facilities (e.g., truck wash stations) to clean trucks and vehicles before they left the site. All wastewater streams would be treated before disposal, and all disturbed areas would be isolated from surface-water systems by the erosion-control methods described in subsection 5.21.3.

Human exposure to radioactively contaminated materials would be reduced by relocating, either temporarily or permanently, the residents of the seven houses within the expanded Canonsburg site, by restricting access to the project sites, and by providing the protective equipment necessary for use by the remedial-action workers.

Appendices F.4 and F.5 discuss the proposed radiological monitoring and safety plans.

5.21.2 Mitigation of impacts from air emissions

The exhausts resulting from the combustion of fuels in equipment and vehicles would be addressed by keeping the engines tuned to reduce emissions to a practical minimum.

Construction areas would be sprayed with water and surfactants as needed to control fugitive dust, and roads would be sprayed with water and surfactants during the remedial-action period. Strict Best Available Technology (BAT) dust-control measures would be used during all material-handling activities. If necessary, covers could be placed over the excavated areas. All materials, both radioactively contaminated and nonradioactively contaminated, would be transported in covered trucks. No material would be disrupted during adverse weather conditions.

5.21.3 Mitigation of impacts from water contamination

To prevent possible flooding of the sites during excavation and handling of the radioactively contaminated materials, protective dikes isolating the disturbed radioactively contaminated materials from surface-water systems would be installed. The construction of a collecting and settling pond and an associated waste-water-treatment plant at all of the sites requiring them would permit the collection and treatment of waste water resulting from washing vehicles and equipment, and would permit the treatment of radioactively contaminated storm water that could collect in excavations or as runoff from the radioactively contaminated areas. In addition, ground water pumped from Area C at the Canonsburg site would also be routed through this waste-water treatment facility before it was discharged to Chartiers Creek. The effluent water would be treated to meet NPDES water-quality criteria (40 CFR 124) before being discharged to surface-water systems. The sediment from the collecting ponds and the resins and residues from the waste-water-treatment plants would be disposed of on the sites.

5.21.4 Mitigation of impacts of noise

The impacts of noise would be reduced by using mufflers on vehicles and equipment, and by scheduling the remedial action for daytime hours only.

5.21.5 Mitigation of impacts on transportation networks

Whenever feasible, the high-capacity, primary road networks would be used to minimize the possibility of damage to the transportation network and to avoid congestion that could be a nuisance to the local populace. Truck traffic through the Borough of Canonsburg would be scheduled to minimize traffic near school zones during school activity times, and congested areas during peak use times. Road repairs, maintenance, and improvements would be evaluated during all transportation actions. Based on the transportation engineering study (Appendix I), material transportation between the three sites by rail is not an economical or viable engineering alternative.

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6 Comments Received on the Canonsburg Draft Environmental Impact Statement and the Responses

6.1 INTRODUCTION AND BACKGROUND

This chapter responds to the substantive comments made by private citizens and government reviewers (Federal and state) on the Canonsburg DEIS (U.S. DOE, 1982a) for remedial actions at the former Vitro Rare Metals Company Plant site in Canonsburg, Pennsylvania.

Comments on the Canonsburg DEIS (U.S. DOE, 1982a) were obtained from the public, citizens' groups, and government agencies during 2 days of public hearings and a 47-day[a] written comment period. The public hearings were held in Black Lick and Hanover, Pennsylvania on January 11, 1983, and in North Strabane, Pennsylvania on January 12, 1983. A total of 26 persons presented oral statements on the remedial action project. Nineteen letters, some as long as 15 pages, were received during the written comment period. Table 6-1 lists the persons who presented oral statements at the public hearings, and Table 6-2 lists the persons, groups, and agencies that submitted written comments.

To put all of the comments into an easily accessible form, each oral statement and letter was analyzed in detail, and comments on specific issues were identified (Table 6-3). The individual comments were numbered in such a way as to provide a general differentiation between their sources (i.e., numbers 1 through 84 cover hearing comments, 101 through 156 and 233 cover individual letters, and 157 through 232 cover agencies). In those cases where a person made the same comment both orally and in a letter, it was given one number from the oral transcripts. The comments were then excerpted in-toto from the transcripts and letters, categorized according to subject matter, and placed into an indexing system to facilitate rapid retrieval of all comments dealing with a specific subject (Table 6-4). This allowed the preparers of the Canonsburg FEIS to consider all comments received on a subject, while revising the parts of the document dealing with that subject.

To organize the comment/response process, the comments were grouped into 13 major categories according to their subject matter. Many of these topics were further organized into subcategories pertaining to specific groupings of issues within that topic (Table 6-5). In those cases where different persons raised the same issue, or where several comments could be addressed by one single expanded response, these comments were grouped together as one issue and provided with a combined response.

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[a]The notice of availability of the Canonsburg DEIS (U.S. DOE, 1982a) was published by the EPA in the Federal Register on December 8, 1982 (47 FR 55305). This notice allowed a 47-day comment period through January 24, 1983. All written comments received on the Canonsburg DEIS (U.S. DOE, 1982a) are considered in the Canonsburg FEIS.

The presentation of issues and responses within this chapter follows this organizational format. Subsections 6.2.1 through 6.2.13 correspond to each of the major categories as shown in Table 6-5. Each subsection includes a summary of the topic, a description of the comments received on the topic, a summarization of the DOE's response, and, if necessary, a reference to the section of the Canonsburg FEIS in which the issue is resolved. The numbers in parentheses following each issue refer to the individual comments concerned with the particular issue. Section 6.3 contains specific comments taken from the hearing transcripts. Section 6.4 contains, in full, copies of the letters received concerning the Canonsburg DEIS (U.S. DOE, 1982a).

Table 6-1. Comments received on the Canonsburg DEIS (U.S. DOE, 1982a) -- public hearing responses

Location/date	Comment no.	Response subsection	Person	Affiliation
Burrell Township				
January 11, 1983	43	6.2.1.1	Ardell, Danelle	Allegheny Conservation Committee, Sierra Club, Pittsburgh, Pennsylvania
	44	6.2.3, 6.2.9.2		
	45	6.2.1.1		
	---		Donaldson, Jerry	Supervisor, Burrell Township, Pennsylvania
	46	6.2.1.1	Wolford, Jean	Resident, Burrell Township, Pennsylvania
Hanover Township				
January 11, 1983	56	6.2.10	Coulter, William	Resident, Hanover Township, Pennsylvania
	57	6.2.10		
	58	6.2.7.1		
	80	6.2.2.1		
	---		Griffith, Martin H.	Vice President, Student Body, Burgettstown Area Junior-Senior High School, Burgettstown, Pennsylvania
	---		Kondik, Andrew J.	Emergency Service Director, Hancock County, West Virginia
	67	6.2.10	Lounder, Donald	Resident, Hanover Township, Pennsylvania
	68	6.2.5.1	Lucchino, George M.	Spokesperson, Concerned Citizens of Southwestern Pennsylvania
	69	6.2.12.1		
	70	6.2.12.1		
	71	6.2.9.1		
	72	6.2.8.3		
	73	6.2.7.1		
	74	6.2.13		
	75	6.2.10		
	76	6.2.6.1		
	77	6.2.8.1		
	78	6.2.4.3		
	79	6.2.1.1		

Table 6-1. Comments received on the Canonsburg DEIS (U.S. DOE, 1982a) -- public hearing responses (continued)

Location/date	Comment no.	Response subsection	Person	Affiliation
	51	6.2.7.1	Mastrantoni, Patricia	Resident, Hanover Township, Pennsylvania
	52	6.2.8.1		
	53	6.2.7.1		
	54	6.2.3		
	55	6.2.10		
	--		Menzer, Donald T.	Mayor, Weirton, West Virginia
	47	6.2.1.2	Murphy, Austin	U.S. Congressman, 22nd District, Pennsylvania
	81	6.2.9.2	Plunkett, Ruth	Reporter, Weirton Daily Times, Weirton, West Virginia
	82	6.2.9.2		
	83	6.2.10		
	84	6.2.10		
	48	6.2.10	Stewart, Cynthia J.	Resident, Hanover Township, Pennsylvania
	49	6.2.7.1		
	50	6.2.5.2		
	---		Trushel, Barbara	Weirton Junior Women's Club, Weirton, West Virginia
	---		Yerace, Felix	Resident, Hanover Township, Pennsylvania
	59	6.2.8.1	Zibritosky, George	Member, Concerned Citizens of Southwestern Pennsylvania; Board of Supervisors, Smith Township, Pennsylvania
	60	6.2.7.1		
	61	6.2.7.1		
	62	6.2.7.1		
	63	6.2.6.2		
	64	6.2.5.2		
	65	6.2.12.1		
	66	6.2.7.2		
Canonsburg				
January 12, 1983	13	6.2.1.2	Amarose, Anthony	Resident, Canonsburg, Pennsylvania; Former employee, Vitro Rare Metals Company, Canonsburg, Pennsylvania

Table 6-1. Comments received on the Canonsburg DEIS (U.S. DOE, 1982a) -- public hearing responses (continued)

Location/date	Comment no.	Response subsection	Person	Affiliation
	20	6.2.6.1	Dunn, Janis C.	Spokesperson, Families Opposed to Radioactive Contamination Exposure (FORCE), Canonsburg, Pennsylvania
	21	6.2.5.1		
	22	6.2.5.1		
	23	6.2.5.1		
	24	6.2.5.1		
	25	6.2.3		
	26	6.2.1.2		
	27	6.2.3, 6.2.12.2		
	28	6.2.10		
	29	6.2.3		
	30	6.2.2.1		
	31	6.2.1.2		
	32	6.2.10		
	1	6.2.2.2	Faiella, Joyce	Committee, St. Patrick's School, Canonsburg, Pennsylvania
	2	6.2.3		
	3	6.2.3		
	4	6.2.5.2		
	5	6.2.2.1		
	6	6.2.2.1		
	7	6.2.2.1		
	8	6.2.2.1		
	9	6.2.3		
	42	6.2.4.3	Johnsrud, Judith, Ph.D.	Spokesperson, Coalition on Nuclear Power; Steering Committee, Eastern Federation of Nuclear Opponents and Safer Energy Proponents; National Solar Lobby
	40	6.2.12.1	Mirisciotti, Sam	Resident, Canonsburg, Pennsylvania
	41	6.2.3		
	---		Murphy, Austin	U.S. Congressman, 22nd District, Pennsylvania
	10	6.2.4.1	Polinski, Henry	Mayor, Houston, Pennsylvania
	11	6.2.5.1		
	12	6.2.1.1		

Table 6-1. Comments received on the Canonsburg DEIS (U.S. DOE, 1982a) -- public hearing responses (continued)

Location/date	Comment no.	Response subsection	Person	Affiliation
	16	6.2.2.1	Solic, Nicholas P.	Chairman, Allegheny Conservation Committee, Sierra Club, Pittsburgh, Pennsylvania
	17	6.2.2.1		
	18	6.2.3		
	19	6.2.1.1		
	33	6.2.5.1	Sperling, Lawrence I.	President, Environmental Law Council, University of Pittsburgh School of Law, Pittsburgh, Pennsylvania
	34	6.2.13		
	35	6.2.2.1		
	36	6.2.1.1		
	37	6.2.2.1		
	38	6.2.1.1		
	39	6.2.1.1, 6.2.1.2		
	---		Stewart, Julie M.	Spokesperson, Pennsylvania Public Interest Coalition
	14	6.2.12.1	Sweet, David W.	Pennsylvania State Representative, 48th District, Pennsylvania
	15	6.2.1.3		
	---		Walter, Donald	Aide, U.S. Senator John Heinz, Pennsylvania

Table 6-2. Comments received on the Canonsburg DEIS (U.S. DOE, 1982a) -- written responses

Comment no.	Response subsection	Individual/agency	Affiliation	Date of letter
43	6.2.1.1	Ardell, Danelle	Allegheny Conservation Committee, Sierra Club, Pittsburgh, Pennsylvania	January 20, 1983
44	6.2.3, 6.2.9.2			
45	6.2.1.1			
101	6.2.10	Benish, Joan E.	Resident, Hanover Township, Pennsylvania	January 16, 1983
20	6.2.6.1	Dunn, Janis C.	Spokesperson, Families Opposed to Radioactive Contamination Exposure (FORCE), Canonsburg, Pennsylvania	January 12, 1983
21	6.2.5.1			
22	6.2.5.1			
23	6.2.5.1			
24	6.2.5.1			
27	6.2.3, 6.2.12.2			
28	6.2.10			
29	6.2.3			
30	6.2.2.1			
31	6.2.1.2			
32	6.2.10			
25	6.2.3	Gofman, John W., Ph.D., M.D.	Professor, Division of Medical Physics, Department of Physics, University of California, Berkeley, California	December 10, 1982
26	6.2.1.2			
102	6.2.3			
103	6.2.5.2			
104	6.2.5.2			
105	6.2.5.1	Engel, Agnes	Resident, Canonsburg, Pennsylvania	January 24, 1983
106	6.2.9.1			
107	6.2.5.2			
108	6.2.5.2			
109	6.2.2.2			
110	6.2.2.2			
1	6.2.2.2	Faiella, Joyce	Committee, St. Patrick's School, Canonsburg, Pennsylvania	January 12, 1983
2	6.2.3			
3	6.2.3			
4	6.2.5.2			
5	6.2.2.1			
6	6.2.2.1			
7	6.2.2.1			
8	6.2.2.1			
9	6.2.3			

Table 6-2. Comments received on the Canonsburg DEIS (U.S. DOE, 1982a) -- written responses (continued)

Comment no.	Response subsection	Individual/agency	Affiliation	Date of letter
111	6.2.13	Fracke, Sue	Resident, Sugarloaf, Pennsylvania	January 12, 1983
---		Heinz, John	United States Senator, Pennsylvania	January 11, 1983
112	6.2.4.1	Leney, George W., P.E.	Consulting geologist, Pittsburgh, Pennsylvania	January 21, 1983
113	6.2.4.1			
114	6.2.2.1			
115	6.2.2.1			
116	6.2.1.1			
117	6.2.11			
118	6.2.11			
119	6.2.11			
120	6.2.11			
121	6.2.8.2			
122	6.2.5.2			
123	6.2.5.1			
124	6.2.2.2			
125	6.2.11			
126	6.2.2.1			
127	6.2.2.1			
128	6.2.1.2			
129	6.2.1.2			
130	6.2.5.2	Lochstet, William A.	Professor, Department of Physics, College of Science, Pennsylvania State University, University Park, Pennsylvania	January 18, 1983
131	6.2.5.2			
132	6.2.1.3			
133	6.2.2.1			
134	6.2.1.3			
135	6.2.1.2			
136	6.2.2.2			
137	6.2.4.1			
138	6.2.8.2			
233	6.2.13	Oppenheimer, Carol	Staff attorney, Southwest Research and Information Center, Albuquerque, New Mexico	January 26, 1983

Table 6-2. Comments received on the Canonsburg DEIS (U.S. DOE, 1982a) -- written responses (continued)

Comment no.	Response subsection	Individual/agency	Affiliation	Date of letter
33	6.2.5.1	Sperling, Lawrence I.	President, Environmental Law Council, University of Pittsburgh School of Law, Pittsburgh, Pennsylvania	January 20, 1983
34	6.2.13			
35	6.2.2.1			
36	6.2.1.1			
37	6.2.2.1			
38	6.2.2.1			
39	6.2.1.1, 6.2.1.2			
139	6.2.5.1			
140	6.2.4.3			
141	6.2.3	Strang, Donald W.	Superintendent of Schools, Canon-McMillan School District, Canonsburg, Pennsylvania	January 21, 1983
142	6.2.2.2			
143	6.2.2.2			
144	6.2.3			
145	6.2.3			
146	6.2.2.2			
14	6.2.12.1	Sweet, David W.	Pennsylvania State Representative, 48th District, Pennsylvania	January 12, 1983
15	6.2.1.3			
147	6.2.5.2			
148	6.2.2.1			
149	6.2.5.1	Terrill, James G., Jr.	James G. Terrill, Jr. and Associates, Environmental Engineers, Murrysville, Pennsylvania	January 22, 1983
150	6.2.5.2			
151	6.2.4.2			
152	6.2.4.2			
153	6.2.11			
154	6.2.11			
155	6.2.2.1			
156	6.2.2.1			
157	6.2.9.2	U.S. Department of the Interior, Office of the Secretary, Environmental Project Review, Washington, DC		February 4, 1983
158	6.2.7.1			
159	6.2.4.3	U.S. Environmental Protection Agency, Region III, Philadelphia, Pennsylvania		February 4, 1983
160	6.2.3			
161	6.2.4.3			
162	6.2.5.2			
163	6.2.5.2			

Table 6-2. Comments received on the Canonsburg DEIS (U.S. DOE, 1982a) -- written responses (continued)

Comment no.	Response subsection	Individual/agency	Affiliation	Date of letter
164	6.2.4.2	U.S. Environmental Protection Agency, Region III, Philadelphia, Pennsylvania (continued)		February 4, 1983
165	6.2.5.2			
166	6.2.5.2			
167	6.2.5.2			
168	6.2.5.2			
169	6.2.5.2			
170	6.2.5.2			
171	6.2.5.2			
172	6.2.5.2			
173	6.2.4.1			
174	6.2.4.1			
175	6.2.9.2			
176	6.2.9.2			
177	6.2.9.1			
178	6.2.9.1			
179	6.2.9.1			
180	6.2.7.1			
181	6.2.9.1			
182	6.2.7.1			
183	6.2.4.1			
184	6.2.9.1			
185	6.2.9.2			
186	6.2.9.1			
187	6.2.9.1			
188	6.2.9.1			
189	6.2.6.2			
190	6.2.6.2			
191	6.2.6.2			
192	6.2.6.2			
193	6.2.6.2			
194	6.2.6.2			
195	6.2.6.2			
196	6.2.6.2			
197	6.2.6.2			
198	6.2.6.2			
199	6.2.6.2			
200	6.2.6.2			
201	6.2.6.2			
202	6.2.2.1			
203	6.2.2.1			
204	6.2.2.1			
205	6.2.2.1			

Table 6-2. Comments received on the Canonsburg DEIS (U.S. DOE, 1982a) -- written responses (continued)

Comment no.	Response subsection	Individual/agency	Affiliation	Date of letter
206	6.2.9.2	U.S. Environmental Protection Agency, Region III, Philadelphia, Pennsylvania (continued)		February 4, 1983
207	6.2.2.1			
208	6.2.2.1			
209	6.2.2.1			
210	6.2.2.1			
211	6.2.7.1			
212	6.2.2.1			
213	6.2.8.3			
214	6.2.9.2			
215	6.2.9.2			
216	6.2.8.3			
217	6.2.8.2			
218	6.2.4.3			
219	6.2.9.2			
220	6.2.7.1			
221	6.2.2.1			
222	6.2.4.1			
223	6.2.5.2			
224	6.2.9.1			
225	6.2.7.2			
226	6.2.4.1			
227	6.2.5.2			
228	6.2.5.2			
---		U.S. Department of Housing and Urban Development, Region III, Philadelphia, Pennsylvania		January 24, 1983
229	6.2.8.1	Pennsylvania Department of Environmental Resources, Office of the Special Deputy, Harrisburg, Pennsylvania		February 4, 1983
230	6.2.8.3			
231	6.2.8.3			
232	6.2.13			

Table 6-3. Comment/response subsection cross-reference guide

Comment no.	Comment page no.	Response subsection no.	Response page no.	Comment no.	Comment page no.	Response subsection no.	Response page no.
1	6-70	6.2.2.2	6-33	23	6-75	6.2.5.1	6-39
2	6-70	6.2.3	6-33, 6-62	24	6-75	6.2.5.1	6-39
3	6-70	6.2.3	6-33	25	6-75	6.2.3	6-33
4	6-70	6.2.5.2	6-42	26	6-76	6.2.1.2	6-25
5	6-71	6.2.2.1	6-29	27	6-76	6.2.3, 6.2.12.2	6-33, 6-62
6	6-71	6.2.2.1	6-27	28	6-76	6.2.10	6-59
7	6-71	6.2.2.1	6-29	29	6-76	6.2.3	6-33
8	6-71	6.2.2.1	6-30	30	6-77	6.2.2.1	6-27
9	6-71	6.2.3	6-33	31	6-77	6.2.1.2	6-25
10	6-71	6.2.4.1	6-34	32	6-77	6.2.10	6-58
11	6-71	6.2.5.1	6-39	33	6-77	6.2.5.1	6-39
12	6-72	6.2.1.1	6-24	34	6-78	6.2.13	6-63
13	6-72	6.2.1.2	6-26	35	6-78	6.2.2.1	6-31
14	6-72	6.2.12.1	6-62	36	6-78	6.2.1.1	6-25
15	6-72	6.2.1.3	6-26	37	6-78	6.2.2.1	6-27
16	6-72	6.2.2.1	6-31	38	6-79	6.2.1.1	6-24
17	6-73	6.2.2.1	6-27	39	6-79	6.2.1.1, 6.2.1.2	6-24, 6-25
18	6-73	6.2.3	6-33	40	6-79	6.2.12.1	6-62
19	6-74	6.2.1.1	6-24	41	6-79	6.2.3	6-33
20	6-74	6.2.6.1	6-45	42	6-80	6.2.4.3	6-37
21	6-74	6.2.5.1	6-39	43	6-80	6.2.1.1	6-24
22	6-74	6.2.5.1	6-39	44	6-80	6.2.3, 6.2.9.2	6-33, 6-58

Table 6-3. Comment/response subsection cross-reference guide (continued)

Comment no.	Comment page no.	Response subsection no.	Response page no.	Comment no.	Comment page no.	Response subsection no.	Response page no.
45	6-81	6.2.1.1	6-24, 6-25	67	6-86	6.2.10	6-58
46	6-81	6.2.3	6-33	68	6-86	6.2.5.1	6-39
47	6-81	6.2.1.2	6-25	69	6-86	6.2.12.1	6-62
48	6-81	6.2.10	6-59	70	6-87	6.2.12.1	6-62
49	6-81	6.2.7.1	6-48	71	6-87	6.2.9.1	6-55
50	6-82	6.2.5.2	6-44	72	6-87	6.2.8.3	6-52
51	6-82	6.2.7.1	6-48	73	6-87	6.2.7.1	6-48
52	6-82	6.2.8.1	6-50	74	6-87	6.2.13	6-64
53	6-82	6.2.7.1	6-48	75	6-88	6.2.10	6-59
54	6-83	6.2.3	6-33	76	6-88	6.2.6.1	6-45
55	6-83	6.2.10	6-59	77	6-88	6.2.8.1	6-50
56	6-83	6.2.10	6-58	78	6-88	6.2.4.3	6-37
57	6-83	6.2.10	6-59	79	6-88	6.2.1.1	6-24
58	6-83	6.2.7.1	6-48	80	6-88	6.2.2.1	6-29
59	6-84	6.2.8.1	6-50	81	6-89	6.2.9.2	6-57
60	6-84	6.2.7.1	6-48	82	6-89	6.2.9.2	6-57
61	6-84	6.2.7.1	6-48	83	6-89	6.2.10	6-60
62	6-85	6.2.7.1	6-48	84	6-89	6.2.10	6-60
63	6-85	6.2.6.2	6-45	85	Only 84 public hearing comments were received.		
64	6-85	6.2.5.2	6-40	86			
65	6-86	6.2.12.1	6-62	87			
66	6-86	6.2.7.2	6-49	88			

Table 6-3. Comment/response subsection cross-reference guide (continued)

Comment no.	Comment page no.	Response subsection no.	Response page no.	Comment no.	Comment page no.	Response subsection no.	Response page no.
89	Only 84 public hearing comments were received.			111	6-112	6.2.13	6-63
90				112	6-113	6.2.4.1	6-34
91				113	6-114	6.2.4.1	6-34
92				114	6-114	6.2.2.1	6-27
93				115	6-115	6.2.2.1	6-27, 6-29
94				116	6-115	6.2.1.1	6-25
95				117	6-116	6.2.11	6-60
96				118	6-116	6.2.11	6-60
97				119	6-117	6.2.11	6-60
98				120	6-117	6.2.11	6-60
99				121	6-117	6.2.8.2	6-50
100				122	6-117	6.2.5.2	6-42
101	6-97	6.2.10	6-58	123	6-117	6.2.5.1	6-39
102	6-102	6.2.3	6-33	124	6-117	6.2.2.2	6-32
103	6-102	6.2.5.2	6-42	125	6-118	6.2.11	6-61
104	6-102	6.2.5.2	6-43	126	6-118	6.2.2.1	6-28
105	6-108	6.2.5.1	6-39	127	6-118	6.2.2.1	6-32
106	6-108	6.2.9.1	6-55	128	6-118	6.2.1.2	6-25
107	6-108	6.2.5.2	6-41	129	6-119	6.2.1.2	6-25
108	6-109	6.2.5.2	6-39	130	6-121	6.2.5.2	6-42
109	6-109	6.2.2.2	6-33	131	6-121	6.2.5.2	6-42
110	6-109	6.2.2.2	6-32	132	6-123	6.2.1.3	6-26

Table 6-3. Comment/response subsection cross-reference guide (continued)

Comment no.	Comment page no.	Response subsection no.	Response page no.	Comment no.	Comment page no.	Response subsection no.	Response page no.
133	6-123	6.2.2.1	6-30	155	6-141	6.2.2.1	6-27
134	6-123	6.2.1.3	6-27	156	6-141	6.2.2.1	6-27
135	6-123	6.2.1.2	6-26	157	6-142	6.2.9.2	6-57
136	6-123	6.2.2.2	6-33	158	6-142	6.2.7.1	6-49
137	6-123	6.2.4.1	6-35	159	6-143	6.2.4.3	6-38
138	6-123	6.2.8.2	6-50	160	6-144	6.2.3	6-33
139	6-131	6.2.5.1	6-39	161	6-144	6.2.4.3	6-38
140	6-133	6.2.4.3	6-37	162	6-144	6.2.5.2	6-42
141	6-136	6.2.3	6-33	163	6-144	6.2.5.2	6-42
142	6-136	6.2.2.2	6-33	164	6-144	6.2.4.2	6-37
143	6-136	6.2.2.2	6-32	165	6-144	6.2.5.2	6-42
144	6-136	6.2.3	6-33	166	6-145	6.2.5.2	6-39
145	6-136	6.2.3	6-33	167	6-145	6.2.5.2	6-42
146	6-136	6.2.2.2	6-32	168	6-145	6.2.5.2	6-44
147	6-138	6.2.5.2	6-40	169	6-145	6.2.5.2	6-41
148	6-138	6.2.2.1	6-27	170	6-145	6.2.5.2	6-43
149	6-139	6.2.5.1	6-39	171	6-145	6.2.5.2	6-44
150	6-139	6.2.5.2	6-50	172	6-145	6.2.5.2	6-39
151	6-140	6.2.4.2	6-37	173	6-145	6.2.4.1	6-36
152	6-140	6.2.4.2	6-37	174	6-145	6.2.4.1	6-34
153	6-140	6.2.11	6-61	175	6-145	6.2.9.2	6-57
154	6-141	6.2.11	6-61	176	6-146	6.2.9.2	6-58

Table 6-3. Comment/response subsection cross-reference guide (continued)

Comment no.	Comment page no.	Response subsection no.	Response page no.	Comment no.	Comment page no.	Response subsection no.	Response page no.
177	6-146	6.2.9.1	6-53	199	6-147	6.2.6.2	6-46
178	6-146	6.2.9.1	6-54	200	6-147	6.2.6.2	6-47
179	6-146	6.2.9.1	6-53	201	6-147	6.2.6.2	6-47
180	6-146	6.2.7.1	6-49	202	6-147	6.2.2.1	6-27
181	6-146	6.2.9.1	6-54	203	6-147	6.2.2.1	6-28
182	6-146	6.2.7.1	6-48	204	6-148	6.2.2.1	6-27
183	6-146	6.2.4.1	6-36	205	6-148	6.2.2.1	6-30
184	6-146	6.2.9.1	6-56	206	6-148	6.2.9.2	6-58
185	6-146	6.2.9.2	6-57	207	6-148	6.2.2.1	6-27
186	6-146	6.2.9.1	6-56	208	6-148	6.2.2.1	6-28
187	6-146	6.2.9.1	6-56	209	6-148	6.2.2.1	6-29
188	6-147	6.2.9.1	6-55	210	6-148	6.2.2.1	6-27
189	6-147	6.2.6.2	6-46	211	6-148	6.2.7.1	6-49
190	6-147	6.2.6.2	6-46	212	6-148	6.2.2.1	6-28
191	6-147	6.2.6.2	6-46	213	6-148	6.2.8.3	6-52
192	6-147	6.2.6.2	6-46	214	6-149	6.2.9.2	6-57
193	6-147	6.2.6.2	6-46	215	6-149	6.2.9.2	6-57
194	6-147	6.2.6.2	6-47	216	6-149	6.2.8.3	6-52
195	6-147	6.2.6.2	6-46	217	6-149	6.2.8.2	6-51
196	6-147	6.2.6.2	6-47	218	6-149	6.2.4.3	6-38
197	6-147	6.2.6.2	6-47	219	6-149	6.2.9.2	6-57
198	6-147	6.2.6.2	6-46	220	6-149	6.2.7.1	6-48

Table 6-3. Comment/response subsection cross-reference guide (continued)

Comment no.	Comment page no.	Response subsection no.	Response page no.
221	6-149	6.2.2.1	6-30
222	6-149	6.2.4.1	6-35
223	6-149	6.2.5.2	6-44
224	6-149	6.2.9.1	6-54
225	6-150	6.2.7.2	6-49
226	6-150	6.2.4.1	6-35
227	6-150	6.2.5.2	6-42
228	6-150	6.2.5.2	6-42
229	6-152	6.2.8.1	6-50
230	6-153	6.2.8.3	6-52
231	6-153	6.2.8.3	6-52
232	6-153	6.2.13	6-63
233	6-125	6.2.13	6-63

Table 6-4. Number of comments received per category on the Canonsburg Canonsburg DEIS (U.S. DOE, 1982a)

Category title	Hearings	Letters Personal	Letters Agency	Total
6.2.1.1	8	1	0	9
6.2.1.2	5	3	0	8
6.2.1.3	1	2	0	3
Subtotal	14	6	0	20
6.2.2.1	10	8	10	28
6.2.2.2	1	7	0	8
Subtotal	11	15	10	36
6.2.3	11	4	1	16
Subtotal	11	4	1	16
6.2.4.1	1	3	5	9
6.2.4.2	0	2	1	3
6.2.4.3	2	1	3	6
Subtotal	3	6	9	18
6.2.5.1	7	4	0	11
6.2.5.2	3	9	13	25
Subtotal	10	13	13	36
6.2.6.1	2	0	0	2
6.2.6.2	1	0	13	14
Subtotal	3	0	13	16
6.2.7.1	8	0	5	13
6.2.7.2	1	0	1	2
Subtotal	9	0	6	15

Table 6-4. Number of comments received per category on the Canonsburg DEIS (U.S. DOE, 1982a) (continued)

Category title	Hearings	Letters: Personal	Letters: Agency	Total
6.2.8.1	3	0	1	4
6.2.8.2	0	2	1	3
6.2.8.3	1	0	4	5
Subtotal	4	2	6	12
6.2.9.1	1	1	9	11
6.2.9.2	3	0	8	11
Subtotal	4	1	17	22
6.2.10	10	1	0	11
Subtotal	10	1	0	11
6.2.11	0	7	0	7
Subtotal	0	7	0	7
6.2.12.1	5	0	0	5
6.2.12.2	1	0	0	1
Subtotal	6	0	0	6
6.2.13	2	2	1	5
Subtotal	2	2	1	5
Total	87	57	76	220

Table 6-5. Categories of public/agency comments received on the Canonsburg DEIS (U.S. DOE, 1982a)

Category	Comment numbers
6.2.1 Alternative remedial actions	
6.2.1.1 Various stabilization strategies	12, 19, 36, 38, 39, 43, 45, 79, 116
6.2.1.2 Various decontamination strategies	13, 26, 31, 39, 47, 128, 129, 135
6.2.1.3 Selection process	15, 132, 134
6.2.2 Engineering	
6.2.2.1 Project design	5, 6, 7, 8, 16, 17, 30, 35, 37, 80, 114, 115, 126, 127, 133, 148, 155, 156, 202, 203, 204, 205, 207, 208, 209, 210, 212, 221
6.2.2.2 Mitigation measures	1, 109, 110, 124, 136, 142, 143, 146
6.2.3 Safety	2, 3, 9, 18, 25, 27, 29, 41, 44, 46, 54, 102, 141, 144, 145, 160
6.2.4 Radiation	
6.2.4.1 Current radioactive contamination	10, 112, 113, 137, 173, 174, 183, 222, 226
6.2.4.2 Measurements	151, 152, 164
6.2.4.3 Standards	42, 78, 140, 159, 161, 218
6.2.5 Health	
6.2.5.1 Current situation	11, 21, 22, 23, 24, 33, 68, 105, 123, 139, 149
6.2.5.2 Future situation	4, 50, 64, 103, 104, 107, 108, 122, 130, 131, 147, 150, 162, 163, 165, 166, 167, 168, 169, 170, 171, 172, 223, 227, 228

Table 6-5. Categories of public/agency comments received on the Canonsburg DEIS (U.S. DOE, 1982a) (continued)

Category	Comment numbers
6.2.6 Meteorology/air quality	
6.2.6.1 Meteorological conditions	20, 76
6.2.6.2 Air quality impact modeling	63, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201
6.2.7 Geology	
6.2.7.1 Baseline conditions	49, 51, 53, 58, 60, 61, 62, 73, 158, 180, 182, 211, 220
6.2.7.2 Impacts predictions	66, 225
6.2.8 Surface water	
6.2.8.1 Public water supplies	52, 59, 77, 229
6.2.8.2 Erosion	121, 138, 217
6.2.8.3 Water quality	72, 213, 216, 230, 231
6.2.9 Ground water	
6.2.9.1 Baseline conditions	71, 106, 177, 178, 179, 181, 184, 186, 187, 188, 224
6.2.9.2 Impact predictions	44, 81, 82, 157, 175, 176, 185, 206, 214, 215, 219
6.2.10 Socioeconomics	28, 32, 48, 55, 56, 57, 67, 75, 83, 84, 101
6.2.11 Costs	117, 118, 119, 120, 125, 153, 154
6.2.12 Relocation of residents	
6.2.12.1 Wilson Avenue (Ward Street) and George Street residents	14, 40, 65, 69, 70
6.2.12.2 Other residents near the expanded Canonsburg site	27
6.2.13 Procedural matters	34, 74, 111, 232, 233

6.2 COMMENTS AND RESPONSES

This subsection presents the comments and questions received concerning the information contained in the Canonsburg DEIS (U.S. DOE, 1982a) at the public hearings, in personal letters, and from Federal and state agencies. Responses are included to answer, expand, and clarify the questions and comments that were received.

The comments/responses are grouped under the following headings:

6.2.1 Alternative remedial actions

Twenty comments were received on the alternatives discussed in the Canonsburg DEIS (U.S. DOE, 1982a); 14 came during the public hearings and 6 personal letters were received.

6.2.1.1 Various stabilization strategies: above-ground containers, monitored retrievable storage, and other encapsulation techniques

Issue 1: Four commenters stated that the radioactively contaminated materials from the Canonsburg and Burrell sites should be placed in above-ground containers. (19, 39, 43, 45, 79)

Response 1: The reasons for eliminating this alternative are given in subsection 3.1.6.3 of the Canonsburg FEIS.

Issue 2: One commenter stated that the Canonsburg FEIS should include an examination of the various possible engineering alternatives for encapsulation. It should include an analysis of the long-term integrity of a variety of possible materials and of alternative designs. (38)

Response 2: After a thorough performance evaluation of various man-made and natural materials (U.S. DOE, 1982b), and drawing on the data generated from the UMTRAP research and technology development program, it was decided that the maximum use of "natural" materials would be used in cover and barrier systems. These naturally occurring materials include soils, clays, and sand and gravel in lieu of synthetic liners or membranes. It is known that these naturally occurring materials are "stable" over geologic time, exhibit a high resistance to biochemical degradation, and should provide long-term integrity within the design basis. The use of natural materials in the proposed design represents the most technologically feasible choice to meet the environmental regulations and remain economically viable.

Issue 3: One commenter stated that the Canonsburg site's radioactively contaminated materials should be stabilized by covering them with a lead shield and property soil. (12)

Response 3: Lead shielding, which is commonly used as a means of protecting individuals from exposure to electromagnetic radiation (e.g., x-rays, gamma rays), would not be needed to protect the public from gamma radiation from the Canonsburg site's radioactively contaminated materials. Gamma radiation is reduced by the mass of the matter between the source of the gamma radiation and the receptor, and the proposed soil cover would effectively reduce the gamma radiation to acceptable levels (U.S. EPA, 1982) as specified by the EPA standards (40 CFR 192). Emplacement of most of the Canonsburg site's radioactively contaminated materials in a specially designed encapsulation cell would allow control of those factors (e.g., human intrusion, infiltration, wind and water erosion) that increase public health hazards and environmental degradation. Thus, the proposed design would greatly reduce the risk to the public and minimize environmental effects.

Issue 4: One commenter stated that if the Canonsburg site's radioactively contaminated materials really are uranium mill tailings, an alternative to decontamination is to disperse the radionuclides and return them to their natural environment. This would be done by allowing ground-water percolation to gradually remove the contaminants and disperse them into the natural environment. Conversely, encapsulation would preserve these radioactively contaminated materials in a concentrated area just below the surface, forever. (116)

Response 4: The Uranium Mill Tailings Radiation Control Act (UMTRCA) of 1978 requires that remedial action at the Canonsburg site meet the EPA standards (40 CFR 192) discussed in Section 2.2 of the Canonsburg FEIS. Continued uncontrolled infiltration and dilution of the radionuclides by ground water would not meet the EPA standards (40 CFR 192), nor would the NRC approve such a method for disposition of the radioactively contaminated materials. Therefore, the more highly radioactively contaminated materials would be moved out of the flood plain and would not be in direct contact with ground water.

Issue 5: Two commenters stated that the disposal of the radioactively contaminated materials should be considered only temporary and that a monitored, retrievable storage system should be used. (36, 45)

Response 5: As discussed in subsection 3.1.6.3 of the Canonsburg FEIS, above-ground containment of the radioactively contaminated materials would require a large containment structure that would be subject to decay. The proposed remedial action and the attendant monitoring and maintenance plans are considered an acceptable method to both stabilize the radioactively contaminated materials through the use of natural materials and to provide a method for monitoring the achievement of this goal. The proposed remedial action would permit the radioactively contaminated materials to be retrieved in the future, if necessary.

6.2.1.2 Decontamination; removing the radioactively contaminated materials to a remote location

Issue 1: Four commenters stated that the Canonsburg site should be completely decontaminated and the radioactively contaminated materials should be removed to a truly remote location. The opinion was expressed that the radioactively contaminated materials should be taken to a Federal repository, ideally a central one for all of the UMTRAP sites. (26, 31, 39, 47, 128, 129)

Response 1: Subsection 3.1.6.4 has been added to the Canonsburg FEIS to discuss the reasons for eliminating this alternative.

Issue 2: One commenter stated that it would be in the national interest to use rail over trucks because of fuel efficiency. Also, one commenter stated that since the radioactively contaminated materials were originally brought to the Canonsburg site by rail, they should be removed by the same means. (13, 135)

Response 2: Chapter 3 of the Canonsburg FEIS has been revised to discuss the reasons for eliminating rail transport as an alternative for hauling the radioactively contaminated materials or the clean fill.

6.2.1.3 Selection process inadequacies

Issue 1: One commenter stated that it appears that the choice of Alternative 3 as the proposed action is based on nonscientific factors such as cost and the public outcry in Hanover Township. (15)

Response 1: This Canonsburg FEIS presents the results of several years of detailed technical study at the various sites. The primary intent of these studies was to assemble baseline information on site radioactive contamination (Canonsburg and Burrell sites), as well as site suitability information (all three sites). This information was used in the feasibility and impact analyses. The evaluation process fundamentally considered environmental and engineering factors, of which cost is an unavoidable one. This Canonsburg FEIS is intended to present the environmental and engineering inputs to the decision-making process.

Issue 2: One commenter stated that the Canonsburg DEIS (U.S. DOE, 1982a) does not show that the NRC principle of "ALARA" (10 CFR 50, Appendix I) has been applied. This is used to determine how much money should be spent to improve control measures to decrease radiation exposure. (132)

Response 2: Strictly speaking, 10 CFR 50 does not apply because the law (PL 95-604) directs the DOE to perform remedial actions that conform to the EPA standards (40 CFR 192). However, ALARA (as low as reasonably achievable) is a good general principle. Its application depends very much on what is meant by the word "reasonably." Practicality and cost must enter into that judgement. The DOE has tried to be reasonable, and the NRC, as provided in the law (PL 95-604), will judge whether that goal has been reached.

Issue 3: One commenter indicated that a better location for the Canonsburg site's radioactively contaminated materials should be chosen. It might be possible to find a location with stable geology that would allow for deep underground disposal. (134)

Response 3: Subsection 3.1.6.5 has been added to the Canonsburg FEIS to discuss the reasons for eliminating this alternative.

6.2.2 Engineering

Thirty-six comments were received on the engineering design and possible mitigation measures under the various alternatives discussed in the Canonsburg DEIS (U.S. DOE, 1982a); 11 came from the public hearings, and 15 personal letters and 10 comments from the EPA were received.

6.2.2.1 Project design

Issue 1: Eight commenters focused on what they felt were optimistic expectations of the design components (i.e., cover and liner system) and the anticipated use of natural materials (e.g., bentonite or other clays). Concern was expressed about failure of the cover, as a barrier to infiltration, resulting in the "bathtub" effect and the release of contaminants. Also mentioned was differential settlement, the effect of the freeze-thaw cycle, and wetting/drying as affecting cover integrity and, thus, the ability of the site to protect the public and the environment over the long-term. (6, 17, 30, 37, 114, 115, 148, 155, 156, 202, 210)

Response 1: The concept design (proposed action) presented in Appendix A.1 of the Canonsburg FEIS is only the first step in a process to produce a final design. Section 1.6 of the Canonsburg FEIS presents the additional design documents that will be published. The development of a final design, which will vary only in minor detail from the proposed design, will be based on detailed analyses and material testing to assess the effects of all of the factors for which commenters expressed concern. The remedial action plan and design will incorporate state-of-the-art research and technology. All work will be reviewed by the NRC, the Commonwealth, the DOE, and the DOE's technical assistance contractor. Subsection 3.1.2 has been changed to discuss the comments received on these subjects.

Issue 2: One commenter stated that the integrity of the liner or cover materials may be affected by inorganic acids in the radioactively contaminated materials or by organic acids in the liner or cover. Research has shown that low pH and high metals content increase permeability. (204, 207)

Response 2: The DOE recognizes the potential for adverse waste/cover/liner interaction. Accordingly, the DOE has contracted with Battelle's Pacific Northwest Laboratory to evaluate the chemical interaction of leachate from the Canonsburg site's radioactively contaminated materials (Area C sludge) with local soil (borrow pit material). Effects of soil amendments, including hydrous oxides, quartz sand, or coarse-grained natural zeolites, will be evaluated to determine the soil's performance as an engineered liner material.

Interaction studies will be performed in batch tests and permeability columns. The batch tests will evaluate the sorption characteristics of the soil for selected contaminants, including thorium, radium, and uranium. Distribution ratios will be determined for thorium, radium, and uranium, as well as for heavy metals including arsenic, selenium, and molybdenum.

Issue 3: Two commenters were concerned about the apparent need for long-term maintenance for continued compliance with the EPA standards (40 CFR 192) and the associated long-term costs. (126, 212)

Response 3: The proposed concept design relies on passive remedial measures (e.g., cover thickness and composition) that will not require active maintenance (e.g., additional cover in a few years). Given the EPA longevity requirement (40 CFR 192) of 200 to 1000 years, those natural phenomena (e.g., erosion, floods, seismic events) that could affect site integrity have been evaluated in subsections 4.3.3, 4.5.1, 4.5.4, and Appendix A.1 of the Canonsburg FEIS. These concerns will be further addressed in the site conceptual design and the final design and specifications documents.

Nevertheless, after completion of the remedial action, monitoring, surveillance, and custodial maintenance would be required. These activities would be undertaken to ensure that security measures are intact and functioning, and that the disposal site had not been disturbed. These activities, and their anticipated minimal costs, would be conducted by a Federal agency pursuant to the license issued by the NRC.

Issue 4: One commenter felt that all radioactively contaminated materials, encapsulated or otherwise, should be isolated above ground water. (203, 208)

Response 4: The encapsulation cell containing the majority ($\pm$ 90 percent) of the more highly radioactively contaminated materials would be above the ground-water level in Areas A and B. In addition, demolition and abandonment of underground structures to eliminate sewer recharge and the reduction of infiltration by the Canonsburg site cover should lower ground-water levels and eliminate mounding in Areas A and B. Some isolated small amounts of radioactively contaminated materials, largely in Area B, would not be encapsulated, but would be covered by additional soil. Further details are available in Appendix A.1 of the Canonsburg FEIS.

Issue 5: One commenter asked if the containment area at the Canonsburg site would be outside the Chartiers Creek flood plain? Two commenters asked if the containment area could really be sealed from the creek? (7, 80, 115)

Response 5: Early in the construction effort, low-lying areas along Ward Street would be filled above the existing grade (see Appendix J of the Canonsburg FEIS). The bottom of the encapsulation cell would be above the 100-year flood level (Appendix A.1 of the Canonsburg FEIS), and the slope would be protected to above the 1000-year flood level (Appendix A.1 of the Canonsburg FEIS). The encapsulated radioactively contaminated materials would be isolated above the 500-year flood plain.

Issue 6: One commenter questioned whether any parts of the Canonsburg site buildings would be sold as salvage? (5)

Response 6: After thorough decontamination, steel may be salvaged from the buildings (see subsection 3.1.2 of the Canonsburg FEIS).

Issue 7: One commenter indicated that mention is made of the attempts that would be made to control vegetation on the areas above the modules. What would be done to guard against invasion by burrowing animals? What precautions would be implemented to be sure that the vegetation, especially deep-rooted vegetation, does not "pipe" radionuclides into above-ground plant tissues? (209)

Response 7: As part of the DOE's research and technology development program, Battelle's Pacific Northwest Laboratory (PNL) has studied the effect of burrows and openings along roots. The effects of vegetation are minor, not like the boring into the pile of radioactively contaminated materials. Nevertheless, several methods have been investigated and considered for control of root and animal penetration. These include selection of an intermediate gravel layer between the vegetation cover and the clay cap. Proper selection of the size and gradation of the gravel or crushed stone to be used as an intermediate layer would be done to discourage burrowing animals and root penetration. Section 3.1 of the Canonsburg FEIS includes a general discussion of the potential penetration controls that would be used. Appendix A.1 of the Canonsburg FEIS provides additional information.

Issue 8: One commenter indicated that no mention is made of any sanitary facilities at the Canonsburg site. Was an onsite system used or was it connected with a public system in the area? (221)

Response 8: A preliminary evaluation has identified above- and underground water mains, gas lines, power lines, sewer lines, etc. It appears that the Canon Industrial Park used onsite disposal systems. Additional details are available in Appendix A.1 of the Canonsburg FEIS.

Issue 9: One commenter questioned what is the future use proposed for the Canonsburg site? What legal guarantee is there that no more radioactively contaminated materials will be brought onto the site? (8)

Response 9: Under Alternatives 2 and 3, the expanded Canonsburg site would be used as a disposal site owned by the Federal government with long-term maintenance and monitoring licensed by the NRC. Most likely its future use for other purposes would be restricted. The addition of other radioactively contaminated materials would be subject to future legislation and separate environmental documentation and analysis.

Issue 10: One commenter stated that the DOE should consider doing the clean-up properly rather than pushing a little dirt over the problem and going away. It would appear that that was the procedure used in 1965-1966 and found to be unacceptable in 1977. (133)

Response 10: The proposed remedial action differs significantly from the relatively simple attempts to clean up the Canonsburg site conducted in the mid-1960's. The proposed remedial action is designed to excavate those radioactively contaminated materials that are "more" radioactively contaminated, and to relocate them to a specially designed encapsulation cell. In this way the vast majority ($\pm$ 90 percent) of the radioactive source would be controlled in one area (the encapsulation cell) and, as such, would not be subject to natural or human influence that could result in dispersal of the radioactively contaminated materials into the environment. The remaining radioactively contaminated materials would be stabilized outside the encapsulation cell by covering them with soil. To ensure that all factors were considered, the design and remedial action would be subject to review and approval by the NRC, the Commonwealth, and the DOE.

Issue 11: One commenter questioned the Burrell remedial action design, especially its ability to maintain the radioactively contaminated materials in a dry state. (205)

Response 11: The water table at the Burrell site is more than 20 feet below the surface in the area where the radioactively contaminated materials are located. The recent more extensive surveys by Weston and Bendix (U.S. DOE, 1982c) show that little, if any, radioactively contaminated materials currently exist at depths below 15 feet from the surface. The earlier ORNL surveys (Leggett et al., 1979) showed radioactively contaminated materials existing to depths of 36 feet and into the water table. (See subsection 4.8.2 of the Canonsburg FEIS.) The recent surveys were more extensive and conducted with better equipment than the earlier survey. Therefore, the recent survey results are taken to represent the existing Burrell site conditions.

The proposed remedial action (see Appendix A.2 of the Canonsburg FEIS) would reduce the water infiltrating from the surface (from precipitation) and would further lower the water table. This design will satisfy the EPA standards (40 CFR 192).

It is assumed that the reduction in the amount of radioactively contaminated materials existing at the Burrell site from the ORNL survey in 1977 to the Weston and Bendix surveys in 1981 and 1982 was caused either by leaching of the radioactively contaminated materials by ground water, or by a redistribution of the radioactively contaminated materials on the Burrell site.

The result of the proposed remedial action would be to slow down the leaching by ensuring that the radioactively contaminated materials are above the water table and by limiting infiltration. It should be noted that if any leaching has occurred in the past, it has been so slow and the flow of the Conemaugh River so great that no measurable radioactive contamination has been detected in the river water.

Issue 12: Two commenters refer to the Interagency Review Group's (IRG) 1979 report to the President. This report said that mill tailings present a greater potential problem than either deeply buried high-level or transuranic wastes (HLW and TRU). The commenters believe that the radioactively contaminated materials at the Canonsburg site should be treated with the same long-term care as the DOE would employ with high-level and transuranic wastes. (16, 35)

Response 12: The IRG (1979) report did not imply that tailings should be put into the same deep geologic disposal as recommended for HLW and TRU. Rather, the tailings problem was characterized as potentially worse because there is such a large amount of tailings material throughout the United States, and up to the time of the report most of these tailings were out in the open, entirely unprotected from dispersal by either natural causes or human carelessness.

Issue 13: One commenter stated that concentration of all of the Canonsburg site's radioactively contaminated materials within a small capsule may violate the EPA standard (40 CFR 192) that radium-226 must not exeed 15 picocuries per gram over 15-centimeter thick layers, more than 15 centimeters below the surface. It is probable that a breach in the encapsulation cell could occur before there is any significant decrease in radioactivity. (127)

Response 13: The EPA standards (40 CFR 192) cited by the commenter refer to Subpart B of the standards for cleanup of open lands and buildings. They do not apply to the final disposal site, which is covered in Subpart A of the standards. The encapsulation cell would be designed to meet the EPA standard (40 CFR 192) that requires control of radioactively contaminated materials for at least 200 years. The subject of the length of time required for the integrity of the remedial action is discussed in the EPA's FEIS on the standards (U.S. EPA, 1982).

6.2.2.2 Mitigation measures

Issue 1: Three commenters asked about various aspects of the schedule. One asked if the project timeframes are all-inclusive and whether they allow for things such as inclement weather. One commenter asked whether the excavation of radioactively contaminated materials could be restricted to the summer months when school is not in session, or when athletic events are not scheduled for Big Mac stadium. One commenter referred to the elevated noise levels and suggested that a reduced scale of operations would be indicated. (110, 124, 143, 146)

Response 1: Subsection 3.1.2 of the Canonsburg FEIS has been changed to indicate that the construction time estimates include all activities from the first day of mobilization at the Canonsburg site through the final demobilization. This includes some provision for weather-related delays. The schedule assumes year-round activity, but controlled where necessary by monitoring on and off the site to protect workers and the nearby public from elevated levels of radiation. The construction activities would normally occur only during daytime hours, and hence, the associated noise should have only a minimal effect on the local community. The specific scheduling would be related to the number of crews and kinds of equipment to be used by the contractor. These subjects will be described in the final design and specifications, and will be subject to review by the NRC and the Commonwealth.

Issue 2: Concern was expressed by three commenters that airborne contaminants would be deposited off the site during remedial action. Commenters suggested several means to control the dispersal of contaminated dust, including wetting soil, covering vehicles, and constructing tents. (1, 136, 142)

Response 2: Subsection 3.1.2 of the Canonsburg FEIS has been changed to include the discussion of the dust control strategies that would be used.

Issue 3: One commenter suggested that a footbridge should be installed over Chartiers Creek to replace the closing of Strabane Avenue. (109)

Response 3: The need for this footbridge will be considered in the final design document.

6.2.3 Safety

Sixteen comments were received on the proposed safety measures discussed in the Canonsburg DEIS (U.S. DOE, 1982a); 11 came during the public hearings, and 4 personal letters and 1 comment from the EPA were received.

Issue 1: Four commenters requested more information on short-term surveillance (i.e., monitoring) during project activities. This should include provisions to control the offsite movement of radiation, and emergency response plans in the event of elevated radiation levels. Specific concern should be paid to local schools. (2, 3, 25, 27, 41, 141, 144, 145)

Response 1: The remedial action plan will include the health and safety plan and the radiological support plan. The basic elements of this program include worker and equipment monitoring for radioactive contamination and offsite monitoring of radioactive contaminants in air and water. These plans will be subject to approval by the NRC and the Commonwealth and will be made available to the public before the remedial action begins. All reasonable precautions would be taken to ensure that radioactively contaminated materials do not migrate off the sites during the remedial action. The details of the type of monitoring and safety measures to be employed are described in Appendices F.4 and F.5 of the Canonsburg FEIS.

Issue 2: Eight commenters requested more information on long-term surveillance (i.e., inspection and monitoring) and maintenance plans. (9, 18, 29, 44, 46, 54, 102, 160)

Response 2: The details of these plans will be found in the UMTRA project licensing plan and the site surveillance maintenance plan. These documents are subject to review and approval by the NRC and the Commonwealth, and will be available to the public prior to completion of the remedial action. Appendix F.4 of the Canonsburg FEIS discusses this subject.

6.2.4 Radiation

Eighteen comments were received concerning the radiation exposures discussed in the Canonsburg DEIS (U.S. DOE, 1982a); three came during the public hearings, and six personal letters and nine comments from the EPA were received.

6.2.4.1 Current radioactive contamination

Issue 1: One commenter questioned the classification of the Canonsburg site's residual radioactive materials as uranium mill tailings. According to the historical descriptions of its uranium content, these residual radioactive materials might be more accurately classified as "low-level radioactive waste." This classification change might require that a different type of remedial action be performed. Another commenter asked about the isotopes present on the Canonsburg site. (10, 112)

Response 1: The Canonsburg site's residual radioactive materials are not uranium mill tailings but are defined in the UMTRCA as "residual radioactive materials." The term residual radioactive materials means radioactive waste in the form of tailings resulting from processing ores for the extraction of uranium and other valuable constituents of the ores, and other radioactive wastes related to such processing, including any residual stock of unprocessed ores or low-grade radioactive materials.

Issue 2: One commenter recommended a more rigorous characterization of the contaminated areas at the Canonsburg site. This should include extensive site sampling as well as examination of old AEC and Vitro records. (113)

Response 2: The Canonsburg site has already been characterized in sufficient detail to identify and evaluate remedial-action alternatives.

Issue 3: One commenter asked if the radionuclides in the ground water are suspended or dissolved, and what is the fraction of each? This may make a difference in the type of water treatment needed. Our review failed to note an assessment of the total quantity of radioactivity in the ground water at the Canonsburg site. (174)

Response 3: Radioactivity measured in water was the dissolved (soluble) fraction except where otherwise noted. Waste water will be treated to reduce concentrations of contaminants to levels specified in the NPDES permit (40 CFR 124) before the water leaves the Canonsburg site. The selection of the waste treatment system will be made during the final design program.

Issue 4: One commenter indicated that no mention is made of an analysis for Po-210. We suggest this nuclide be included in all analyses of surface water, ground water, and sediments. In addition, stream sedimient analyses will be very useful for long-term monitoring. (226)

Response 4: Both polonium-210 and lead-210 are part of the uranium-238 decay chain, as is radium-226. Since uranium-238 and radium-226 analyses were performed, it was not considered necessary to also measure polonium-210. However, the usefulness of measuring polonium-210 and lead-210 will be considered in future monitoring programs. Stream sediment analyses will also be considered in long-term site monitoring programs (refer to Appendix F.4 of the Canonsburg FEIS).

Issue 5: One commenter asked when George's Pottery was built and for how long a period did it operate? Was any of the Vitro uranium or other radioactive materials used in the pottery and glazing? (222)

Response 5: The former George's Pottery property is being included as part of the expanded Canonsburg site remedial-action program, and it has been subject to radiological sampling. It is not known whether any radioactively contaminated materials from the Canonsburg site were used in the pottery operations.

Issue 6: One commenter disagreed with the statement that the Wilson Avenue and George Street residences are nonradioactively contaminated; it was stated that one house has a radioactively contaminated chimney. (137)

Response 6: This statement has been changed in subsection 3.1.2 of the Canonsburg FEIS. Radioactively contaminated residences will be treated either under the vicinity property program (cleanup) or the Canonsburg site remedial-action program (acquisition), therefore, any radioactive contamination of these properties will be remedied. Five of the six houses on Wilson Avenue and the one house on George Street have already been designated as vicinity properties (155 Wilson Avenue has not been so designated as of April 1983).

Issue 7: One commenter indicated that it appears the study has overlooked the area to the south of the expanded Canonsburg site (beyond the railroad tracks). Since it is known that radioactive contamination exists and has moved off the expanded Canonsburg site, then this area might be studied further. However, this may be a vicinity property. If so, should anything be said regarding any radioactive contamination remedial activities? (183)

Response 7: Preliminary cleanup action is currently underway at radioactively contaminated offsite areas under the vicinity properties cleanup program. This program includes properties south of the railroad tracks. This action is being performed separately from the remedial action at the Canonsburg site, and an Environmental Assessment (U.S. DOE, 1982d) has been prepared on it (available from the DOE UMTRA project office in Albuquerque, New Mexico). Ground-water quality south of the railroad tracks is addressed in subsection 4.6.2.

Issue 8: One commenter asked if there is any theory as to why the 1977 surveys at the Burrell site are so different from the more recent studies? Will further sampling be done to verify the recent data? The variation between the radioactive contamination level reported for the 1977 studies and those reported in this document should receive further explanation. Is it possible, for example, that leaching has taken place at the Burrell site to the extent that radioactive leachate contamination in the future will be negligible? If so, would this argue against further remedial action at the Burrell site? (173)

Response 8: The results of the Bendix survey in 1982 agreed with the Weston data of 1981 and are considered to be the conditions that currently exist on the site (U.S. DOE, 1982c). Based on these more recent and more extensive data, it is assumed that only one-third to one-tenth the radiological activity originally placed on the Burrell site remains there, and that most of this radiological activity occurs at depths of less than 12 feet. It is assumed that the reduction in the amount of radioactively contaminated materials existing on the Burrell site from the ORNL 1977 survey (Leggett et al., 1979) and the Weston and Bendix 1981-1982 surveys (U.S. DOE, 1982c) was due to leaching by ground water or by a redistribution of the radioactively contaminated materials at the Burrell site. The Burrell site currently meets the EPA standard (40 CFR 192), except in a few small areas. This, in turn, could imply that a much smaller remedial-action plan is necessary than originally envisioned (i.e., acquiring the Burrell site, covering the radioactively contaminated portion of the Burrell site with a minimum soil cover, and designating that portion of the Burrell site as a disposal site as described in Appendix A.2). The Burrell site is currently classified as a vicinity property, but the DOE is proposing to redesignate the Burrell site as a disposal site. The Burrell site's use is currently restricted by the U.S. Army Corps of Engineers flood-control easement for the Conemaugh Dam.

6.2.4.2 Measurements

Issue 1: One commenter stated that radiological measurements should be explained better. For example, the Canonsburg DEIS (U.S. DOE, 1982a) refers to a radon-222 release of 2 picocuries per square meter per second. How do you propose to measure that? Also, the Canonsburg DEIS (U.S. DOE, 1982a) often uses "picocuries per gram" -- per gram of what? (151, 152)

Response 1: Because of the procedural difficulty in measuring radon-222 flux rates, there are no standard instruments that may be used to monitor the performance of the remedial action (40 CFR 192). As specified by the EPA standards (40 CFR 192) in Section 192.02, footnote a, "Because the standard applies to design, monitoring after disposal is not required to demonstrate compliance." This concept is discussed in the EPA's FEIS on the Remedial Action Standards for Inactive Uranium Processing Sites (U.S. EPA, 1982). The "gram" in this unit would refer to the medium being sampled (e.g., soil).

Issue 2: It was suggested by one commenter that a working level for radon be defined in the report and in the definitions. (164)

Response 2: Definitions of "working level" and "working level month" are given in the glossary of the Canonsburg FEIS.

6.2.4.3 Standards

Issue 1: Three persons commented on the less stringent requirements of the final EPA standards (40 CFR 192), especially the 200-year limit for stabilization. One person also stated that according to the final EPA standards (40 CFR 192), five sites previously listed under the UMTRA program can now be removed from the program. (42, 78, 140)

Response 1: The EPA standards (40 CFR 192) state that the requirement for longevity is "up to 1000 years to the extent reasonably achievable, but at least 200 years." The law (PL 95-604) requires the DOE to conform to the EPA standards. The EPA has published an EIS (U.S. EPA, 1982) on the development and impacts of the standards. The question of whether some of the other sites under the UMTRA program may be removed from the program is not relevant to action at the Canonsburg site.

Issue 2: One commenter stated that the Canonsburg FEIS should specify how the remedial action will meet the EPA standards (40 CFR 192), instead of saying that they will be met. (159, 161)

Response 2: The preliminary design analyses in the Canonsburg FEIS have shown that the proposed conceptual design will meet the EPA standards (40 CFR 192). The models used to predict cover thickness to attenuate radon and to withstand erosion are discussed in subsections 5.2.3 and Appendix A.5 of the Canonsburg FEIS; the issue of ground-water radioactive contamination (current and future) is examined in subsections 4.6.2 and 5.6.2 of the Canonsburg FEIS; seismicity is discussed in subsection 4.5.4 of the Canonsburg FEIS; and Appendices A.1 and A.2 of the Canonsburg FEIS discuss the conceptual design for the expanded Canonsburg site and the Burrell site, respectively. Additional site and project documents, as outlined in Section 1.6, will present further design information.

Issue 3: One commenter indicated that on page 4-32 (last paragraph) of the Canonsburg DEIS (U.S. DOE, 1982a), the EPA (40 CFR 192) and NRC (10 CFR 20) standards are different but the EPA standards (40 CFR 192) cover this project. Since the document is intended to be widely distributed to both the scientific community and the public, an explanation should accompany the text so that confusion over the various standards is avoided. The differing purposes of the EPA (40 CFR 192) and NRC (10 CFR 20) standards should be explained. (218)

Response 3: Section 4.8 of the Canonsburg FEIS explains that the NRC standards (10 CFR 20) do not specifically apply to the cleanup of abandoned uranium-mill-tailings sites. The NRC standards (10 CFR 201) are used in the Canonsburg FEIS only as a basis for comparison.

6.2.5 Health

Thirty-six comments were received on the health matters discussed in the Canonsburg DEIS (U.S. DOE, 1982a); 10 came from the public hearings, and 13 personal letters and 13 comments from the EPA were received.

6.2.5.1 Current situation

Issue 1: Six persons said that the Canonsburg DEIS (U.S. DOE, 1982a) does not adequately address the existing health problems in the Canonsburg site area. They ask that the Federal government perform a health study and include its results in the Canonsburg FEIS. Several objected to the mention of the use of the University of Pittsburgh's Canonsburg health study (Lanes, 1982), saying it did not include any of the area families with known lung cancers. (22, 23, 24, 33, 68, 105, 123, 139, 149)

Response 1: The specific purpose of this Canonsburg FEIS is to analyze the impacts of alternative approaches on the proposed cleanup of the Canonsburg site. What has happened in the past will not affect what remedial action will be chosen. While the existing health problems in the Canonsburg site area and their possible relationship to the Canonsburg site, both historically and presently, are of concern, they are outside the scope of this Canonsburg FEIS. The limitations of the University of Pittsburgh studies (Lanes, 1982; Talbott et al., 1982) are noted in Section 1.5 of the Canonsburg FEIS.

Issue 2: One of the Wilson Avenue (Ward Street) residents questioned the statement that the nearest home is 250 feet from the Canonsburg site. Her house measures 80 feet from its back wall to the Canonsburg site's property line. (21)

Response 2: The 250-foot value is the distance from the edge of the expanded Canonsburg site to the nearest houses across the railroad tracks to the south that will remain after remedial action under Alternatives 2 or 3. The distance from the edge of the Canon Industrial Park portion of the expanded Canonsburg site to the nearest home on the expanded Canonsburg site is approximately 80 feet. A change has been made in subsection 4.12.5 of the Canonsburg FEIS to clarify this situation.

Issue 3: One commenter asked whether the present condition of the Canonsburg site really poses a health hazard. (11)

Response 3: Tables 5-1 and F.3-1, and the discussion in subsection 5.2.1 of the Canonsburg FEIS contain information on the potential health impacts under "no action" for the Canonsburg site (i.e., continuation of the present situation).

6.2.5.2 Future situation

Issue 1: Three commenters questioned the accuracy of the radiological impact predictions. One person asked if cancer rates can really be predicted accurately. One asked about the uncertainty of the health effects from radon progeny. The third questioned the statement on page F.2-3 of the Canonsburg DEIS (U.S. DOE, 1982a) that "calculated doses are within 20 percent of the doses likely to be received by the general public and remedial-action workers." (108, 166, 172)

Response 1: These matters are discussed in Appendix F.2, subsections F.2.2 and F.2.3 of the Canonsburg FEIS. The accuracy of the predictions is usually taken to be within a factor of 2. (The 20 percent figure is only the calculational accuracy, assuming the complete accuracy of the inputs to the calculations.)

Issue 2: One commenter stated that the Canonsburg DEIS (U.S. DOE, 1982a) still leaves the reader uncertain about the health hazards to which residents have already been exposed, future hazards to be caused by cleanup efforts, and the ultimate safety following stabilization. (147)

Response 2: Section 5.2 of the Canonsburg FEIS has been rewritten to make it clearer and to give more details of the results of the calculations. Also refer to Appendix F.2 of the Canonsburg FEIS for information on the analytical process used.

Issue 3: One commenter does not agree that since remedial action will reduce lung cancer incidents by a factor of 700 that the rate for "no action" can be divided by 700 to determine the rate after remedial action. (64)

Response 3: This is not how it was done. The cancer incidence for each of the alternatives (1 through 5) was determined separately. The results of each action alternative were then compared against the result for "no action" to determine the reduction factor. The reduction factor of 700 no longer appears in the Canonsburg FEIS. Chapter 1 and Section 5.2 of the Canonsburg FEIS indicate why the 700 number was eliminated and discuss the revised impact assessment.

Issue 4: One commenter disagreed with expressing cancer deaths in terms of fractions. Instead, they should be rounded off to whole numbers and given as a range (e.g., 10 to 20). Also, the incidence of cancer should be expressed in terms other than death. (150)

Response 4: The cancer death rates were presented in standard epidemiological format, which is not necessarily limited to whole numbers. Based on the current status of medical advancement, the majority of lung cancers result in death.

Issue 5: A number of persons questioned the results of the radiological impact predictions. One such person questioned the statement that Canonsburg residents will be receiving about the same radiation exposure during the remedial action as under no action. A situation was cited during the cleanup of vicinity properties in the fall of 1982 when the Canonsburg site area experienced slightly increased radon levels. Since this material is less radioactively contaminated than the Canonsburg site's radioactively contaminated materials, the potential exists for significantly elevated radon levels during the remedial action. (107)

Response 5: The predictions in the Canonsburg DEIS (U.S. DOE, 1982a) were made by assuming that the radioactively contaminated materials are bare and not mostly covered as they actually are now. The radioactively contaminated materials could, in any case, be partially exposed during remedial action. Thus, the exposure rates were calculated for worst-case situations. The commenter's observation is correct; remedial action, no matter what the alternative, would mean more exposure than no action, because the radioactively contaminated materials would be uncovered and stirred up. The predictions in the Canonsburg FEIS for no action have been changed to take account of the fact that the radioactively contaminated materials are currently covered. This change reduces the predictions for no action and could make exposure rates during the remedial action about twice what they are now. However, this increased exposure would be controlled so that there would be no significant health effects received by the residents during the remedial-action activities. After 96 weeks time, however, the exposure rates will be decreased from what they are now by a factor of about 4 (see Section 5.2 of the Canonsburg FEIS for additional information).

It is not known at present if the vicinity-property remedial-action activities were responsible for the slight increase in radon levels. Factors that may increase or decrease radon levels (e.g., climatic conditions) may have affected radon emanation.

Issue 6: One person commented that the estimate that the workers would increase their risk of cancer 0.3 to 0.6 percent may be a factor of 10 too high. From Tables 5-4 and 5-5 of the Canonsburg DEIS (U.S. DOE, 1982d) the risk would be increased 0.0004 to 0.0008 or 0.04 to 0.08 percent. Should this be corrected? (169)

Response 6: The risk has been corrected to 0.06 to 0.08 percent (see subsection 5.2.1 of the Canonsburg FEIS). The method of calculation used compared total lung cancer deaths due to the remedial action to those lung cancer deaths normally expected (Tables 5-7 and 5-8 of the Canonsburg FEIS). This yielded 0.0013/(0.07 x 32.5) and 0.0010/(0.04 x 32.5) increased risks or 0.06 to 0.08 percent.

Issue 7: One commenter stated that it should be explained why the status quo (8300 man-rems) results in more cancer deaths than the 12,000-man-rem short-term exposure for remedial action. The reason is the latter dose is a whole-body dose while the former dose is a dose to the lungs. (163)

Response 7: This is a misinterpretation of the table. Under "no-action" the exposure would continue indefinitely, while under any of the remedial actions, it would only occur for about 2 years. Table 1-3 of the Canonsburg FEIS has been reformatted to provide clarification.

Issue 8: Two commenters questioned the size of the area used in calculating health impacts. One stated that the analysis should address an area less than 2 kilometers downwind from the Canonsburg site, while the other stated that the analysis should consider persons living further than 2 kilometers from the Canonsburg site. (122, 131)

Response 8: The study area has been expanded to include a 10-kilometer radius around the Canonsburg site (see Section 5.2 of the Canonsburg FEIS).

Issue 9: Two commenters raised questions regarding the length of the exposure period given. The Canonsburg DEIS (U.S. DOE, 1982a) states that under "no action" there would be 5.4 additional deaths in the next 32.5 years. How long does that rate continue? (130, 162, 165, 167)

Response 9: Where it was feasible to do so, the Canonsburg FEIS has been changed to present all risk and health impact values on an annual basis. This rate will continue into the future (see Subsection 5.2 of the Canonsburg FEIS).

Issue 10: Because the radioactively contaminated materials are randomly scattered over the Canonsburg site, one commenter questioned the use of a single radon exhalation rate. (227, 228)

Response 10: The Canonsburg site was divided into three source areas for the calculations. Further subdivision of the source areas would not have improved the accuracy of the predictions.

Issue 11: Two commenters addressed the fact that children are more sensitive to radiation exposure than are adults. Information on radon and radon-daughter levels projected for the St. Patrick's school was requested, as well as for the short- and long-term health effects on the children. (4, 103)

Response 11: The age and sex distribution of the public are taken into account in the health risk factors used. Dose rates specific for the St. Patrick's and Canon-McMillan Schools are given in Tables F.3-1 through F.3-5 of the Canonsburg FEIS.

Issue 12: One commenter stated that residents should be concerned that locally grown foodstuffs might be a source of further radiation exposure, since radium in surface waters or in the soil can be taken up by plants. (104)

Response 12: Information on agricultural production within the study area has been taken into account in the analysis of radiation exposures (see Appendix F.3 of the Canonsburg FEIS).

Issue 13: One commenter objected to the Canonsburg DEIS (U.S. DOE, 1982a) using MILDOS to estimate radiological doses. They said that MILDOS and its related programs is not state-of-the-art, depending on ICRP-2 (International Commission on Radiological Protection (ICRP), 1959) and other old data bases, and that the programs give dose estimates considerably lower than a more up-to-date code like INREM (a computer code for calculating internal radiation dose equivalent) for some cases.

A better estimate could have been made using AIRDOS (conversion of air concentration to dose radionuclides) or AIRDOS-EPA with INREM II (computer implementation of recent models for estimating the dose equivalent to organs of man from an ingested or inhaled radionuclide) or ICRP-30 models and data base. This would lend support to the remedial action. (170)

Response 13: AIRDOS and INREM do not contain all of the critical pathways and critical radionuclide dose analyses that are available in MILDOS. Doses calculated using AIRDOS or INREM may not be as accurate or as useful in this situation, as MILDOS. MILDOS is the code recommended for use by the NRC. MILDOS provides a complete accounting of the proposed impacts and a relative comparison of the proposed impacts (see Response 14 of this subsection for additional information).

Issue 14: One commenter said the risk coefficients are wrong: they should be $100/10^6$ (100 per million).

1. The lung cancer risk coefficient $100/10^6$ PWLM (person working level months) ($20/10^6$ person-rems) is taken from Evans et al. (1981) with a conversion factor of 5 rem/WLM perhaps from BEIR III (National Academy of Sciences, 1980). One of the coauthors of the paper by Evans, et al. (J.H. Harley), has pointed out that this is at least a factor of 2 lower than what he thought was agreed upon (Stratton Hearings, 1982). It is about a factor of 4 lower than a reasonable estimate, and further supports the decision to do the remedial work.

2. The "all-cancer-death" risk, $120/10^6$ person-rems, is taken from Cohen (1981). Cohen derived his numbers from the linear quadratic estimates in BEIR III. The BEIR III estimate was force fit to an $_2/\ _1$ coefficient derived from the analysis of gamma and neutron risk coefficients for leukemia in the Hiroshima-Nagasaki data (BEIR III, pp 185-188; National Academy of Sciences, 1980). Since it

subsequently was shown there was no appreciable neutron exposure in Japan, the BEIR III estimate is wrong since it is force fit to nonexistent coefficients. A more reasonable risk estimate based on BEIR I and UNSCEAR 1972 (United Nations Scientific Committee on the Effects of Atomic Radiation) is $200/10^6$ person-rems. (171)

Response 14: It should be emphasized that the purpose of these analyses is to provide a comparison among alternatives, and as long as the same risk factor is used for each analysis, the comparison is valid. The use of higher or lower risk factors would not change the relative comparison among the alternatives. Harley's factor of 2 was taken into account in interpreting the outputs from the MILDOS code (see subsection F.2.3 of the Canonsburg FEIS). Modifications of the BEIR III estimates are being studied by a committee of the ICRP, with recommendations expected in 1984.

Issue 15: One commenter asked how many more people would be exposed to radiation by moving the Canonsburg site's radioactively contaminated materials to the Hanover site than if it remains in place. (50)

Response 15: About 30 more workers are needed for Alternatives 4 or 5 than for Alternatives 2 or 3. There are also the people who live along the transportation route between the Canonsburg and Hanover sites. Finally, there are the 114 people within 2 kilometers of the Hanover site. The levels of exposure these people would receive are given in Section 5.2 of the Canonsburg FEIS.

Issue 16: One commenter stated that the EPA standard (40 CFR 192) is misinterpreted. It is not a standard for man-rems to a lumped population; it is a standard for indoor radiation levels for buildings constructed from or near tailings materials. Table 5-5 of the Canonsburg DEIS (U.S. DOE, 1982a) needs further work. (168)

Response 16: Table 5-8 of the Canonsburg FEIS has been amended to reflect this correction.

Issue 17: One commenter requested that quantitative estimates of accidental death be presented rather than the qualitative statements given. (223)

Response 17: Section 5.16 of the Canonsburg FEIS has been changed to include these estimates.

6.2.6 Meteorology and air quality

Sixteen comments were received on meteorology and air quality as discussed in the Canonsburg DEIS (U.S. DOE, 1982a); 3 came during the public hearings, and 13 comments were received from the EPA.

6.2.6.1 Meteorological conditions

Issue 1: Two commenters questioned the use of short-term (2 years) wind data as it does not accurately portray maximum wind speeds. One person referred to the occurrence of wind gusts at the Canonsburg site greater than the values given in the Canonsburg DEIS (U.S. DOE, 1982a). (20, 76)

Response 1: As stated in Section 4.3 and Appendix B.1 of the Canonsburg FEIS, meteorological data for the Canonsburg site were obtained through onsite monitoring. This was necessary because the only long-term information available for this area is from the Pittsburgh Airport and these data are not appropriate for the Canonsburg site. Therefore, the only meteorological data available for the Canonsburg site are those from the 2-year monitoring program. Although longer-term information is available for the Hanover site, two years of data were used to be consistent. All meteorological information is given as hourly averages. Therefore, the maximum wind speeds are not absolute values, but averages for 1-hour intervals. This clarification has been made in subsection 4.3.4 of the Canonsburg FEIS.

6.2.6.2 Air-quality impact modeling

Issue 1: One commenter stated that the transportation of the Canonsburg site's radioactively contaminated materials to the Hanover site could adversely affect air quality. (63)

Response 1: The potential air quality impacts associated with each of the remedial-action alternatives are presented in Section 5.3 and summarized in Table 5-9 of the Canonsburg FEIS. As explained in Section 5.3, the major air quality impact at the Hanover site area will be the possibility for exceedance of the NAAQS for total suspended particulates. This would result principally from truck travel over unpaved access and onsite roadways.

Issue 2: One commenter questioned Table 1-3 of the Canonsburg DEIS (U.S. DOE, 1982a) which gives air impacts in grams per cubic meter. Should this be micrograms per cubic meter? (189)

Response 2: This has been corrected to micrograms per cubic meter in Table 1-3 of the Canonsburg FEIS.

Issue 3: One commenter stated that the Canonsburg DEIS (U.S. DOE, 1982a) refers to the total suspended particulate 60-microgram per cubic meter secondary air quality standard (40 CFR 50). This is not a standard but merely a guideline to meet the 150 micrograms per cubic meter 24-hour standard. It is not necessary to meet the 60 micrograms per cubic meter guideline level. (190, 192, 195)

Response 3: Table 5-9 of the Canonsburg FEIS has been changed to reflect the fact that the 60 micrograms per cubic meter total suspended particulate concentration is a guideline value and not a standard (40 CFR 50).

Issue 4: One commenter stated that a statement is made that the Southwest Pennsylvania AQCR (Air Quality Control Region) is in attainment for all pollutants but ozone. This is not true. The AQCR is nonattainment for SO_2 and total suspended particulates, although the Canonsburg area is most likely in attainment. (191)

Response 4: The portion of the Southwest Pennsylvania AQCR in which the three sites are located is an attainment area for all pollutants, except ozone. Sections 1.4 and 4.4 of the Canonsburg FEIS have modified to indicate that the statement only refers to the portion of the AQCR in which the three sites are located.

Issue 5: One commenter stated that water spray is not effective for control of total suspended particulates from unpaved roads, and can be counter-productive if vehicles are not washed before entering streets as mud can be tracked out. A petroleum-based agglomerating agent or some other equally suitable agent would be more appropriate. Stabilizing agents should be applied monthly, not quarterly. (193, 198, 199)

Response 5: The DOE recognizes that there are several means of controlling dust from various sources during remedial action. As discussed in subsection 3.1.2 of the Canonsburg FEIS, a specific control procedure would be prepared prior to initiation of remedial action and would be subject to Commonwealth review and approval. Best Available Technology would be used and could include methods such as water sprays, water or petroleum-based surfactants, sprays under pressure, and the like. The control procedure would probably reduce emissions by 85 to 90 percent (a 90 percent reduction was used in the air quality impact calculations).

Issue 6: One commenter stated that the NO_x calculations predicting standards violations are dubious, since the standard (40 CFR 50) would be violated at every major construction project and in every city if this were the case. This may be a problem with the way the ISC (Industrial Source Complex) model has been applied -- probably the initial sigma is too small. Also, note that the hydrocarbon standard will be withdrawn shortly by the EPA. This issue should be resolved because NO_2 violations were predicted for the NAAQS. (194, 196, 200)

Response 6: The NO_x concentrations were computed using an area source formulation of the ISC model. A revised modeling analysis has been conducted that uses a volume source formulation as suggested by the U.S. EPA, Region III. This approach does not predict NO_x concentrations that would violate the NAAQS. Appendix B.2 and Sections 4.4 and 5.3 of the Canonsburg FEIS have been modified to reflect the new values using the revised modeling approach. Appendix B.2 of the Canonsburg FEIS also contains a complete listing of the options used in the analysis.

The DOE is aware of the EPA's withdrawal of the hydrocarbon standard (48 FR 628-629, January 5, 1983).

Issue 7: One commenter stated that the AP-42 emission factors (U.S. EPA, 1977) should be checked for currency since many recent changes have been made. (197)

Response 7: Discussions with Mr. Bill Lamason (1983) of the U.S. EPA, Research Triangle Park, North Carolina confirms that there are no new AP-42 emission factors for construction vehicles. Mr. Lamason is responsible for updating the sections of AP-42 relative to construction vehicle emissions. The assumptions used in the air quality modeling analysis are documented in Appendix B.2 of the Canonsburg FEIS.

Issue 8: One commenter stated there is no systematic relationship between total suspended particulates and settleable dust. Note that the ISC model has an option that would allow settled dust to be calculated, but the calculation should be done for a rooftop location since this is where dustfall is routinely measured. (201)

Response 8: The deposition rate for particulates was recalculated using the ISC long-term model and the measured particle size distributions at the sites (see Appendix B.2 of the Canonsburg FEIS). The results of this analysis are incorporated in the Canonsburg FEIS.

6.2.7 Geology

Fifteen comments were received on the geology of the three sites presented in the Canonsburg DEIS (U.S. DOE, 1982a); nine came during the public hearings, and six were received from the U.S. EPA and the U.S. Department of the Interior.

6.2.7.1 Baseline conditions

Issue 1: Four commenters stated that the Hanover site has been dynamited during past mining operations. This has created fractures and, together with the remaining mine rubble, causes high porosity in the Hanover site's substrate, therefore, safe disposal is impossible. (49, 51, 58, 60, 61, 62)

Response 1: Subsection 5.4.3 has been added to the Canonsburg FEIS to address this concern.

Issue 2: Two commenters questioned whether disposal at the Hanover site is feasible because of the unknown interactions that would occur between the radioactively contaminated materials and chemical wastes, and between the chemical wastes and the liner. (53, 73)

Response 2: Subsections 3.1.4, 4.6.2, and 5.6.2 of the Canonsburg FEIS address this concern.

Issue 3: One commenter stated that there is confusion over the use of the term, "red dog." (220)

Response 3: "Red dog" is defined in the glossary of the Canonsburg FEIS.

Issue 4: One commenter stated that in Appendix C of the Canonsburg DEIS (U.S. DOE, 1982a), there is an inconsistency with respect to the material directly overlying the bedrock at the Canonsburg site. It is described as grey to brown silt and sand, and brown sandy silt and clay in the same location. (182)

Response 4: This discrepancy has been corrected in Appendix C of the Canonsburg FEIS.

Issue 5: One commenter stated that the discussion on the difference between the permeability of the fill and the bedrock presented in the Canonsburg DEIS (U.S. DOE, 1982a) does not include a value for the permeability of the bedrock. Even though the fill at the Burrell site has a much higher permeability than that of the alluvium and the bedrock, this is not conclusive proof that recharge is not occurring. The difference in head between the two units will ultimately control whether any recharge can occur. Permeabilities will influence the amount of recharge. Appendix D.2 should provide data on the head differences between the various units. (180)

Response 5: Flow net calculations appear in Table D.2-4 of the Canonsburg FEIS.

Issue 6: One commenter stated that since the Canonsburg area has been mined extensively for coal, the Canonsburg DEIS (U.S. DOE, 1982a) would benefit from additional information about mine subsidence which could affect the structural and hydrological integrity of the site. (158)

Response 6: Subsection 5.4.3 has been added to the Canonsburg FEIS to address this concern.

Issue 7: One commenter stated that the random fill that exists at the Canonsburg and Burrell sites raises questions concerning the stability of the fill under loading. Landsliding and subsidence would seem to be likely risks. Has the ability of this random fill to support vertical or lateral (due to flood water for example) loads been assessed? (211)

Response 7: Subsection 5.4.3 has been added to the Canonsburg FEIS to address this concern.

6.2.7.2 Impact predictions

Issue 1: One commenter stated that disposal of the Canonsburg site's radioactively contaminated materials at the Hanover site may adversely affect the use of the Hanover site area's geological resources, since there are oil and gas wells within 1 mile of the Hanover site. (66)

Response 1: Disposal of the radioactively contaminated materials at the Hanover site would probably not affect oil and gas recovery beneath the Hanover site or in the immediate Hanover site vicinity. These resources, if suitable in quality and quantity to warrant extraction and at sufficient depth, could be tapped by directional drilling.

Issue 2: One commenter stated that in the future, coal currently considered unmineable (for technological or economic reasons) may become accessible. The DOE should either reserve any of this coal in the Canonsburg site area, or analyze for any possible deep contamination resulting from future development of these reserves. (225)

Response 2: Subsection 5.4.3 has been added to the Canonsburg FEIS to address this concern.

6.2.8 Surface Water

Twelve comments were received concerning the surface water at the three sites as discussed in the Canonsburg DEIS (U.S. DOE, 1982a); four came during the public hearings, and two personal letters and six comments from the U.S. EPA and the Pennsylvania DER were received.

6.2.8.1 Public water supplies

Issue 1: Three commenters felt that the possibility for contamination of surface waters beyond the boundaries of the Hanover site was discussed too lightly. They expressed concern that drainage from the Hanover site enters sources of drinking water such as the Ohio River and the Smith Township water supply reservoir. (52, 59, 77)

Response 1: The remedial-action design concept that would be used, should the radioactively contaminated materials be moved to the Hanover site, would include measures to prevent runoff from leaving the Hanover site during remedial action. Once the Hanover site has been covered, rain would run off without passing through the radioactively contaminated materials. Thus, radioactively contaminated materials could not reach the Ohio River or the Smith Township water supply reservoir (which, in any case, is in a different watershed).

Issue 2: It was stated by one commeter that the Canonsburg DEIS (U.S. DOE, 1982a) needs to discuss potential impacts to public water suppliers in the three site areas. (229)

Response 2: Table D.1-5 has been added to the Canonsburg FEIS to indicate the public water supplies within 3 miles of each site. Subsection 5.6.2 of the Canonsburg FEIS discusses the impacts of the alternatives on ground water at each site.

6.2.8.2 Erosion

Issue 1: Two commenters stated that long-term erosion after remedial action, both on the site (e.g., by rills or gullying) and by river meanders, should be more fully evaluated. Soil loss predictions appear to be too low. Erosion enhanced by all-terrain vehicles should be considered. (121, 138)

Response 1: The soil cover loss for each alternative was estimated using the Universal Soil Loss Equation (refer to Appendix A.5 of the Canonsburg FEIS). The Universal Soil Loss Equation makes use of estimates of precipitation, soil erodibility, topography, cover, area, and other factors, to evaluate the yearly cover loss. Although the predicted soil loss over 1000 years is small, it is a reasonable estimate given the cover systems and access controls (i.e., fencing to prevent human or vehicle intrusion) proposed in conjunction with occasional site inspection, and custodial maintenance.

Appendices A.1 and A.2 of the Canonsburg FEIS discuss the potential tendency of Chartiers Creek and the Conemaugh River to meander into the Canonsburg and Burrell sites, respectively. Appendix A.1 of the Canonsburg FEIS also discusses measures that would be taken to protect against stream-bank erosion at the expanded Canonsburg site.

The DOE recognizes that the issue of erosion requires a careful evaluation to ensure the integrity of the sites over 200 to 1000 years. Accordingly, detailed assessments are underway to model gully, rill, and sheet erosion on the pile and to model changes in creek and river morphology (e.g., by analysis of aerial photographs and land shapes). Design details will be altered, should the studies so dictate. The results of this work will be included in the remedial action plan.

Issue 2: One commenter stated that the changes in surface- and ground-water configurations may be further complicated by streambed realignment, which is always accompanied by flood-plain shifts. Since the design is for a period of at least several hundred years, an attempt should be made to anticipate any problems that may result from extreme flood events, i.e., the probable maximum flood or storm with the one-in-ten chance of occurring for the 1000-year period. (217)

Response 2: Appendix A.1 of the Canonsburg FEIS addresses these concerns. A brief discussion of extreme flooding events for the Canonsburg, Burrell, and Hanover sites has been added to their respective discussions (subsections 4.6.1.1, 4.6.1.2, and 4.6.1.3) of the Canonsburg FEIS. Discussions of the use of and effects on the flood plains are presented in Appendix J of the Canonsburg FEIS.

6.2.8.3 Water quality

Issue 1: One commenter questioned the statement that sulfate and iron concentrations in Chartiers Creek are a result of operating mines in the drainage basin. Except for the discharge of acid mine drainage from abandoned operations, all discharges within the basin are operating under Pennsylvania DER permits that have effluent limits to protect water quality. A major abandoned mine discharge to Chartiers Creek, just above Carnegie, causes water quality degradation as noted in Table D.1-3 of the Canonsburg DEIS (U.S. DOE, 1982a). (230)

Response 1: Subsection 4.6.1.1 of the Canonsburg FEIS has been corrected to reflect this situation.

Issue 2: One commenter stated that the water-quality criteria in Table D.1-3 of the Canonsburg DEIS (U.S. DOE, 1982a) are wrong.

1. The Pennsylvania DER does not have a sulfate limit for Chartiers Creek.

2. Total dissolved solids is expressed as 750 milligrams per liter.

3. It was noted that the fecal coliform data for Chartiers Creek are from 1978. Since then, both the Washington and East Washington sewage treatment plants have been upgraded, thus this information needs updating. (231)

Response 2: Table D.1-3 of the Canonsburg FEIS has been updated using more recent data.

Issue 3: One commenter questioned the validity of the results of a surface-water sampling program performed by the owners of the Hanover site. This should have been done by an independent consulting firm. (72)

Response 3: The Canonsburg FEIS uses data from the U.S. EPA (Downie and Petrone, 1980) as well as data from the current owners of the Hanover site. These data are the most representative of current conditions. No additional data were necessary for impact assessment.

Issue 4: One commenter stated that projects of this kind where surface configuration is changed could carry implications for surface runoff water quality. The major concerns are the water-quality problems that could be expected if pyritic minerals are disturbed, and runoff and seeps from those areas where low-level radioactively contaminated materials are to be buried. Current runoff patterns and seeps probably cannot be used for predicting the picture after the project is completed. Very little information is included regarding surface runoff and its quality impacts on the receiving streams. (213, 216)

Response 4: Subsection 5.6.2 of the Canonsburg FEIS has been expanded to address this concern.

6.2.9 Ground water

Twenty-two comments were received on ground water at the three sites as discussed in the Canonsburg DEIS (U.S. DOE, 1982a); 4 came during the public hearings, and one personal letter and 17 comments from the U.S. EPA and the U.S. Department of the Interior were received.

6.2.9.1 Baseline conditions

Issue 1: One commenter indicated that it is stated in the Canonsburg DEIS (U.S. DOE, 1982a) that not all of the Canonsburg site's 1979 wells were used in the 1982 studies because some wells had been plugged and vandalized. There is no mention of how the wells were plugged or if the vandalized wells were subsequently plugged. This is important, since these wells could serve as conduits for contaminants to the deeper aquifer. Also, the description does not clear up the issue of any effects or lack of effects from radioactively contaminated materials. The hydrogeological study appears to be incomplete and will need to be resolved by additional evaluations as design proceeds. On the other hand, as the design proceeds, it will become clear that the remedial action should reduce radionuclide contamination of ground waters if done properly. (177)

Response 1: Subsection 4.6.2.1 of the Canonsburg FEIS has been changed to address well vandalism. Appendix A.1 of the Canonsburg FEIS and the remedial action plan address the need for hydrogeological monitoring.

Issue 2: One commenter stated that an effort should be made to identify background levels for both radioactively and nonradioactively contaminated materials. For example, the reason for the concentration of selenium significantly exceeding the EPA's National Interim Primary Drinking Water Standards (40 CFR 141) at the Canonsburg site was speculated as either associated with Canonsburg site activities or due to selenium's natural occurrence as a trace constituent in coal. To assess the current and potential impacts, a clearer picture of the background water quality is necessary, and a sufficient number of upgradient monitoring points should be established. (179)

Response 2: See subsection 4.8.1 of the Canonsburg FEIS for background radiological information, and subsection 4.6.2 of the Canonsburg FEIS for background nonradiological information. Upgradient wells have been drilled and sampled since the Canonsburg DEIS (U.S. DOE, 1982a) was written. The results of this additional sampling program are now included in the above referenced sections of the Canonsburg FEIS.

Issue 3: One commenter stated that the results of analyses for priority pollutants for three contaminants at the Hanover site are shown at values above detection limits. Two of the three, butyl benzyl phthalate and methylene chloride, are often found as contaminants of the sampling and analytical protocols since they can be found in sampling and analytical equipment (as a plasticizer in plastic tubing) or laboratories (as a cleaning solvent). This should be noted in the Canonsburg FEIS, unless quality control blanks were evaluated and can be used as a basis for substantiating the values given. Any quality control information that substantiates the presence of these two contaminants in the ground water should be reported. (181)

Response 3: Neither butyl benzyl phthalate nor methylene chloride were used in the sampling equipment, or in the preparation of laboratory equipment. However, both are ubiquitous in the environment because they are so commonly used.

Issue 4: One commenter stated that the socioeconomic survey of the area within 1 mile of the Canonsburg site states that none of the respondents to the survey reported that the ground water was used for drinking purposes. Based on Appendix G, pages G-2 through 5 of the Canonsburg DEIS (U.S. DOE, 1982a), only 10 percent of the residents of the Village of Strabane were asked this question specifically. Since there are wells in this area, perhaps further investigations should be conducted, unless the responses constitute a statistically acceptable basis for conclusions. (178)

Response 4: In addition to the responses from the Canonsburg site area socioeconomic survey, well data were sought by examining well permit files. No permitted wells were identified within 1 mile of the Canonsburg site. Subsections 4.6.1 and 4.6.2 and Appendix D of the Canonsburg FEIS have been updated with information received from Chnupa (1983).

Issue 5: One commenter asked if there is any information available regarding the condition and final disposition of the 4000 tons of water mentioned in connection with the Burrell site? The possibility exists that it already has all leached away and presents no problem towards blocking design of the remedial action. (224)

Response 5: The figure of 4000 tons of water represents an estimate made in 1956 of how much of the wet radioactively contaminated materials was actually water. Subsection 4.2.2 of the Canonsburg FEIS has been changed to provide this clarification.

Issue 6: One commenter stated that the Canonsburg DEIS (U.S. DOE, 1982a) describes an area on the Canonsburg site that was once a swamp, but has since been used as a repository for radioactively contaminated materials. This area may serve as a ground-water discharge area or flood plain, or both. It could also have been supplied by a spring or seep which should be investigated before the area is reclaimed. This area could carry implications for the flood plain as well as for ground water. (188)

Response 6: Subsequent hydrological testing of Area C was conducted after the Canonsburg DEIS (U.S. DOE, 1982a) was issued. Subsection 4.6.2 of the Canonsburg FEIS includes this additional information, which addresses this concern.

Issue 7: One commenter indicated that the Canonsburg DEIS (U.S. DOE, 1982a) states that ground water at the Hanover site does not meet the then EPA proposed ground-water quality standards (40 CFR 192 (proposed)). What does it contain? (71)

Response 7: See Table D.2-6 of the Canonsburg FEIS.

Issue 8: One commenter stated that the ground-water information for the expanded Canonsburg site appears to be incomplete. This information will be necessary to evaluate the possibility for transport of radioactively contaminated materials from onsite to offsite wells. (106)

Response 8: Additional ground-water information for the expanded Canonsburg site, including data from offsite wells, has been collected since publication of the Canonsburg DEIS (U.S. DOE, 1982a). Subsection 4.6.2 and Appendices C and D of the Canonsburg FEIS include this additional information.

Issue 9: One commenter stated that some very assured statements are made regarding the ground-water flow directions. Neither Chapter 4 nor Appendix D.2 of the Canonsburg DEIS (U.S. DOE, 1982a) sufficiently describes how the conclusions were derived. (184)

One commenter stated that Appendix D of the Canonsburg DEIS (U.S. DOE, 1982a) describes some constraints to the ground-water investigations. These constraints appear to have required the investigators to arrive at their conclusions using assumptions rather than hard data. In addition, the limited sampling information is inadequate to arrive at definite conclusions. A clear example is found on the first page of Appendix D of the Canonsburg DEIS (U.S. DOE, 1982a). The second paragraph states that "...the slug tests were not considered reliable. Therefore, other measurements ... had to be used...", but these are apparently not described in the Appendix D of the Canonsburg DEIS (U.S. DOE, 1982a). The Canonsburg FEIS should describe how design progress has cleaned up this deficiency. (186)

One commenter stated that if, on the other hand, the ground-water information is correct, especially for the Burrell site, then additional analysis might be considered. (187)

Response 9: Chapter 4 and Appendices C and D of the Canonsburg FEIS have been revised to reflect additional data collected since publication of the Canonsburg DEIS (U.S. DOE, 1982a).

6.2.9.2 Impact predictions

Issue 1: One commenter stated that Table D.2-1 of the Canonsburg DEIS (U.S. DOE, 1982a) shows elevated sulfate levels at the Canonsburg site. This may indicate the presence of pyritic minerals which can cause acidic ground-water seeps if surface disturbance allows such pyritic materials to be exposed to oxidation. Low pH water may carry implications for the mobilization of radionuclides. Are any other contaminants present in the ground water as a result of activities at the Canonsburg site? (185)

One commenter stated that acid mine drainage is a very real problem in the area of Pennsylvania where Canonsburg is located. This is a result of exposure of iron and other metal sulfides to air. As this reaction develops, the lowered pH, which results from the oxidation of the compounds, tends to encourage an increase in reaction rates and, in addition, ubiquitous bacteria complicate the problem by specifically using sulfide as an energy source. Once started, this reaction goes on until all metal sulfides are oxidized and under current technology there is no site where this situation prevails that has ever stopped producing acid mine drainage. Occasionally, a flooded deep mine (one or two exist in the anthracite region of Pennsylvania) will slow or even cease producing acid mine drainage for a time, but the potential to resume production is there merely waiting for the mine pool level to go down. Such an acid condition could provide a means for the mobilization of radionuclides. (214)

One commenter stated that disturbance of such areas followed by stabilization can be expected to eventually have a reestablished ground-water system. These almost always are difficult to predict with any precision. If this condition prevails, i.e., the production of acid mine drainage, then seeps can be expected to develop around the periphery of the reclaimed area and these may mobilize many ions that are soluble at low pH's. Current state-of-the-art technology exists to assess this possibility and should be incorporated into the Canonsburg FEIS by reference, as part of the long-term monitoring program. (215)

One commenter stated that ground-water quality at the Hanover site indicates the possible presence of pyrites which cause acid mine drainage. (219)

Response 1: Subsection 5.6.2 of the Canonsburg FEIS addresses this concern.

Issue 2: One commenter questioned the potential at the Hanover site for leaching of contaminants (Alternative 4, short-term impact)? (175)

Response 2: The use of an encapsulation cell at the Hanover site will minimize the potential for leaching (see Appendix A.1 of the Canonsburg FEIS for additional information).

Issue 3: One commenter asked whether sufficient ground water is available at the Hanover site to decontaminate trucks? Also, if ground water is already of such poor quality, maybe it is being contaminated with something other than radioactivity. (81, 82)

Response 3: Ground-water quantity is not a problem at the Hanover site. As discussed in Section 3.1 of the Canonsburg FEIS, waste waters would be treated by an onsite facility prior to offsite disposal. The present poor ground-water quality at the Hanover site is not due to radionuclides, but to sulfates and total dissolved solids (see Table D.2-6 of the Canonsburg FEIS).

Issue 4: One commenter indicated that the Canonsburg FEIS should address the fate of pollutants already in the ground water at the Canonsburg site. It is not clear whether the remedial-action plan includes provisions for withdrawing and treating ground water until the EPA standards (40 CFR 192) are met in the aquifer. (157)

Response 4: The radioactively contaminated ground water under the expanded Canonsburg site is either discharging so slowly to Chartiers Creek, or is so diluted when it enters the creek, or both, that it cannot be detected. Therefore, the remedial-action plan does not include withdrawal and treatment of the ground water, per se. Nevertheless, there would be monitoring of ground water after completion of the remedial action. This monitoring program would ascertain that radioactively contaminated water remaining under the expanded Canonsburg site is not migrating off the expanded Canonsburg site.

Issue 5: One commenter stated that no mention is made of ground-water impacts associated with the remedial methods described for decontamination or stabilization. These impacts may be substantial and deserve attention. (176)

Response 5: The DOE expects these impacts to be minor, or at the worst, controllable. This possibility is part of the reason for having a waste-water treatment plant and a sedimentation and flow equalization basin in the remedial-action plan.

Issue 6: Two commenters pointed out that it is stated that the new cover at the Burrell site would reduce percolation by a factor of 4 allowing about 8 inches of precipitation per year to penetrate to the radioactively contaminated materials. It appears that the Burrell site has been designed to allow percolation (from precipitation above and ground water below) to leach radioactively contaminated materials from their matrix into a swale that will carry the mixture to the Conemaugh River where dilution will take place. The DOE should design against further contamination of surface waters by any unscheduled releases of radionuclides. (44, 206)

Response 6: Subsection 4.8.2 of the Canonsburg FEIS addresses this concern.

6.2.10 Socioeconomics

Eleven comments were received concerning the socioeconomic information presented in the Canonsburg DEIS (U.S. DOE, 1982a); ten came during the public hearings, and one personal letter was received.

Issue 1: Three commenters expressed the concern that the Hanover site area is already economically depressed, and that disposal of the Canonsburg site's radioactively contaminated materials there would cause further property devaluation and discourage new businesses from moving to the Hanover site area. (56, 67, 101)

Response 1: This type of potential impact is difficult to predict or quantify. It can only be restated that the disposal of the Canonsburg site's radioactively contaminated materials at the Hanover site would be a one-time action. Congressional action would be required to dispose of any additional radioactively contaminated materials at the Hanover site. The Hanover site would remain permanently closed and administered by the DOE.

Issue 2: One commenter stated that stabilization of the radioactively contaminated materials at the Canonsburg site will make local properties worthless forever. (32)

Response 2: The value of properties near the Canonsburg site may currently be affected by concern over the existing Canonsburg site condition. Following stabilization, this concern is expected to lessen. This in turn should benefit local real estate prices.

Issue 3: One commentor requested financial reimbursement or aid for the Hanover site families who might be adversely affected by the disposal of the Canonsburg site's radioactively contaminated materials at the Hanover site. (55)

Response 3: The remedial alternatives involving the disposal of the Canonsburg site's radioactively contaminated materials at the Hanover site (Alternatives 4 and 5) have been designed to avoid adversely affecting any Hanover Township families. Therefore, financial aid would be unnecessary. Additionally, this type of reimbursement is not authorized under Public Law 95-604.

Issue 4: Two commenters objected to moving the Canonsburg site's radioactively contamined materials to the Hanover site where there is a growing population. (28, 48)

Response 4: In 1980 there were 78 persons living within 1 mile of the Hanover site. This total is projected to increase by only 2 persons by the year 2000 (see subsection 4.12.1 of the Canonsburg FEIS).

Issue 5: One commenter expressed concern over the proximity of Harmon Creek to the Colliers School in Colliers Township, West Virginia. Runoff from the Hanover site comes close to this school. (57)

Response 5: The Colliers School is approximately 5 miles downstream (west) from the Hanover site on Harmon Creek. If the Hanover site were to be used to dispose of radioactively contaminated materials from the Canonsburg and Burrell sites, the encapsulation cell built at the Hanover site would preclude any release of the radioactively contaminated materials into the Harmon Creek watershed that would pose a danger to the Colliers School.

Issue 6: One commenter stated that the public reaction section of the Canonsburg DEIS (U.S. DOE, 1982a) is too general. (75)

Response 6: Subsection 4.12.9 of the Canonsburg FEIS is presented to reflect the general reactions of individuals and groups to the present situation at the Canonsburg and Burrell sites and the alternatives for remedial action. The complete transcripts of the scoping meetings and the public hearings are available in libraries near the Canonsburg, Burrell, and Hanover sites. In addition, this chapter addresses specific public reactions presented during the public hearings, as well as those comments received in writing.

Issue 7: One commenter disagreed with the statement in the Canonsburg DEIS (U.S. DOE, 1982a) that there are no future land-use plans for the Hanover area. Starvaggi Industries, the site owner, has future development plans. (83)

Response 7: Subsection 4.9.3 of the Canonsburg FEIS has been revised to refer to official land-use plans. Hanover Township has not developed any official future land use plans under the comprehensive planning process. Individual land owners may have plans for future development or use of their properties, but these plans have not been incorporated into any official plans for Hanover Township.

Issue 8: One commenter disagreed with the value of $202 given in the Canonsburg DEIS (U.S. DOE, 1982a) for real estate taxes for the Hanover site area. Taxes in this area are broken up into the Hanover Township Tax, the Burgettstown School Tax, and the Washington County Tax. The average total is closer to $992. (84)

Response 8: Table G-26 of the Canonsburg FEIS has been updated with 1979 values. The total real estate tax collected in 1979 in Hanover Township was $25,686 (Pennsylvania Department of Community Affairs, 1982).

6.2.11 Costs

Seven comments were received on the estimated costs of the remedial action discussed in the Canonsburg DEIS (U.S. DOE, 1982a); these comments came through personal letters.

Issue 1: One commenter suggested that the costs given in Appendix A.4 of the Canonsburg DEIS (U.S. DOE, 1982a) for Alternatives 2, 4, and 5 are overstated. Specific discrepancies cited pertain to the costs for transportation, site preparation, encapsulation, monitoring, and legal/administration. (117, 118, 119).

Response 1: The discrepancies in transportation, site preparation, and encapsulation costs have been corrected in the Canonsburg FEIS. The monitoring and legal and administrative costs are directly tied to the level of effort at the project sites under each alternative and, therefore, will show some variation.

Issue 2: One commenter indicated that the big cost weakness in the Canonsburg DEIS (U.S. DOE, 1982a) is its lack of engineering support, especially material amounts. (120)

Response 2: Detailed design engineering has not been completed for the Canonsburg FEIS; therefore, complete supporting engineering data are not yet available. Section 1.6 indicates the timetable for publication of the final design and specifications document. However, estimated material amounts based on currently available information were used for the designs as described. Present data are adequate to support a decision among the alternatives.

Issue 3: One commenter stated that since this will be a model project, it should include all identifiable costs, such as: development of methodology, development of the Canonsburg FEIS, land purchase, public meetings, NRC interaction, vicinity property cleanup, maintenance and monitoring, and health monitoring. (153)

Response 3: Maintenance monitoring and health monitoring costs are included in the 15 percent value given for monitoring and radiation management in Table A.4-1 of the Canonsburg FEIS. Methods development and Canonsburg FEIS development are included in Table A.4-1 of the Canonsburg FEIS in the amount given for engineering and construction management, and the legal and administrative costs. The cost for vicinity-property cleanup is the same under all alternatives and need not be addressed in the Canonsburg FEIS.

Issue 4: One commenter questioned the value given for grading ($22.50 per square foot) on page A.4-7 of the Canonsburg DEIS (U.S. DOE, 1982a). (154)

Response 4: This was a typographical error. Table A.4-6 of the Canonsburg FEIS has been corrected.

Issue 5: One commenter stated that the cost section should include "societal costs" such as: health concerns, depressed property values, industry relocations, and emigration. (125)

Response 5: Dollar values were not assigned to these societal values, but the potential positive and negative impacts of each alternative relative to socioeconomic concerns are discussed in Chapters 4 and 5 and Appendix G of the Canonsburg FEIS.

6.2.12 Relocation of residents

Six comments were received concerning the relocation of local residents, as discussed in the Canonsburg DEIS (U.S. DOE, 1982a); these comments came during the public hearings.

6.2.12.1 Wilson Avenue (Ward Street) and George Street residents

Issue 1: Four commenters stated that it appears that the seven residences slated for acquisition as part of the expanded Canonsburg site are to be bought for less than fair market prices. (14, 40, 65, 69, 70)

Response 1: Under the terms of the cooperative agreement between the Commonwealth and the DOE, the Commonwealth is not obligated to acquire the seven residences and the former Georges Pottery property that comprise the expanded Canonsburg site. Therefore, the DOE would acquire these properties directly if Alternative 2 or 3 is chosen.

First, the DOE has entered into a Task Agreement with the U.S. Army Corps of Engineers, which has many years of real estate experience. Under the Task Agreement, the Corps will map, gather title evidence, and appraise the properties. The Corps has begun this preliminary effort. The appraisals will evaluate the fair market value of the properties on the basis of comparable sales of other similar residences in the Canonsburg area. It is important to note that the bulk of any residential property's fair market value is in the buildings and improvements.

Second, if Alternative 2 or 3 is selected, the DOE will ask the Corps to attempt to negotiate the purchase of the properties from the owners. The Corps would at that time make available to the owners a summary of the appraisal information that they have to date. The Corps would advise the owners of the relocation assistance available to them under Federal law. The relocation assistance would include items such as financial assistance in moving and purchasing a new home. This step would not take place until after the Record of Decision (ROD) on the Canonsburg site is issued, which is anticipated in August 1983.

Third, if the Corps could not negotiate a purchase, the DOE would request that the Corps and the United States Attorney General's Office in Pittsburgh commence condemnation proceedings. Hopefully, this could be avoided. In that event, the DOE would be obligated to deposit with the U.S. District Court the estimated just compensation for the property. The property owner is entitled to this money as soon as it is deposited, and the issue of fair market value would subsequently be decided by the Court.

6.2.12.2 Other residents near the expanded Canonsburg site

Issue 1: One commenter stated that the residents of streets near the expanded Canonsburg site should be relocated. (27)

Response 1: Based on the potential impacts calculated for each alternative, it has been determined that it would be unnecessary to relocate any residents on streets near the expanded Canonsburg site, either during or after the remedial action.

6.2.13 Procedural matters

Five comments were received on several procedural matters in the Canonsburg DEIS (U.S. DOE, 1982a); two comments came during the public hearings, two were received in personal letters, and one was received from the Pennsylvania DER.

Issue 1: Three commenters stated that the DOE failed to provide adequate notice in the Federal Register, about either the availability of the Canonsburg DEIS (U.S. DOE, 1982a) or notice of the date of the public hearings. (34, 111, 233)

Response 1: The DOE provided adequate notice of availability of the Canonsburg DEIS (U.S. DOE, 1982a). Notice of its availability was published in the Federal Register on December 8, 1982 (47 FR:55305) along with the announced closing date (January 24, 1983) for comments. Copies of the Canonsburg DEIS (U.S. DOE, 1982a) mailed on December 3, 1982 contained a notice of the public hearing dates. The Canonsburg DEISs (U.S. DOE, 1982a) were mailed to those persons and groups shown in "List of Agencies, Organizations and Persons to Whom Copies of This Statement are Being Sent" in the Canonsburg DEIS (U.S. DOE, 1982a). Included in this list are many representatives of the local media, including radio and television stations and newspaper personnel, and local public libraries. Additionally, news releases were disseminated in the affected areas concerning the dates and places of the public hearings. All comments received are included in the Canonsburg FEIS.

Issue 2: One commenter stated that when the project is undertaken, the proper Commonwealth permits to control erosion and sedimentation will be required. Permits will also be required in accordance with the Dam Encroachment Act and/or the Pennsylvania Flood Plain Management Act (232).

Response 2: The necessary Commonwealth permits to control erosion and sedimentation will be obtained by the remedial-action contractor. Appendix J of the Canonsburg FEIS has been added to provide the flood plain assessment required by the DOE regulations (10 CFR 1022). It brings together in one place in the Canonsburg FEIS the information necessary to comply with the Pennsylvania Flood Plain Management Act. The preparation of the flood-plain assessment required by the Pennsylvania Flood Plain Management Act will be completed after the Record of Decision (ROD) is published.

Issue 3: One commenter referred to the listing of persons to whom copies of the Canonsburg DEIS (U.S. DOE, 1982a) were sent. Fifty names are listed, but there were 500 persons at the Hanover site public meeting. (74)

Response 3: Copies of the Canonsburg DEIS (U.S. DOE, 1982a) were sent to everyone who requested one. They were also made available in local libraries.

6.3 TRANSCRIPT EXCERPTS

Public hearings were held on January 11 and 12, 1983 to solicit public comments on the Canonsburg DEIS (U.S. DOE, 1982a). Official transcripts were made of these hearings. The statements presented in this subsection are excerpts taken verbatim from these transcripts. The name of the person making the comment is given in parentheses at the end of each excerpt. Tables 6-6, 6-7, and 6-8 show the names of the commenters and the page numbers where their statements may be found for the Canonsburg, Burrell, and Hanover sites, respectively.

Table 6-6. Excerpts from the Canonsburg public hearing -- January 12, 1983

Commenter	Comment no.	Comment page no.
Amarose, Anthony	13	6-72
Dunn, Janis C.	20	6-74
	21	6-74
	22	6-74
	23	6-75
	24	6-75
	25	6-75
	26	6-76
	27	6-76
	28	6-76
	29	6-76
	30	6-77
	31	6-77
	32	6-77
Faiella, Joyce	1	6-70
	2	6-70
	3	6-70
	4	6-70
	5	6-71
	6	6-71
	7	6-71
	8	6-71
	9	6-71
Johnsrud, Judith, Ph.D.	42	6-80
Mirisciotti, Sam	40	6-79
	41	6-79
Polinski, Henry	10	6-71
	11	6-71
	12	6-72
Solic, Nicholas P.	16	6-72
	17	6-73
	18	6-73
	19	6-74

Table 6-6. Excerpts from the Canonsburg public hearing -- January 12, 1983 (continued)

Commenter	Comment no.	Comment page no.
Sperling, Lawrence I.	33	6-77
	34	6-78
	35	6-78
	36	6-78
	37	6-78
	38	6-79
	39	6-79
Sweet, David W.	14	6-72
	15	6-72

Table 6-7. Excerpts from the Burrell Township public hearing -- January 11, 1983

Commenter	Comment no.	Comment page no.
Ardell, Danelle	43	6-80
	44	6-80
	45	6-81
Wolford, Jean	46	6-81

Table 6-8. Excerpts from the Hanover Township public hearing -- January 11, 1983

Commenter	Comment no.	Comment page no.
Coulter, William	56	6-83
	57	6-83
	58	6-83
	80	6-88
Lounder, Donald	67	6-86
Lucchino, George M.	68	6-86
	69	6-86
	70	6-86
	71	6-71
	72	6-87
	73	6-87
	74	6-87
	75	6-88
	76	6-88
	77	6-88
	78	6-88
	79	6-88
Mastrantoni, Patricia	51	6-82
	52	6-82
	53	6-82
	54	6-83
	55	6-83
Murphy, Austin	47	6-81
Plunkett, Ruth	81	6-89
	82	6-89
	83	6-89
	84	6-89
Stewart, Cynthia J.	48	6-81
	49	6-81
	50	6-82

Table 6-8. Excerpts from the Hanover Township public hearing -- January 11, 1983 (continued)

Commenter	Comment no.	Comment page no.
Zibritosky, George	59	6-84
	60	6-84
	61	6-84
	62	6-85
	63	6-85
	64	6-85
	65	6-86
	66	6-86

Comment no./ response subsection no.	Comment

Canonsburg Public Hearing -- January 12, 1983

1 6.2.2.2	However, since the recommended course of action is to stabilize the material at the site, our following questions and comments are based on that fact. We would recommend that the least amount of contaminated earth be disturbed to minimize the chance of airborne contamination. Also as noted in the EIS draft, contaminated materials should be dampened to further reduce the chance of airborne contamination and all vehicles transporting this material should be adequately covered. (Faiella)
2 6.2.3	Regarding the monitoring of onsite activity as it relates to airborne contamination, we would recommend that the onsite monitors be equipped with alarm systems to notify personnel to stop work when minimal health standards are exceeded. We do not want to be informed at a later date that work continued after healthful limits for children were exceeded; nor do we want to be put in a position of not having protected our children and teachers if for some reason this limit is exceeded for a long period of time. (Faiella)
3 6.2.3	While the cleanup activities are in progress, offsite monitoring of conditions should also continue. It is imperative that monitors be placed in and around the school during remedial action and results of these be given daily. Also, some type of alarm and measuring system be set up in the event levels in and around the school increase. Along with the above mentioned systems, DOE should work with St. Patrick's School to set up guidelines for evacuation on a short-term and long-term basis in the event of an emergency. Mention is made in the Environmental Impact Draft Statement of measures that would be taken if an emergency would arise at the working site but not at the school or nearby areas. (Faiella)
4 6.2.5.2	As we read through the EIS draft, many questions are raised. One, exactly what levels of radon gas and radon daughters are projected to show up in and around St. Patrick's during the cleanup activities? We want to know to what levels our children will be exposed to the radon gas picocuries per liter and the radon daughters in working levels. Two, since children are ten times more susceptible to problems from radiation exposure, what are the long-term and short-term health effects on the children?

Comment no./ response subsection no.	Comment
	Three, what increase in risk of cancer or other health problems are projected in children as a result of the remedial action? Should not the Environmental Impact Statement Draft have included information regarding questions such as these? Questions pertaining specifically to children. (Faiella)
5 6.2.2.1	The engineering plans and specific procedures to be followed during the cleanup activities are also questioned. One, will any or any parts of the buildings be sold as salvage? (Faiella)
6 6.2.2.1	Two, will bentonite clay capsules be adequate? Will there be any leakage from the capsule in the distant future? (Faiella)
7 6.2.2.1	Three, will the containment area be outside of the flood plain? (Faiella)
8 6.2.2.1	We need to be informed as to the future proposed for this site. It is our strong feeling that no other than storage of the material presently there should be contemplated. We are adamant concerning the issue and want the NRC to legally guarantee that no additional radioactive material will ever be brought to the site for storage, disposal, or handling. (Faiella)
9 6.2.3	Further, to insure that this site never again is the health hazard that it presently is, we want monitors and personnel to interpret the data permanently assigned to the site to insure that it will never again exceed the health and public safety standards as developed by the EPA. (Faiella)
10 6.2.4.1	I would like to know the chemical weights that we are working with here and what will be the chemical weights after it is completed? The Government did not know what they were playing with when they brought it in and I don't think they still know. We do know 238 and 235 mixed together are very dangerous. We don't want this to happen here. (Polinski)
11 6.2.5.1	I would like to know how many rem our people is going to be receiving after and what we are taking now? Is it a health hazard as your say? I can show you where a man lived right next to this. He is 101 years old. Is this a health hazard? I can show you a woman, Mrs. Lux (phonetic), lived to be 100. Is this a health hazard? (Polinski)

Comment no./ response subsection no.	Comment
12 6.2.1.1	Why play with something when you don't know what you are doing with it and the same way with moving that. I would say, yes, contain it, put it in Canonsburg, put a lead shield around it, cover it in properly so it will not get out of there. That is the only way. (Polinski)
13 6.2.1.2	One more thing I want to say, if you brought this stuff in when I worked down there on rails, Mister, take it out on rails. Where you put it is your business. (Amarose)
14 6.2.12.1	A second point ... has been Federal legal interpretations about what constitutes fair market value for contaminated properties. I think those interpretations have been grossly unfair and they have and will continue to result in costly and expensive litigation not only for those who must join in that litigation from the Plaintiff's point of view but also for the taxpayers who must pay for the Government's attorneys. I think that it is not at all fair for us to have appraised the property that has already been appraised at its value post-knowledge of contamination rather than its value pre-1977. (Sweet)
15 6.2.1.3	I can't help but conclude that your recommendation 3 is based upon non-scientific factors. I can't help but conclude that it was determined that, number 1, all other recommendations were extremely expensive and, number 2, that public outcry in places like Hanover Township was so great that in effect our hands were thrown up and we said perhaps we will leave it in Canonsburg. (Sweet)
16 6.2.2.1	Second, the report to the President by the Interagency Review Group on Nuclear Waste Management in March 1979, stated, "The relative magnitude of actinide elements, for example, uranium, thorium, radium, radon, et cetera, in mill tailings, high-level wastes and transuranic wastes per unit of energy generated suggest that all of these waste streams may present problems of comparable magnitude for the very long, that is, beyond a period of 1000 years. By virtue of their presence at the surface, these actinide elements in mill tailings may constitute a greater potential problem even than those in deeply buried high-level waste or transuranic waste sites. Due to the long half-life of thorium-230, the parent of radium, the quality of radon and radium in the tailings will diminish by only half in roughly in 80,000 years.

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	"Moreover, this long half-life of thorium-230 dictates that the research and development in tailing stabilization must consider the effects of geological processes operating over geological time upon the transport of radon and radium through biosphere and hydrosphere surrounding the tailings. "The ultimate objective should be to dispose of the tailings in such a manner that emissions of radon and radium are released to or as near background levels as can reasonably be achieved and that no active institutional care be required to keep the tailings isolated from people following disposal." This statement indicates the major potential problem at the site and this should not be overlooked. (Solic)
17 6.2.2.1	I have not been able to find any studies which prove that a clay liner for the site's contaminating material would meet the above criteria. It is my understanding that the only field study, a liner evaluation for uranium mill tailngs as presented in the DOE Nuclear Waste Management Quarterly Progress Report, July to September 1980, is not yet scheduled for completion. Therefore, we must depend only upon laboratory studies to predict the performance of the bentonite, gravel and sand mixture liner as proposed for this site. (Solic)
18 6.2.3	Third, maintenance and monitoring for the site is only described in three short sentences in the draft EIS. I quote, "After all of the cleanup work is finished, the DOE or another Federal agency charged with custody of the disposal site will continue to monitor the final disposal site to ascertain whether the remedial action program continues to comply with the EPA standards. This will include measurements of parameters such as air and water contaminant levels as specified by the NRC in its license and maintenance of the site as required. All EPA standards will have to be met before the remedial action is considered officially completed." For what I believe is unproven technology, I would want the monitoring schedule spelled out in more than general statements. I am thinking how the monitoring wells are spaced over the site; how often samples are taken; availability of the the data which would indicate leaching, etc.; the availability to local citizens and local groups. How are we to evaluate the adequacy of the draft EIS if important considerations of monitoring and eventual responsibility for the site are not really presented to us. (Solic)

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19 6.2.1.1	Since the solution preferred by DOE includes stabilization at the site, as opposed to relocation, I feel this is justified in terms of the large volumes of material contaminated at the site; anywhere from 200,000 to 600,000 tons. But in the light of the questions I have raised and if stabilization is going to be at the site, I would prefer an alternative which would be more easily monitored and repaired; namely, stabilization in above-ground containment buildings properly shielded. (Solic)
20 6.2.6.1	Section 4, Paragraph 9-4.3.4, "Wind," tells us that the average wind speed is 4.7 miles per hour and we never have winds exceeding 22.4 miles per hour; at least not from 1979 to 1980 when the winds were measured. I have to question this statement because I am well aware of the fact that it is not uncommon for us to have wind gusts up to 35 and 40 miles per hour. We did all day last Friday, January 7, and the second day the NLO was working at the American Legion, they had to stop work because of the high winds. We measured up to 32 and 35 miles per hour. We've had wind gusts up to 68 and 70 miles per hour usually in February and March. I think that is pertinent information that should be included in the final EIS. (Dunn)
21 6.2.5.1	Section 4, paragraph -- page 41, paragraph 4.12.5 under "Housing" tells us that the closest houses to the Canonsburg site are as near as 250 feet away. Now I borrowed my husband's measuring tape and I stretched it from the fence across my yard inside the kitchen by 2 inches and I measured 80 feet. So I ask that this correction be made in the FEIS. (Dunn)
22 6.2.5.1	The DEIS covers every imaginable subject and would lead one to believe that nothing is left unsaid; but, I can find nothing in the Canonsburg DEIS about the 11 cancer deaths in the Davis family who live on Payne Avenue; only feet away from the lagoon. There is nothing mentioned about the fact that every house on Strabane Avenue, Payne Avenue and the lagoon side of Youngstown Street has experienced cancer or a cancer-related death. The national leukemia rate is 3 or 4 in 100,000. We have three on Strabane Avenue; a street with only 10 houses. I didn't read this in the DEIS. An unusually high number of 1979 Canon-McMillan graduates have experienced cancer; 9 out 385. Two have died from it. After this information was made public seven other members of the 1979 class phoned to report conditions and illnesses that were labeled by their physicians as hard to diagnose and unusual for people that young.

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	Because the school is within three-quarters of a mile of the site, because some of these people played ball on the lagoon and because of all of the other cancers near the site, I feel there should be a thorough investigation to determine if there is a link between the cancers and the radiation. (Dunn)
23 6.2.5.1	We request that the Federal Government provide a health study to include all of the facts about our health in the final EIS. If the EIS becomes final without these health facts, it will be incomplete. (Dunn)
24 6.2.5.1	The DEIS states that under Alternative number 1 (no remedial action), the present situation would remain and that the main impact of this alternative is the 5.4 lung cancer deaths over the next 32.5 years within 1 and a quarter miles of the site. These figures are totally inaccurate for the Canonsburg area. We have had eight lung cancers within only 200 yards of the site in approximately 12 years. There are three on Strabane Avenue, one on West Pike Street, two on Payne Avenue, one on Youngstown Street and one admitted on Latimer Avenue. The others -- there are two others suspected but they haven't been admitted. Steven Lanes, from the University of Pittsburgh, conducted a lung study of the Canonsburg area. Not one of the homes where I mentioned above where the lung cancers occurred was included in the study and yet the DEIS uses his study as a reference. I think this is unfortunate and irresponsible. The DEIS states that, "After any of the other alternatives are completed, the chance of dying from lung cancer will be reduced to 1 in 1,000,000. How can we believe these figures when it is obvious from the Option 1 figures that the data from which these were taken does not apply to our area? When I surveyed my neighbors' health problems, I was astounded by the many cancers in my area and suspected that radiation was the cause. (Dunn)
25 6.2.3	Also they should indeed be concerned about just how any remedial action is proposed to be taken. There is a grave danger that more radium can be suspended into the air in an improper effort to move any of the contaminated materials within sites or to other locations. This is going to require serious consideration of ongoing capable monitoring and may well raise the question in the residents' minds that they may wish to seek evacuation from the area during any proposed remedial action. (Dunn)

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26 6.2.1.2	The ideal solution would be to get all of this contaminated material, hundreds of thousands of tons of it, out of this area that is an inhabited area and take it to some isolated area hopefully virtually free of human inhabitants and with care a repository for the contaminated material should be created wherefrom the radioactivity has as small a chance as is possible of gaining access either to the air or to surface waters. While this is an ideal solution, it carries risks with it. The stirring up of all the contaminated material will create a hazard for vicinity residents; the transport to some distant site may avoid -- must avoid spills if we are not to increase the existing hazard. It is easy for people to talk of doing this with good engineering practice, but it would be highly advisable that the residents of the area have some way of achieving confidence that this will indeed be done without adding to their radiation exposure in a serious manner. And they should be fully informed about all this so that the issue of possible evacuation can be considered and discussed before such remedial action. (Dunn)
27 6.2.3	Now, the DEIS does state that there will be an additional health hazard created during remedial action when contaminated particles will be stirred up but no provisions have been made to relocate the residents during this time. We have been told that this is not necessary because every precaution will be taken to prevent this hazard but the Department of Energy can't give us a written guarantee that there will not be this additional exposure -- hazard at this time.
27 6.2.12.2	None of us wants to be here. We shouldn't be living here now I don't believe. So I would like you to include provisions for our relocation in the FEIS; not just Ward Avenue but also the other streets that are near the site. (Dunn)
28 6.2.10	It seems to make no sense to move these wastes to Hanover where they are already overburdened with waste problems. I can't see the sense in creating another waste dump. (Dunn)
29 6.2.3	In-situ stabilization in Canonsburg does not come with a guarantee that the dump will be monitored and maintained until it becomes inactive. This material has a half-life of approximately 1500 years. We have no guarantee that it will remain intact over 200 years; if that long. (Dunn)

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30 6.2.2.1	This is what the EPA has to say about secure landfills. My reference source is <u>Low-Level Waste Policy Act</u>, 94 Statute 3347-9, Public Law No. 96-573, 96th Congress, December 22, 1980. There is good theoretical and empirical evidence that the hazardous constituents which are placed in land disposal facilities very likely will migrate from the facility in the broader environment. This may occur several years, even many decades, after placement of the waste in the facility but data and scientific prediction indicate that, in most cases, even with the application of the very best available land disposal technology it will occur eventually. So it seems inevitable that somewhere down the line those living in this area will be experiencing problems with this dump. I don't want my great, great, great, great grandchildren to experience the same hell I am going through. I don't want them to search the records to learn that in 1983 we had a chance to be rid of this problem but instead decided to patch it up and hand it down to them. If we allow this to happen, they have every right to curse us and call us fools for indeed we will have been. (Dunn)
31 6.2.1.2	I believe there is one solution to this problem which exists in 25 different locations; I believe a central repository should be found immediately. All contaminated material should be brought to this depository creating one dump instead of 25. It would seem this would be in the long run financially feasible since one dump would need to be monitored and maintained instead of 25. (Dunn)
32 6.2.10	Finally, if number 3, stabilization in Canonsburg is chosen, the properties within 1 mile radius would be forever worthless. I believe that eventually it will become a dead area. There are no provisions in the DEIS to compensate the residents for their loss. (Dunn)
33 6.2.5.1	The confidence of the local community and the competency of Federal agencies to permanently isolate these wastes and contaminated materials from their environment have been shattered by the severity of the current situation. Citizens of Canonsburg and Strabane live in daily fear of exposure to radiation, nuclear contamination, cancer, chromosome damage, et cetera; yet as we have heard this evening, DOE from the start bases its varied assumptions about the current public health effects on studies which are incomplete, inaccurate and which, to my knowledge, have not been available to the public. (Sperling)

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34 6.2.13	Furthermore, I have become aware that the Department of Energy has failed to provide adequate public notice of the very publication of this Draft Environmental Impact Statement. These examples are indicative of a failure throughout the DEIS to meet the goal of improving public knowledge of participation in the Nuclear Waste Management Program which was -- a goal which was called for in the program summary document. (Sperling)
35 6.2.2.1	To insure the public confidence in the proposals submitted in this EIS, it is imperative at the very least that the DOE, in its final EIS, address this statement made in the Interagency Review Group Report and develop a proposal engineered to insure that the mill tailings in Canonsburg will be treated with the same degree of longterm care as DOE would treat high-level wastes and transuranic wastes. (Sperling)
36 6.2.1.1	In light of this Interagency Review Group recommendation, the onsite stabilization of mill tailings, if an onsite option were to be selected, it should be treated along the lines of monitored, retrievable, temporary storage rather than permanent disposal. This DEIS conspicuously lacks any detailed discussion of long-term monitoring of the site. While it is true that a monitoring license must be obtained from the NRC, this requirement does not mitigate the importance of analyzing monitoring systems in the EIS for several reasons. First of all, an adequate monitoring system should be incorporated in the engineering design of containment facilities itself; specifically if the facility is below ground where there is a substantial risk that the integrity of the capsule may be disrupted without detection. Furthermore, monitoring systems will affect the overall cost of the project and possibly influence the choice of alternatives. (Sperling)
37 6.2.2.1	Most importantly, however, an EIS which fails to adequately guarantee the long-term safety of the community from radioactive contamination fails to achieve its fundamental purpose of insuring public confidence. There is in fact no discussion in the DEIS of how long the proposed encapsulation will last, while there are intimations that water will begin to percolate through the system within a very few short years. (Sperling)

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38 6.2.1.1	It is thus conspicuous indeed that the DEIS fails to examine engineering alternatives for encapsulation techniques. Without such an examination the DEIS again fails in its purpose of ensuring public confidence that the proposed action is truly in the interest of long-term public health. A proper analysis should examine the long-term integrity of a variety of possible materials and of alterative designs which include monitoring systems and should make clear how long each alternative is expected to last. (Sperling)
39 6.2.1.1	Furthermore, in light of the long-term radiological hazards of mill tailings, the disposition of these wastes in a populated area should also be viewed as temporary. The Canonsburg DEIS should at least include proposals for eventual complete decontamination of the site.
39 6.2.1.2	Many experts and laymen alike look to the possibility of above-ground storage options for meeting this need and suggest that an above-ground facility will also expedite adequate monitoring and decrease the possibility of undetected destabilization. The advantages of such an option in the savings and monitoring costs may well outweigh the added construction costs and aesthetic detractions and should at least be examined as a reasonable alternative rather than dismissed cursorily in order to insure public confidence that the ultimate proposal is not chosen merely because it is the cheapest. And furthermore, I would like to lend support to Janis Dunn's suggestion that -- to solve all these problems right now and find a central, permanent repository for all the mill tailings sites. (Sperling)
40 6.2.12.1	Comment on the purchase of homes, the seven or so homes that are within the area of these tailngs. I feel that these people are not given -- have been given considerations about the worth of their properties; whether they want to label it fair market value. I would sooner label it fair replacement price. They are not going to take their money and run. I am sure they want to relocate and they need that money to purchase something to live in that is equal to what they are living in. (Mirisciotti)
41 6.2.3	I would also like to see a monitoring system devised so the local citizens may understand what is going on, and to use an expression, be able to read it like a simple meter; so many degrees Fahrenheit and so on and have a representative from the area who is a local citizen be part of the monitoring team so that he too may have an office and phone number so it might alleviate any anxieties that are caused by whatever procedures are taking place and I am sure it would give the people in the area more confidence of what is transpiring. (Mirisciotti)

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42 6.2.4.3	Now, the new EPA standard, I have had time to glance through enough to discover, takes a much more relaxed approach; especially in the matter of the timing of consideration and I would like to emphasize to you that 200 years is in the realm of scarcely the beginning of a drop in the bucket of time that mill tailings piles will remain hazardous to the public. The 1000-year period the EPA had previously indicated is only a slightly larger drop. The full period of toxicity is the time period that should be indeed considered and I would refer you to both the National Environmental Policy Act and the two court interpretations of that Act that I believe would apply in DOE's consideration of time period. Now 6 feet of cover simply won't do it because we are in fact talking about geological time. We are not talking about 200 years. We are not talking about 1000 years. We are talking about a much longer time period. (Johnsrud)
	<u>Burrell Township Public Hearing -- January 11, 1983</u>
43 6.2.1.1	So after we carefully reviewed the Environmental Impact Statement, I feel that the eliminated alternative to stabilize the uranium mill tailings above ground at the Burrell site is the most feasible. (Ardell)
44 6.2.9.2	Alternative 3 proposes to stabilize the nuclear waste at the Burrell site under 3 feet of landfill. The Environmental Impact Statement states of the 40 inches of rain falling on the site per year, 8 inches, or 20 percent, will infiltrate to the underlying contaminated zone. The report goes on to say that as time goes on, decomposition of the landfill will cause surface depressions and more water will percolate to the nuclear waste. This proposal shows precipitate draining into a drainage swale. Through leaching, the contaminated water will get into the ground water and then will be channeled into the Conemaugh River. The radioactivity level of this runoff will become greater as the fill settles. The Environmental Impact
44 6.2.3	Statement also states this method will "keep infiltration under reasonable control for perhaps 50 years." A maximum of 50 years. But parts of the uranium mill tailings waste have a half-life of 80,000 years. Whose responsibility will it be when infiltration is no longer under reasonable control? Whose responsibility will it be when the radioactivity level reaches unacceptable proportions in the Conemaugh River? (Ardell)

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45 6.2.1.1	In review of the maintenance and monitoring section, the DOE does not submit to how long they will continue to monitor the cleanup site to be certain that EPA standards are met. I would like to see more details as to how often and how thoroughly these standards are checked and for how long. I feel that just by their nature, all nuclear dump sites should be considered temporary. The storage of radioactive waste should be monitored and retrievable. This would indicate to me above the ground storage. (Ardell)
46 6.2.3	I talked before when you had the meeting before, and I keep on saying, I want to keep agreed to stabilization of Burrell Township material, and also we want nothing or no more brought into the area. We want to stabilize it, cover it over and also be monitored during the years because the level might go up. We don't know that. But we want it to keep stabilized and we don't want it moved. (Wolford)
	Hanover Township Public Hearing -- January 11, 1983
47 6.2.1.2	Although Options 2 to 5 do, as you stated, provide an improvement to the current situation, most of us would have preferred an additional option of transporting the material far away to a truly unpopulated area. Options 4 and 5 would merely provide a disturbing and transporting of the material a short distance from one populated area to another populated area; albeit this area has perhaps less of a population, it is nevertheless a populated and growing area which does not seem to me to be the wisest choice. (Murphy)
48 6.2.10	I sympathize with the people of Canonsburg greatly. I understand how they feel about the contamination and the radiation being there all these years. I know they do want it out of there. But when you talk about the years that it would take to move it from there to here and how much damage it may do to the people of the future generations by moving it to our area, when we could stabilize it there in Canonsburg, and if you had to relocate some of the people, I could even understand and justify the cost for that. But I cannot see taking it from that area and bringing it up here where our population is growing. (Stewart)
49 6.2.7.1	We are a land in Hanover Township that is consistent with underground streams. We have underground mines and caves and your are going to put this contaminated radiation waste into this area where it is going to move out like a sieve, it is going to go -- just funnel into

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	all these different areas from Hanover-Beaver to Hanover-Washington, to Findley Township, Burgettstown, Avella, Cross Creek; it is going to affect the people, Weirton, West Virginia -- thousands upon thousands of people. (Stewart)
50 6.2.5.2	An article recently appeared in the Pittsburgh Press on the Sunday, December 19 issue, where Canonsburg residents estimated that in 20 years four deaths will occur from this radiation that is there now. But in 20 years, how many other people would have been exposed to it by moving it up to this area? (Stewart)
51 6.2.7.1	The Starvaggi Industries land, which you are considering for the dumping site, has been strip mined for some time. Dynamite was used in the course of this operation and I stated before that I was very concerned about the possibility of fracture damage to this area. (Mastrantoni)
52 6.2.8.1	Page 415 (4-15) of the Draft Environmental Impact Statement states, "It is possible that there was fracture at the Hanover site caused by this type of blasting during the strip mine operations." Your own studies have proven that water at Hanover drains into the Ohio River. Page 420 (4-20) also states, "The area of these sub-basins that is directly affected by surface water runoff is approximately 425 acres." Since millions of people depend on the Ohio River for their drinking water, contamination of this river by radioactive waste even if the dilution faction is within EPA guidelines, is totally unacceptable. (Mastrantoni)
53 6.2.7.1	It is well known that if these radioactive tailings were to come in contact with other waste which is incompatible, the chemical reactions which result from such contact can cause injury, intoxication or death of workers, members of the public, wildlife and domestic animals. As I told you last year, many long-term residents of this strip mined area have witnessed chemical trucks entering this area and dumping their truckloads of chemicals. Since they carried no visible signs naming their chemical contents, residents were never sure of what chemicals had been dumped. I requested that extensive testing be done of the soil above and below ground level in the area being considered for waste disposal to assure that dangerous chemical reactions could not occur.

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	On Page 429 you note that water samples in this area are highly contaminated by acid rain, chlorides, iron, and dissolved solvents. However, the kind of extensive soil testing I had requested has not been conducted to my knowledge. If this is true, you have completed only half the job in the area of testing. (Mastrantoni)
54 6.2.3	Number 3, long-range monitoring. Last year I also requested the detailed plans for the constant and thorough monitoring of the soil, air, and water in the area surrounding the proposed dumping site be presented for citizen approval before any wastes are disposed of in this area. You have discussed environmental consequences in your statement. You have also discussed mitigation measures during the remedial action. However, I have not come across long-range, detailed plans for the constant and thorough monitoring of the soil, air and water in this area. (Mastrantoni)
55 6.2.10	Since the possibility does exist that future medical studies may prove loss of life or health, directly associated by that contamination, I requested that before any dumping of radioactive waste occurs in this area, provisions would be made for financial reimbursement to victims and/or the families if future contamination occurs in this area and proves financially, physically or emotionally harmful to the people and/or their land in this area. I do not believe that such financial provisions have been made. (Mastrantoni)
56 6.2.10	We are about to lose maybe Weirton Steel as one of the biggest employers around this community. If that was to happen and they was to move this tailings into this area, it would only add a burden on our community to induce other businesses to come into our area. (Coulter)
57 6.2.10	One of the things in my mind, though, is our school. It is so close to this area. We have a big playground here and also that the runoff from this area runs right within 300 feet of a school in Colliers and these are the main issues I feel. Plus the fact that with the loss of the money in this community right now there is no way that we could rebuild another school in any other place around here. I don't believe we could get any bond issues floated or anything else for one. (Coulter)
58 6.2.7.1	I do know, I was in this area years ago when we had small earth-moving equipment. At that time we had to shoot extra-heavy dynamite to open these pits up. I seen them shoot so hard when they got down to where

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	the coal was, the coal was under the spoil piles. They just blowed the coal clear -- they didn't know where the coal went when they got there, that is how hard of dynamite they was doing back in them days. So it had to get on down and crack up the formations in underneath. I felt these shots as far as five miles away when they was doing this dynamiting. (Coulter)
59 6.2.8.1	At the time of last June, I had indicated that the lack of credibility of the site selection team in selecting one of the sites in Hanover Township which included the watershed of the Smith Township water supply; it is the pond, lake and so on. And I think it further shows the lack of credibility on the reviewers who had permitted it to go on rather than to eliminate that as one of the sites. But that is perhaps one of the main concerns. (Zibritosky)
60 6.2.7.1	It is stated that near surface geology at the Hanover site has been disturbed by strip mining of the Pittsburgh coal seam. The site is now underlain by mine rubble which is quite porous and enhances the permeability and transmissibility of the surface and ground water. Furthermore, it is more susceptible to additional movement and settlement. In many areas within Hanover site, the clay layer typically found below the Pittsburgh coal seam was presumably removed by the strip-mining operation. Below the clay it was reported that the Castleman formation exists and it was fractured. It was common practice in the area to blast the rock formations under the coal seam to facilitate drainage. Okay. What are the probable effects of this surface geology and fractured rock strata underlying the real coal seam. A case in point is the affected water wells which were properly cased in the nearby Smith Township watershed which is adjacent to one of the current sites that is being considered for this disposal. It serves -- our water supply area serves approximately 1300 customers. They were wells drilled in the area where the Pittsburgh coal seam was nonexistent; that is, it cropped out into the hills and down in the valley where there was no coal or no disturbed layers or strata or geological formations. Wells have been drilled, properly cased, and water was, prior to the strip mining operation and so on, was of good quality -- drinking quality. (Zibritosky)
61 6.2.7.1	Subsequently the water has become polluted and it contains all the indications of mine drainage and this supports what the two previous speakers indicated that this is removed some distance from the strip mine operation itself and it just shows you that rock structure underneath the coal had been fractured or contains faults which permitted this water to penetrate into the area and penetrated into

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	the ground water and into the wells. So this is a case in point that supports what the two previous speakers have indicated. Penetration of the water with the acid rain drainage characteristics into the wells whose immediate surroundings were unaffected by the strip mine operations may be attributed as I said to faults and fracture of the rock strata below the coal. Thus, we may draw conclusions that the coal rubble which is proposed to be used in effecting the encapsulation is highly porous. Water percolating through coal rubble becomes acidic and therefore becomes significantly more active which will make it increasingly more difficult to achieve safe encapsulation. The subsurface rock strata are either faulted or fractured or both resulting in growing areal ground-water pollution and contamination as indicated by this so-called well. I think there are three wells in the watershed that was at one time used as a supply to the water authority. Any leaks in the encapsulation structure will therefore enter the ground water and subsurface strata because of the fractured strata. (Zibritosky)
62 6.2.7.1	Because of the coal rubble (rock, coal, shale and so forth) which makes up coal rubble, settlement will likely occur with its attendant stresses placed on the encapsulation structure. Therefore, the thinking would be that cracks would be generated. (Zibritosky)
63 6.2.6.2	Another factor is air quality at Hanover Township. Total suspended, particulates also already exceed National Ambient Air Quality Standards. The proposed transportation of materials from the Canonsburg site will further adversely affect the air quality via dust and exhaust fumes from vehicles utilized in transportation, disposition of the material on the site. (Zibritosky)
64 6.2.5.2	The radiation effects on health. You people have indicated in your Canonsburg DEIS that 5.4 people of the relatively 14,000 people in the Canonsburg area might contract lung cancer within the next 32 years. In your DEIS, you have indicated with proper stabilization -- or the stabilization type that you people are proposing, that this [lung cancer] would be reduced by a factor of 700 and you indicate then that you just divide 5.4 by 700 and you assume it is a linear relation and I think that is incorrect. It would be more -- it would be by a greater factor because of the lower intensity level of radiation and therefore it should have less influence or less effect on any individual. (Zibritosky)

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65 6.2.12.1	I attended the meeting that was held in Canonsburg just recently and one of the main -- one of the primary complaints was by the seven home owners in the area that would be directly affected and I think one of their main complaints was that they would be compensated an amount which would be determined by local realtors who would assess the value of those particular houses as is and where they are presently located and they say that of course will adversely affect their prices of their house or what they will get. I think in addition you will find that they have a real legitimate complaint in that you are going to require, if these people do retain their house and so on, that they are going to have to vacate them for two or three years during this so-called stabilization or removal to say a proposed site such as Hanover. I think that there is error on the DOE and whomever is responsible for making this statement that the price -- or the value of the house that will be established by local realtors on the as is condition and I think that is unfair and I think some of the costs that might be saved should be applied toward that because those houses will be vandalized. They are going to have to be repaired if those people elect to reclaim them after the removal and so on. (Zibritosky)
66 6.2.7.2	This 100 acres in this particular area is underlaid with another seam of coal which is known as Upper Freeport. In addition, this -- the Appalachian overthrust belt, which is an oil-bearing belt, extends down from Alabama up through New York and it extends up through this particular area and also presume into the Canonsburg area. However, oil wells and gas wells are located within a mile of this Hanover site area and I think it would therefore affect somewhat economic resources of this area. (Zibritosky)
67 6.2.10	This area now is hard hit by the economic depression. If the tailings are brought here, you really are just going to make it harder for businesses to be attracted to this area. (Lounder)
68 6.2.5.1	It [the Canonsburg DEIS] is not complete; very general. It talks about birds, talks about air, talks about water, but does not talk about people - the people in Canonsburg. It does not bring up the fact that we have a high rate of cancer deaths in Canonsburg. (Lucchino)
69 6.2.12.1	As we stated in our previous testimony, we felt that the people located next to this property should be relocated as soon as possible. As of now they have not been relocated.

Comment no./ response subsection no.	Comment
	The people should be moved, relocated, and they should have -- know that any health effects affected from this, like I said before, Government screw-up, these people will be compensated so they don't have to worry about medical bills. (Lucchino)
70 6.2.12.1	Also I understood that the properties were going to be bought up at values way below market value. They are going to be bought up at values because they live next to a dump which this is not their fault. (Lucchino)
71 6.2.9.1	Okay. On page 4-20, you talk about ground water does not meet EPA water standards. Okay. What does it contain? I mean you say it doesn't meet the standards, but we don't -- you know, we just generalized on it and why doesn't it meet the standards? What is in the water? What problems do we have with this water? (Lucchino)
72 6.2.8.3	You have here on 4-20, "A sampling program conducted by the owner of the site was done," and they talk about the problems of that site. That should have been done by individual -- a consulting firm separate from it. (Lucchino)
73 6.2.7.1	I look at your DOE 169, their evaluation of the site, and on page 16, they basically said there is a possibility an unauthorized dumping of toxic and hazardous waste in the past. This was one of our concerns. If you put down this garbage bag liner that we basically do not know what has been dumped there in the past and how it will affect that liner. But it would seem that the EIS has just skimmed over it and passed by it like it dosen't even exist or, you know, there is no great concern there. So we feel, you know, there should be a much lengthy study on that site if you people still consider on bringing this out here. This would be one of our major concerns. (Lucchino)
74 6.2.13	In the EIS here, you have here "Members of the general public" and we have 50 people's names listed there. If I remember, I think there was like 500 people that were considered general public. This is I think an oversight or -- deliberate or not, I don't know -- but as a matter of fact, there is not even a page number. It talks about the different agencies, organizations and persons who copies of statements are being sent and it has Federal, elected agencies and then it has "Members of the general public." (Lucchino)

Comment no./ response subsection no.	Comment
75 6.2.10	You talk about the public reaction. That was very general. It was fair enough that you people had undercover State Police here protecting you. Also we had a lot of press coverage. We know the way the DOE went about releasing this to the news media caused almost a riot out here. So that was just, you know, gone over real gently. Nothing there. (Lucchino)
76 6.2.6.1	Okay. Also we have here about wind. You took surveys from the Greater Pittsburgh Airport. I think you said our maximum wind speed out here is 19 miles an hour. That is general. There should have been maybe a 5- or 10-year review of wind speed for Canonsburg and this area out here to see exactly what it is. (Lucchino)
77 6.2.8.1	You brought up about the water. You said there is a watershed in the area; didn't look into it close enough. Also you didn't bring up that this water from this area drains into the Ohio and also the water from this supplies for downstream Weirton. That was very -- real loosely put together. (Lucchino)
78 6.2.4.3	Now, you bring up in this EIS about new standards that are to be adopted. We didn't have -- we haven't had a complete review of the new standards but what was told to me was the new standards are not as stringent as the old standards and also that five sites could be eliminated out of the whole Tailing Act. So there you are loosing the credibility and I can understand what your people's hands are tied but you have to look at us that we look at you, you are the only people we can see, and we have no trust in you when we see what has happened to the toxic waste issue and we can see what is happening in Washington. (Lucchino)
79 6.2.1.1	Now, if you people can't even help those people in Canonsburg, just like it was brought up again, you know, the state-of-the-art which is just propaganda, what is going to happen 30 years from now when we have the state-of-the-art over here in Hanover and it has been moved? I think our position we will state is the same, that the material should be stored in above-ground containment buildings at the site of generation, which is Canonsburg. (Lucchino)
80 6.2.2.1	This Chartiers Creek running down through here close to the site up there at Canonsburg turns right around and goes back in towards Pittsburgh through several large towns and back down the Ohio River, or one of the rivers, and goes right down past our door again. It's been hard for me to understand how they are going to be able to seal

Comment no./ response subsection no.	Comment
	this stuff from moving on towards this creek. My question is, is it possible to seal this from that creek? (Coulter)
81 6.2.9.2	On page 3-16 it states, "A temporary water supply well and pond will be constructed." I guess after the analysis of the water in the area of Hanover, and I am addressing only my comments on the Hanover statements in the DEIS, because I feel that that is what this meeting is for tonight, I think that there is a question whether water would be available to decontaminate the trucks which are to haul the radioactive material to the Hanover site. (Plunkett)
82 6.2.9.2	If the water is of such terrible quality, I wonder if it wouldn't be getting contaminated with something else besides the radioactivity. (Plunkett)
83 6.2.10	On page 437, Section 4.9.3, it states, "There are no future land use plans." At the scoping meeting, Donald Darnel of Starvaggi Industries outlined some of the future plans they had for that area. (Plunkett)
84 6.2.10	On page 5-35, the real estate taxes collected in Hanover Township were $202. Now, that may have been the property transfer taxes but I don't think there is a Hanover Township resident in this room that didn't pay more than $202 on real estate taxes. We do have them divided up. There is a Hanover Township tax. There is a Burgettstown area school tax and there is a Washington County tax and I am sure that all of those added up to more than $202 out of I think that it was estimated 95 or maybe it was 87 or something like that, $992. But anyway, I think that those things should be corrected in your EIS. (Plunkett)

6.4 LETTERS RECEIVED DURING THE COMMENT PERIOD

The letters received on the Canonsburg DEIS (U.S. DOE, 1982a) during the comment period are reproduced in full in this subsection. The comments that have been addressed in this Canonsburg FEIS are bracketed and numbered. The subsection where the comment is discussed appears under the comment number. Table 6-9 lists the name of the commenter, the comment numbers, and the page number where the letter appears.

Table 6-9. Letters received during the Canonsburg DEIS (U.S. DOE, 1982a) comment period

Commenter	Comment no.	Page no.
Ardell, Danelle	43	6-96
	44	6-96
	45	6-96
Benish, Joan E.	101	6-97
Dunn, Janis C.	20	6-98
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Gofman, John W., Ph.D., M.D.	102	6-102
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Engel, Agnes	105	6-108
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	109	6-109
	110	6-109
Faiella, Joyce	1	6-110
	2	6-110
	3	6-110
	4	6-110
	5	6-111
	6	6-111
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	8	6-111
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Table 6-9. Letters received during the Canonsburg DEIS (U.S. DOE, 1982a) comment period (continued)

Commenter	Comment no.	Page no.
Fracke, Sue	111	6-112
Heinz, John	---	
Leney, George W., P.E.	112	6-113
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	123	6-117
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	126	6-118
	127	6-118
	128	6-118
	129	6-119
Lochstet, William A.	130	6-121
	131	6-121
	132	6-123
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	134	6-123
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	136	6-123
	137	6-123
	138	6-123
Oppenheimer, Carol	233	6-125
Sperling, Lawrence I.	33	6-131
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	39	6-133

Table 6-9. Letters received during the Canonsburg DEIS (U.S. DOE, 1982a) comment period (continued)

Commenter	Comment no.	Page no.
Strang, Donald W.	141	6-136
	142	6-136
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Sweet, David W.	14	6-138
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Terrill, James G., Jr.	149	6-139
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	156	6-141
U.S. Department of the Interior	157	6-142
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U.S. Environmental Protection Agency	159	6-143
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	172	6-145, 6-146
	173	6-145
	174	6-145
	175	6-145
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Table 6-9. Letters received during the Canonsburg DEIS (U.S. DOE, 1982a) comment period (continued)

Commenter	Comment no.	Page no.
U.S. Environmental Protection Agency (continued)	177	6-146
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Table 6-9. Letters received during the Canonsburg DEIS (U.S. DOE, 1982a) comment period (continued)

Commenter	Comment no.	Page no.
U.S. Environmental Protection Agency (continued)	219	6-149
	220	6-149
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U.S. Department of Housing and Urban Development	---	
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3542 Beechwood BC
Pittsburgh, PA 15217
Jan 20, 1983

Mr James A Morley
Uranium Mill Tailings Project
US DOE
PO Box 5400
Albuquerque, NM 87115

Dear Sirs,

As a member of the Allegheny Sierra Club Conservation Committee I would like to comment on the Draft Environmental Impact Statement dealing with Remedial Actions at Vitro Rare Metals Site.

43 6.2.1 My remarks address the Burrell site only. After careful review of the Environmental Impact Statement, I feel the eliminated alternative to stabalize the uranium mill tailings above ground at the Burrell site is most feasible.

Proposed alternatives 2 + 4 involve transport of hazardous material through major populations. The expense, noise levels, and risks involved make these proposals unexceptable.

44 6.2.3 6.2.9 Alternative 3 proposes to stabalize the nuclear waste at the Burrell site under 3 feet of land fill. The EIS states of the 40 inches of rain falling on the site per year, 8 inches or 20% will infiltrate to the underlying contaminated zone. The report goes on to say that as time goes on decomposition of the fill will cause surface depressions and more water will percolate to the nuclear waste. This proposal shows precipitate draining into drainage swale. Through leaching, the contaminated water will get into the ground water + then be channeled into the Conemaugh River. The radiactivity level of this run off will become greater as the fill settles.

44 6.2.3 6.2.9 The EIS states this method will "keep infiltration under reasonable control for perhaps 50 years." A maximum of 50 years. But parts of the uranium mill tailings waste have a half life of 80,000 years. Whose responsibility will it be when infiltration is no longer under reasonable control? Whose responsibility will it be when the radioactivity levels reach unacceptable proportions in the Conemaugh River?

45 6.2.1 In view of the Maintenance + Monitoring Section, DOE does not commit to how long they will continue to monitor the cleaned up site to be certain EPA standards are met. I would like to see more details as to how often and how thoroughly these standards are checked and for how long.

I feel that just by their nature, all nuclear dump sites should be considered temporary. The storage of radioactive wastes should be monitored and retrievable. This would indicate to me above ground storage. Citizens of Burrell have indicated a desire to stabalize existing tailings at the site with minimal disruption. Thus dangerous transport of contaminated materials is eliminated.

A building of steel or lead would house the hazardous material on site. Accurate monitoring of radiation levels could be achieved. The buildings would also serve to remind the community of the tremendous waste generated by nuclear industry and that the problem has not gone away.

Sincerely,
Danelle Ardell

R. D. 1
Bulger, Pa. 15019
January 16, 1983

Uranium Mill Tailings Project Office
U. S. Department of Energy
Albuquerque Operations
P. O. Box 5400
Albuquerque, New Mexico 87115

Dear Mr. Morley:

I reviewed your study on the uranium mill tailings located in Canonsburg and also attended the DOE meeting January 11, 1983 at Hanover Township. After reviewing and listening to all of the speakers comments it is my conclusion that alternative 3--the stabilization of waste in Canonsburg and Burrell Twp. is the best selection. My arguments for this are:

1. The health and safety factors of workers moving materials from one site to another. I cannot see how peoples safety could possibly be guaranteed.

2. Transporting of waste materials will surely create the possibility for accidents, spills and the wind factor is another problem for spreading contamination.

3. We already have 2 contaminated sites, 1 contaminated creek and 1 contaminated river. I cannot see creating another contaminated site--another creek (Harmon Creek) and another river, the Ohio.

4. This area has suffered ground fracturing due to heavy dynamite blasting by strip-mining. This is bound to have affects on ground water in the area. As I stated at a previous meeting--only 1/3 of all of the water in the world is fresh water. If the government does not stop the polluting of water there will be no where for them to run either.

5. Also as stated at the Hanover meeting, the contaminated Connemaugh River passess several small towns then comes back around Pittsburgh to enter the Ohio River which would be further contaminated.

6. Another point brought up was what was intended to be done with the contaminated water which is to be used to hose down contaminated trucks carrying waste materials?

In conclusion I feel that if the residents of Canonsburg were given fair market prices for their homes and re-location and a guarantee for health benefits should they arise--it would be much less costly than 34.5 or 44.5 million dollars to move the site. Put the effort and money in the present site.

101
6.2.10
The Hanover Twp. site is already a depressed area due to the closing of Weirton Steel Co. I see no reason to add to the de-valuation of property to an already depressed area.

I also feel that large corporations who create hazordous waste should be liable for proper disposal and storage of the waste and the cost of cleanup of already polluted sites.

I do hope this letter will help in making a just and fair decision for all the people concerned in this matter.

Very truly yours,

Joan E. Benish

Janis C. Dunn-Spokesperson for FORCE (Families Opposed to Radioactive Contamination Exposure)

The Environmental Impact Statement is quite a comprehensive study of the area in and around the Canonsburg Industrial Park.

It tells us about our weather patterns, temperatures, the number of cars that travel our roads each day----section 4...page 9....paragraph 4.3.4. WINDS tells us that our average wind speed is 4.7 miles per hour and that we never have winds exceeding 22.4 miles per hour, at least not from 1979 to 1980 when the winds were measured.

20

6.2.6 I have to question this statement because I am well aware that it is not uncommon for us to have wind gusts of 35 and 40 miles per hour. We did all day Friday, January 7 of this year. NLO had to stop work several times the second day of clean-up at the American Legion because of high winds that we measured at 32 and 35 miles per hour most of the day. We have had wind gusts up to 68 and 70 miles per hour - usually in February and March. I think that this is pertinent information that should be included in the Final EIS.

21

6.2.5 Section 4...page 41...paragraph 4.12.5 HOUSING - tells us that the closest houses to the Canonsburg Site are as near as 250 feet away. I borrowed my husband's measuring tape and stretched it from the fence on site to the inside of my kitchen by 2 inches and measured 80 feet. I ask that this correction be made in the FEIS.

The DEIS covers every imaginable subject and would lead one to believe that nothing is left unsaid - but....I can find nothing in the DEIS about the 11 cancer deaths in the Davis family who live on Payne Ave.----feet away from the Lagoon.

There is nothing mentioned about the fact that every house on Strabane Ave., Payne Ave. and the Lagoon side of Youngstown St. has experienced cancer or a cancer-related death.

22 The nat'l Leukemia rate is 3 or 4 in 100,000. We have had 3 on Strabane Ave.----a street with only 10 houses. I didn't read this in the DEIS.

6.2.5 An unusually high number of 1979 Canon-McMillan graduates have experienced cancer...9 out of 385 - 2 have died from it.

After this information was made public 7 other members of the 1979 class phoned to report conditions and illnesses that were labelled by their physicians as - hard to diagnose or unusual for young people

Because the school is within 3/4 mile of the site -- because some of these people played ball on the Lagoon and because of all the other cancers near the site----there should be a thorough investigation to determine if there is a link between the cancers and the radiation.

The Uranium Mill Tailings Radiation Control Act of 1978 - Public Law 95-604 was passed after Congress heard testimony that potential hazards to the public exists because of exposure to the radioactive wastes....the DEIS, in the summary and in several other sections states that "this EIS evaluates five alternatives for removing the potential public health hazard associated with the contaminated material.'

I believe that it is safe for me to conclude, after reading these statements, that I and my neighbors are the important part of this whole issue....we are the reason for all of these studies and reports. Yet, 50 million dollars have been spent to study birds, grass, flowers, dirt, buildings....everything above, on and below the ground.....not one cent has been spent to study our bodies..

The Federal Government caused this problem for us -- we have every right to know the extent of the damages we have received because of it.

We have a right to know how much radiation our bodies have absorbed. We have a right to know how our blood and our organs have been effected by exposure to these hazardous wastes.

23 We request that the Federal Government provide a health study to include all of the facts about our health in the Final EIS. If the EIS

6.2.5 becomes final without these health facts----it will be incomplete.

The DEIS states that under Alternative 1 (no remedial action) --- the present situation would remain and that the main impact of this alternative is the 5.4 lung cancer deaths over the next 32.5 years within 1.24 miles of the site. These figures are totally inaccurate for the Canonsburg area.

We have had 8 lung cancers within only 200 yards of the site in approximately 12 years. There have been 3 on Strabane Ave.--1 on West Pike St.----2 on Payne Ave.----1 on Youngstown St. and 1 admitted on

24 Latimer Ave. Two others are suspected but have not been admitted.

6.2.5 Steven Lanes, from the University of Pittsburgh, conducted a lung study of the Canonsburg area. Not one of the homes mentioned above, where the lung cancers occurred, was included in his study, yet the DEIS uses his study as a reference. This is unfortunate and irresponsible.

The DEIS states that "after any of the other alternatives are completed the chance of dying from lung cancer will be reduced to 1 in 1,000,000. How can we believe these figures when it is obvious from the option 1 figures that the data from which these were taken do not apply to our area?!?!?

When I surveyed my neighbors health problems I was astounded by the many cancers in my area and suspected that radiation was the cause. Not sure of my assumptions I began consulting with experts in the field of radiation research. After reviewing the facts these scientists advised that there was no doubt in their mind that radiation was the cause.

One of these scientists, who is one of the world's foremost experts in the field of radiation research is Dr. John W. Gofman. He is also one of the most admired and respected scientists in the world today.

I introduce into evidence the affidavit of Dr. Gofman - given under oath. Attached to his affidavit are his qualifications. These will be given to the Dept. of Energy and I ask that they be recorded in their entirety.

Because this affidavit is lengthy it would take up too much time to read all of it here and so I have chosen several paragraphs which I believe should be read at this time.

The DEIS states that additional health hazards will be created during remedial action when the contaminated particles will be stirred-up. No provisions have been made to relocate the residents during this time. We have been told that this is not necessary because every
27 precaution will be taken to prevent these hazards. The Dept. of Energy
6.2.3 will not give us a guarantee that we will not receive additional
6.2.12 exposure at that time. None of us wants to be here----we shouldn't be living near those wastes now---- please include provisions for our relocation in the FEIS. Not just Ward Ave. but also the other streets near the site.

The DEIS evaluates two main options for remedying the situation - move the wastes to Hanover or stabilize them in Canonsburg. Neither will cure our problem.

28 It makes no sense to move these wastes to Hanover -- already
6.2.10 overburdened with waste problems - why create another waste dump?!

In-situ stabilization in Canonsburg does not come with a guarantee
29 that the dump will be monitored and maintained until it becomes inactive.

6.2.3 This material has a half-life of approx. 1500 years --we have no guarantee that it will remain intact after 200 years -- if that long.

This is what the EPA has to say about secure land fills(ref. source "Low-Level Waste Policy Act," 94 Statute 3347-9, Public Law 96-573, 96th Congress, Dec. 22, 1980.)

There is good theoretical and empirical evidence that the hazardous constituents which are placed in land disposal facilities very likely will migrate from the facility into the broader environment. This may occur several years, even many decades after placement
30 of the waste in the facility, but data and scientific prediction indicate that, in most cases, even with the application of best avail-
6.2.2 able land disposal technology, it will occur eventually.

So, it seems inevitable that somewhere down the line those living in this area will be experiencing problems with this dump. I don't want my great, great, great grandchildren to experience the same hell that I'm going through. I don't want them to search the records to learn that in 1983 we had the chance to solve this problem but instead decided to patch it up and hand it down to them.

If we allow this to happen then they have every right to curse us and call us fools - for indeed we will have been.

The decision to stabilize the wastes in Canonsburg automatically guarantees that all of the other 24 sites will also be stabilized in place. What will we have after millions and millions of dollars are spent on this project?? We will still have 25 waste dumps that promise to give us more problems in the future. What kind of sense is this?!?!?

I believe that there can be only one solution to this problem which
31 exists in 25 different locations. A central repository should be found immediately---all contaminated material should be brought to this
6.2.1 repository....creating one dump instead of 25. It would seem that this would be, in the long run, financially feasible, since one dump would need to be monitored and maintained instead of 25.

If No. 3 - Stabilization in Canonsburg is chosen the properties within a mile radius of Canonsburg would be forever worthless ---
32 I believe that eventually it will become a dead area - yet, there
6.2.10 are no provisions in the EIS to compensate the residents for this loss.

Are we, indeed, the most important part of this issue????????
The Final Environmental Impact Statement will tell us the truth.

AFFIDAVIT John W. Gofman, M.D., Ph.D.

In re: C.A. No. 82 0437 CLASS ACTION COMPLAINT FOR INJUNCTIVE RELIEF

(IN THE UNITED STATES DISTRICT COURT FOR THE WESTERN DISTRICT OF PENNSYLVANIA)

Dr. John W. Gofman being duly sworn , deposes and says:

As a result of my extensive education, training, teaching, research, and radiation-industrial medical experience, as detailed in the curriculum vitae attached as Exhibit 1, I feel qualified to make the statements which follow in this affidavit.

If called upon to testify in this litigation, I would testify as follows:

(1) Persons exposed to ionizing radiation, either externally from gamma rays, x-rays, beta particles, or alpha particles or internally from the same types of radiation received as the result of ingestion, inhalation, or absorption of radionuclides from open cuts or wounds, have indeed sustained extremely serious personal physical injury to their bodies. The injury will be increased as the total dose of radiation is increased, there being no dose, however small, which is free from such injurious effects. The larger is the dose, the greater will be the injury sustained. There is no reversing any sustained personal injury from radiation beyond the first few hours after radiation. And there is no way that any person can exercise any special or due care to prevent such injury from being sustained other than avoidance of receiving the radiation itself. Since each personal injury is sustained and persists as injury for many decades, it follows that each incremental dose of ionizing radiation adds to the total personal injury received. So radiation injury is said to be cumulative.

(2) Said personal physical injury is definite with respect to a variety of chromosomal damage both to somatic cells throughout the bodies of the exposed individuals and the reproductive cells (sperm-line cells and ova), plus genetic damage to DNA molecules, the bearers of genetic information in the cells of humans. Such damage to chromosomes and to genes, while unequivocal, does not necessarily constitute the only physical damages that have been sustained from ionizing radiation. There may be additional damage to cellular structures, e.g. cell or organelle membrane damage, over and above the chromosomal and gene damage. Both the chromosomal and gene damage, as well as other damage to cells, manifest themselves later clinically. While the clinical manifestations occur later, the physical damage to the individuals occurs at the time of the irradiation.

6-100

(3) In connection with this litigation, I have had access to and have reviewed the following documents:

1. DOE/EV-0003/3 Revised. "Formerly Utilized MED/AEC Sites Remedial Action Program :Radiological Survey of the Former VITRO Rare Metals Plant Canonsburg, Pennsylvania",June 1979, FINAL REPORT.
2. DRAFT "Remedial Action Concept Paper For the Uranium Mill Tailings Site At Canonsburg, Pennsylvania",April 1981 (Rev. April 23, 1981), Uranium Mill Tailings Remedial Actions Project Office, DOE ,Albuquerque, New Mexico, 87115
3. UMTRA-DOE/ALO-226, GECR #R-811, "Geochemical Investigation of UMTRAP Designated Site At Canonsburg, Pa." Markos,G., Bush, K.J., and T. Freeman, May, 1981 .
4. DOE/UMT -0101, FBDU 360-20, U.C. 70, "Engineering Assessment of Inactive Uranium Mill Tailings, CANONSBURG SITE, CANONSBURG, PENNSYLVANIA" by Ford, Bacon, & Davis Utah Inc., April, 1982.
5. UMTRA-DOE/ALO-10 "Uranium Mill Tailings Remedial Action Project (UMTRAP) Public Participation Plan" The Mitre Corporation, February, 1982.
6. UMTRA-DOE/ALO-168 "Preliminary Evaluation of Areas for Canonsburg Residues" Roy. F. Weston, Inc. September, 1981.
7. UMTRA- DOE/ALO-31 " Remedial Action Concept Paper For the Uranium Mill Tailings Site at Canonsburg, Pennsylvania" February, 1982.
8. UMTRA-DOE/ALO- 169 "Evaluation of Site Suitability for Canonsburg Residues" Roy. F. Weston, Inc. September, 1981.
9. Class Action Complaint C.A. No. 82-0437.
10. Class Action Complaint C.A. No. 82-0438.
11. DOE/NE-0025 "Annual Status Report on the Uranium Mill Tailings Remedial Action Program" U.S. Department of Energy, Assistant Secretary for Nuclear Energy, December, 1981.
12. Letters from William E. Mott, Acting Director, Public Safety Division, Office of Operational Safety, Department of Energy (December 23, 1980, February, 1981, and July 27, 1982) pertaining to the radiological surveys of certain specific properties. (Vicinity Property CA 090, 143 Ward Avenue, Canonsburg, 155 Ward Avenue, Canonsburg, and Lot west of 143 Ward Avenue, Canonsburg.)
13. Press Release from the University of Pittsburgh entitled "Results Presented from the Study of Canonsburg-Strabane People Adjacent to a Uranium Processing Plant" August 11, 1982.
14. Canonsburg Town Meeting Agenda for Presentation of the Canonsburg Health Effects Study, Wednesday, August 11, 1982.

(4) Based upon my knowledge and experience in this particular field and the materials made available to me for review, it is clear to me that persons who have lived in this Canonsburg area, within one mile of the Plant Site, for a period,say, 20 years, have indeed suffered personal physical harm to their bodies. It is clear that radiation levels in vicinity properties, in

the streets and fields, and in the area within one mile in general have been elevated over what they would have been if there had never been this Plant operating in the vicinity. It is evident from the record of measurements that radioactivity has definitely escaped confinement at the Plant Site, and has spread into the surroundings, including the use of contaminated materials from the site in constructic of buildings. Since this radioactivity has been spread in this manner, it is inevitable that persons within the one mile distance from the site have received ionizing radiation. And since there is no "safe, threshold" dose of ionizing radiation, it can be correctly stated that physical injury to individuals in this area began with their first exposure to such ionizing radiation, and that such physical injury will be added to cumulatively with each additional exposure.

I do not suggest here that a 20 year exposure is required for serious harm to be done to these people. Serious harm is done with each exposure, since there is no safe exposure, but I simply am emphasizing that 20 years of such exposure is serious indeed. There can be no question that a substantial danger to health has occurred for those exposed. The danger to health has been fixed into these people's bodies in the form of chromosomal and gene damage. This cannot be undone. The clinical manifestation, in the form of extra cases of cancers of a variety of organs, leukemias, and genetic and chromosomal disorders in offspring, come at variable times after the damage to the chromosomes and genes. So it is correct to say the damage is done already at the time of the irradiation. The visible clinical <u>expression</u> of the damage is manifest years to decades later in the exposed generation, and in offspring from the exposed generation.

I regard the danger to health to have been substantial from the extent of elevation of radiation levels in the area within one mile from the site . And such damage is being added to at the present time from the persistent radiation in the environment and from radionuclides which have inevitably been taken into people's bodies.

(5) There are several types of injury that must have occurred, based upon the evidence I have reviewed. First of all, it is clear that ^{226}Radium has been transported off the Plant Site, in part, no doubt, by winds, and in part, by the use of contaminated materials from the site. The presence of such ^{226}Radium has produced the result of elevated gamma ray levels in the vicinity properties (quite variably between properties). Residence in and movement about in areas with elevated gamma ray levels guarantees that there will be health injuries of the types I have already described. (Cancer, leukemia, and genetic-chromosomal injuries).

6-101

Secondly, the ^{226}Radium which is transported by the winds is in the form of fine particles (which is why it is picked up by the winds), and such fine particles are intercepted by humans breathing as the particles descend to earth. The fate of such inhaled particles depends upon their particular particle size. If they are relatively large (over 10 micrometers in diameter), they will be rejected up the respiratory tree and will largely be swallowed into the intestinal tract. Such particles then have two fates.If they represent soluble material, the radium will be absorbed into the blood stream, go to bones, remain there for many decades, and enhance the risk of bone cancers over what would have been the case without the radium. If the particles are insoluble, they will slowly pass through the colon, and on so doing, irradiate sensitive colon cells and lead to an excess of colon cancers over what would have occurred without the radium.

If the particles are smaller, then they will get down into the bronchioles of the lung, and may remain there for hundreds of days, irradiating the sensitive bronchial cells and leading to an excess of bronchogenic (lung) cancer over what would have occurred had the radium not been present. If some of the particles are relatively soluble, they will pass into lymph and blood streams, and in time get deposited in bone, again enhancing the risk of bone cancer as well as leukemia.

Third, ^{222}Radon is emanated (said to be "breathed") out of any deposits of ^{226}Radium, because the radioactive decay of ^{226}Radium leads to creation of ^{222}Radon, a gas. When ^{222}Radon is inhaled by humans, it and some of its radioactive "daughter products", irradiate the sensitive tissues of the bronchi. There is no doubt at all of the effectiveness of radon daughter products in producing human lung cancer and death. The higher the radon concentration in breathed air, the greater is the risk of later manifestation of a lung cancer. Elevated radon levels have been found in vicinity properties, partially from radon wafting from the Plant Site itself and partly from ^{226}Radium that has itself been transported to vicinity properties.

Fourth, the gamma radiation coming from ^{226}Radium depositions in soil or building materials will irradiate the sperm and ova -line cells and the chromosomal-gene damage in such cells can become manifest later as a defective newborn human.

As to which of the ways of escape of radioactivity from the Site are important, I would say all modes of escape are serious. Obviously, the use of contaminated materials from the Site for purposes of building houses or other structures where humans will spend time is a very serious matter indeed. Second, wind-transported ^{226}Radium to be deposited on soils in the vicinity means that there will be long, long periods of years of continued gamma-ray exposure of people in the vicinity.

102 6.2.3 From the amount of uranium tailings which have been dumped or stored on the various parts of the site (Parcel A, Parcel B, Parcel C) there is the ever-present danger that the ^{226}Radium will find its way into sources of area drinking water. That would be serious indeed, but as yet the evidence I have seen does not show this to be a major part of the radiation exposure problem the people of this class are experiencing or have experienced. This requires careful monitoring for a long time into the future, lest such a source become important but not appreciated.

6. It is to be emphasized that the hazards to health which have been described above are by no means "theoretical" for the individuals concerned. There is a massive body of human experience (as well as experimental animal study) which demonstrates unequivocally that ionizing radiation does indeed cause human cancers of virtually every known type of cancer, does indeed cause every type of human leukemia, with the exception of the one leukemia called "chronic lymphatic leukemia". and that human genes and chromosomes suffer demonstrable injury from these radiations. Moreover, such evidence exists for all the kinds of ionizing radiation, the alpha particles of radium, radon, and radon daughter products, for the gamma rays and x-rays coming out of several of the radionuclides in the radium decay chain, and for the beta particles which also come out of some of the nuclides in the chain of uranium-radium decays.

Further, there is no "minimum" amount of radiation exposure required to produce such damage and disease. The evidence is overwhelming that the effect starts at the very lowest doses of radiation, and that the risk of additional cancers, leukemias, and chromosomal-genetic damage goes up proportional to dose. This evidence is outlined in extenso,with hundreds of literature references, in my book RADIATION AND HUMAN HEALTH, Sierra Club Books, Inc, 1981.

So it is clear that there is a very sound body of scientific knowledge accepted by experts in this field concerning the kinds of health problems which have occurred in the people exposed in this area or the health problems which will yet manifest themselves as the result of exposure.

7. There is excellent reason for the residents of this area to be seriously concerned about harm accruing to themselves and to their children from the exposure which has been thrust upon them as a result of escape of radionuclides from this Plant site. This potential harm in the form of cancer or leukemia is not a hypothetical thing. The evidence is overwhelming that it occurs, and any person should indeed be concerned about receiving <u>any</u> unnecessary radiation. And what is more it is
103 6.2.5 eminently reasonable that the residents be very concerned about the exposure of

103 6.2.5 their children to the ionizing radiation which has been thrust upon them, because it is well-known, and thoroughly documented, that children are many times more sensitive to the cancer-producing effects of suoh ionizing radiation than are adults.

I wish to make it clear that radiation is not the only cause of cancer and leukemia and genetic-chromosomal damage in humans.There are other causes. But what is important to realize is that radiation is a powerful cancer producer, produces almost every type of human cancer, and is effective even down to the lowest doses. Also, I wish to make it clear that while <u>every</u> person experiences injury to cells at the time of irradiation , it still does not follow that every person so exposed will manifest the injury in the form of a cancer. We are not sure why some persons do manifest the cancer and others do not, but we have no doubt at all about radiation causation of human cancer and leukemia.

I would also wish to make it clear that the residents should indeed be very concerned about the earliest possible resolution of this problem in a sound manner. They and their children are receiving additional injury from the ongoing radiation, and hence experiencing an added risk of future cancers with each passing month.
25 6.2.3 Also they should indeed be concerned about just how any remedial action is proposed to be taken. There is grave danger that more radium can be suspended into the air in an improper effort to move any of the contaminated materials, within sites, or to other locations. This is going to require serious consideration of on-going capable monitoring, and may well raise the question in the residents'minds that they may wish to seek evacuation from the area during any proposed remedial action.

All these types of concerns of the residents for themselves and their children are eminently reasonable, given the facts concerning this Plant site and what has already happened.

104 6.2.5 It should also be pointed out that the residents would have a reasonable fear that foodstuffs grown locally might be a source of further radioactivity exposure to them and their families, since radium in surface waters or in soil can definitely be taken up by plants and be ingested thereby by humans.

8. I would certainly agree with the Department of Energy that remedial action is necessary in the Canonsburg area. Harms have been done to humans, and
26 6.2.1 the harm will increase until and unless remedial action is taken. The ideal solution would be to get all of this contaminated material (hundreds of thousands of tons of it) out of this area that is an inhabited area, and take it to some isolated area, hopefully virtually free of human inhabitants , and with care

26 a repository for the contaminated material should be created wherefrom the rad-
6.2.1 ioactivity has as small a chance as is possible of gaining access either to the air or to surface waters. While this is the ideal solution, it carries risks with it. The stirring up of all the contaminated material will create a hazard for vicinity residents, the transport to some distant site must avoid spills if we are not to increase the existing hazard. It is easy for people to talk of doing this with "good engineering practice", but it would be highly advisable that the residents of the area have some way of achieving confidence that this will indeed be done without adding to their radiation exposure in a serious manner. And they should be fully informed about all this, so that the issue of possible evacuation can be considered and discussed before such remedial action.

Even if the option is suggested that there might be a lower hazard to try to immobilize the contaminated material at the current site, the necessary action will by no means be free of risk. The possibility is discussed in some of the engineering reports that a liner system would have to be installed on the site,and that would mean digging up and moving contaminated material from one part of the site to another,a procedure the residents should wish to know a great deal about, and to have been assured with careful studies and careful proposals for monitoring if it be done this way.

There is no perfect solution to a problem created by the totally ill-advised use that has been made of a site in a populated area. The Plant should not have been in this area in the first place, but the task is now to be constructive and to stop further increases in the radiation harm to the residents.

9. One might ask the question of whether it is certain that all the processing activities of the defendants is indeed the cause of the area contamination and the high radiation levels encountered. Having reviewed the evidence concerning how the radioactivity is distributed, having reviewed the kind of operations done at the Plant site (processing ores, residues, dumping tailings, and storing wastes),and knowing of such operations in other locations in the world, I can state with a very high degree of confidence that it is indeed the activities of this plant which have created the problem of radiation exposure for the residents of the area. There is no possibility, in my opinion, that the <u>distribution</u> of radioactivity is "natural", and not the result of man's actions here.

10. The kinds of effects of the radioactivity distributed through the defendants conduct are a general class of effects, and will be observed in persons throughout this area. In other words, if radioactivity has escaped and been

distributed so that people east of the plant get a particular dose of ionizing radiation therefrom, we have every reason to expect identical types of effects on other humans west, or south, or north of the plant who get a similar dose of ionizing radiation from distribution from the plant site. To be sure, the larger the dose, the more frequent will be the radiation-caused cancers in the exposed group,but precisely the same kinds of effects will occur in the persons in one direction from the plant as in any other direction, if radiation is experienced by the people.

11. In summary, residents of the area within a mile of the Plant site have already experienced irreversible physical injury from ionizing radiation thrust upon them by the conduct of the defendants in this litigation. That irreversible physical injury will <u>manifest</u> itself some time after the radiation in the form of clinical cancer or leukemia or defective children. But this <u>later</u> manifestation clinically should not deceive us about the physical injury to genes and chromosomes. That injury has been done. And with further radiation exposure, either in vicinity properties, or from still further releases from the plant site,the injuries will increase.

There is no credible basis for assigning the source of this added radiation to the residents to anything other than the activities of the Plant Site and those who operated it and condoned its operation.

Remedial action is itself a source of further danger to the residents, and the fullest, early exposition of the possibilities must be made with the residents so they can make reasonable choices for their own and their children's health.

December 10, 1982

San Francisco, California

John W. Gofman, M.D., Ph.D.

John W. Gofman, M.D., Ph.D.

Subscribed and sworn to before me this
___ day of December, 1982
[illegible], Notary Public.
State of California • Principal Office, San Francisco County

OFFICIAL SEAL
RITA R. BEARD
NOTARY PUBLIC-CALIFORNIA
City and County of SAN FRANCISCO
My Commission Expires August 17 1986

Exhibit 1

CURRICULUM VITAE
John W. Gofman

Birth: September 21, 1918 in Cleveland, Ohio.

Education:

Grade and high school in Cleveland, Ohio.
A.B. in *Chemistry from Oberlin College*, 1939.
Ph.D. in Nuclear/Physical Chemistry from the University of California at Berkeley, 1943.
Dissertation:
The discovery of Pa-232, U-232, Pa-233, and U-233.
The slow and fast neutron fissionability of U-233.
The discovery of the 4n + 1 radioactive series.
M.D. from the School of Medicine, University of California at San Francisco, 1946.
Internship in internal medicine at the University of California Hospital, San Francisco, 1946-1947.

Positions:

Academic appointment in 1947 in the Division of Medical Physics, Department of Physics, University of California at Berkeley. Advancement in 1954 to the full professorship, a position held to the present time, with shift to Emeritus status in December, 1973.

Concurrent appointment since 1947 as either instructor or lecturer in Medicine in the Department of Medicine, University of California, San Francisco.

Additional appointments held:

(1) Associate Director, Lawrence Livermore Laboratory, 1963-1969. Resigned this post to return to full-time teaching and research. Remained as Research Associate at Lawrence Laboratory through February, 1973.

(2) Founder and first Director of the Biomedical Research Division of the Lawrence Livermore Laboratory, 1963-1965. This work was done at the request of the Atomic Energy Commission for the purpose of establishing a program of overall evaluation of the effects of all types of nuclear energy activities upon man and the biosphere.

(3) Member of the U.S. government's Advisory Board for NERVA (Nuclear Engine Rocket Vehicle Application), approximately 1963-1966.

(4) Member of the Reactor Safeguard Committee, University of California, Berkeley, approximately 1955-1960.

(5) Group Leader with the Plutonium Project (for the Manhattan Project) at the University of California, Berkeley, 1941-1943.

(6) Physician in Radioisotope Therapy, Donner Clinic, University of California, Berkeley, 1947-1951.

(7) Consultant to the Research Division of the Lederle Laboratories, American Cyanamid Corporation, 1952-1955.

(8) Medical Director, Lawrence Radiation Laboratory (Livermore), 1954-1957.

(9) Consultant to the Research Division of the Riker Laboratories, approximately 1962-1966.

(10) Medical consultant to the Aerojet-General Nucleonics Corporation, with special emphasis on the hazards of ionizing radiation, for approximately eight years during the 1960's.

(11) Scientific consultant to Vida Medical Systems, 1970-1974; co-invented the VIDA heart monitor, a pocket-worn computer to detect and announce the occurrence of serious cardiac irregularities; invented a skin cardiographic electrode now widely used throughout the USA.

(1) Gold headed Cane Award University of California Medical School 1946, presented to the graduating senior who most fully personifies the qualities of a "true physician"

(2) Modern Medicine Award, 1954, for outstanding contributions to heart disease research

(3) The Lyman Duff Lectureship Award of the American Heart Association in 1965, for research in atherosclerosis and coronary heart disease

(4) The Stouffer Prize (shared) 1972, for outstanding contributions to research in arteriosclerosis

(5) American College of Cardiology, 1974, selection as one of twenty-five leading researchers in cardiology of the past quarter century

Publications

Approximately 150 scientific publications in the following fields

(1) Lipoproteins, atherosclerosis, and coronary heart disease
(2) Ultracentrifugal discovery and analysis of the serum lipoproteins
(3) Characterization of familial lipoprotein disorders
(4) The determination of trace elements by X-ray spectrochemical analysis
(5) The relationship of human chromosomes to cancer
(6) The biological and medical effects of ionizing radiation, with particular reference to cancer, leukemia, and genetic diseases
(7) The lung-cancer hazard of plutonium
(8) Problems associated with nuclear power production

Books

(1) What We Do Know about Heart Attacks
(2) Dietary Prevention and Treatment of Heart Attacks (with Alex V Nichols and E Virginia Dobbin)
(3) Coronary Heart Disease
(4) Population Control through Nuclear Pollution (with Arthur Tamplin)
(5) Poisoned Power The Case against Nuclear Power Plants (with Arthur Tamplin)
(6) Advances in Biological and Medical Physics (co-editor with John H Lawrence and Thomas Hayes, a multi volume series)
(7) Contributor of chapters to numerous books including some c nuclear engineering, cancer induction, biochemical and biophysic research methods, heart disease, and effects of radiation

Teaching

(1) Application of radioactive tracers to chemical, biological, and medical problems
(2) The biological and medical effects of ionizing radiation
(3) Mechanisms of cancer induction
(4) Atherosclerosis and heart disease
(5) Environmental factors in the induction of cancer
(6) Epidemiological approaches in cancer and heart-disease research
(7) Research guidance of some 25 students toward the doctorate in biophysics or medical physics

Patents

(1) The slow and fast neutron fissionability of uranium-233, with its application to production of nuclear power or nuclear weapons
(2) The sodium uranyl acetate process for the separation of plutonium from uranium and fission products from irradiated fuel
(3) The columbium oxide process for the separation of plutonium from uranium and fission products from irradiated fuel

Current work

(1) Continuation of research on induction of cancer and leukemia by ionizing radiations from radionuclides and X-ray sources, as well as the biological hazards of plutonium
(2) Guidance of Ph D research dissertations of students in the biophysics program at the University of California
(3) Independent consulting
(4) Chairman, The Committee for Nuclear Responsibility (uncompensated public-interest work)

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Current Work (Supplemental Data)

(5) Publication: Gofman, John W. "The Question of Radiation Causation of Cancer in Hanford Workers", Health Physics 37, 617-639, 1979.

(6) Publication: Gofman, John W. "Response to the Letter of P. Spiegler on Radiation Causation of Cancer in Hanford Workers" Health Physics 40,412, 414, 1981.

(7) Publication: Gofman,John W. "Response to Dr. C.L. Chan's "Exact Test for All Fourfold Tables and Comments on Hanford Findings of Gofman" Health Physics , 39, 833-835, 1980.

(8) Publication: Gofman, John W. "The Use of Gofman's Doubling Dose in Estimating Low-level Radiation Risk : Response to D. David Maillie's Letter" Health Physics, 41,204-208, 1981.

(9) Publication (Book): Gofman,John W. "Radiation and Human Health", Sierra Club Books, San Francisco, 1981. 908 pages.

(10) Publication: Gofman,John W. "Ionizing Radiation:Concepts for the Dental Assistant" (In three parts), The Dental Assistant July/August, 1982, Sept/Oct,1982, and Nov/Dec, 1982.

(11) Publications: Chapters by John W. Gofman in two recent books. Both are on ionizing radiation and their health effects.

6-106

January 24, 1983

Agnes Engel
565 Ash Street
Canonsburg, PA 15317

Uranium Mill Tailings Project Office
U.S. Department of Energy
P.O. Box 5400
Albuquerque, New Mexico 87115

Dear Sir,

Attached are comments and questions which I would like documented for evaluation, as part of the preparation process for the final draft of the Environmental Impact Statement.

Respectfully Submitted,

Agnes Engel

Agnes Engel

Enclosure:
DEIS Comments

Ps. Per agreement by telephone conversation with Dick McKee, in charge of Public Information, the attached comments were to be accepted even if delivered after the January 24, 1983 deadline.

QUESTIONS AND COMMENTS PRESENTED FOR REVIEW IN PREPARATION OF THE FINAL DRAFT OF THE ENVIRONMENTAL IMPACT STATEMENT FOR THE CANONSBURG REMEDIAL ACTION PROCESS

RESPECTFULLY SUBMITTED:

Agnes Engel

AGNES ENGEL
565 ASH STREET
CANONSBURG, PA 15317

412-745-4898

My name is Agnes Engel, and I presently live at 565 Ash Street, Canonsburg, PA 15317 (1-412-745-4398). I have been a life long resident of North Strabane Township, Washington County, having lived within two or three blocks of the Canonsburg Industrial Site property, for close to forty years.

During the past four and one-half years, I devoted many hours to researching and cataloguing historical facts about the old Standard Chemical Company; reviewing and trying to decipher mountains of data pertaining to the Canonsburg Industrial Site, as well as radiation in general; obtaining volunteers and assisting Mound Facility, Monsanto Research Division, in setting up a radon monitering network in the Canonsburg area; and I independly prepared a residential research survey of thyroid disease in Strabane. Because of the effort I have put forth, I do not claim to be an expert, or even regard myself as having all the answers. What I do claim, as a result of my own personal observation, is inadequate distribution of authority and priorities have kept, and are still keeping, the biggest part of the radiation problem here in Canonsburg improperly serviced.

While reviewing the DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS), the long awaited salvation of progress for cleanup at the Canonsburg Industrial Park, I came to better understand the problems we are facing here in Canonsburg, and why we continue to be an eternal skeketon in DOE's closet. The proposed options for remedial action, presented in the DEIS, along with the other impressive information concerning air, truck transportation, water, animals, plants, etc., failed miserably to gain my confidence in the spending of taxpayers dollars. One would not think that my feelings

had legal justification, considering that surely there would have to be some pertinent information contained somewhere in the over 700 pages. To be honest, it was not so much the information compiled within the DEIS that caused me to doubt proper spending of tax dollars, it was the lack of priority given to the most important part of the environment.......the human being!

105
6.2.5

During the preceeding four and one-half years, every indication points to adequate time being available for a comprehensive health survey to have been completed. Although a whole-hearted attempt was made to obtain information concerning radiation health effects in the Canonsburg area, only inconclusive information resulted. As a main factor in the environment, the health of the residents of the Canonsburg area appears to be a concern addressed in the DEIS. In reality, how much of a concern was evidenced by comparing the information compiled on the effects of radiation on plants and annimals in our environment, and realizing the effects of radiation on the health of the residents, depended on inconclusive information? In the setting of priorities, where did the health of the Canonsburg residents rate on the financial scale of government spending?

106
6.2.9

At the time of the DEIS printing, ground water information concerning the possible contamination of off-site wells, was still incomplete. The importance of this information would seem to mandate the final choice of option for remedial action. As transportation of contaminated well water, to off-site wells, would indicate additional problems for the decontamination process, how would this be addressed in option "2" and "3"?

107
6.2.5

During the implementation of Alternatives 2 through 5, the DEIS indicates the Canonsburg population will continue to

to receive approximately the same radiation exposure as during Alternative 1. How can this reassurance be justified, when radon
107 6.2.5 monitering results during the fall off-site cleanup period indicated slight elevations in the radon concentration levels? Considering that the majority of the waste removal in the fall (82) was mainly reprocessed ore, and not compared to that which is buried in Area C, what will the true radiation exposure projection be during the cleanup of especially Area C in paticular?

As there is no positive way of determining the immediate effect when combining low level long term exposure, previous excessive exposure during the operation or cleanup of the site, slightly elevated risks during the remedial action process or even the possible effect radiation may have had congenitally on an in-
108 6.2.5 dividual, how can a true expectation rate for cancer be projected, giving all the above considerations? Also, is the possibility of a PREDISPOSED CONDITION susceptable to acceleration by the slightly elevated risks during the remedial action process?

The term "TEMPORARY CLOSING" is often referred to the closing of Strabane Avenue, during the remedial action process. In my opinion, this "TEMPORARY CLOSING" will be a "HARD SHIP" to those who have no automobile, walk to church or school, must catch a bus on Pike Street for Pittsburgh, partake in activities any
109 6.2.2 where in Canonsburg or Strabane, or just wish to visit a friend in either community. With all due consideration of the possible remedial action process, given to the fact that there may be increased railroad traffic, attempts to reach Canonsburg or Strabane via the railroad tracks will prove very hazardous. As a safety precaution, is there a possibility that a foot bridge could be constructed for the convenience of the residents of

the area involved? Possible access routes that may be considered are: Selwyn Street to the rear of the W.S. George Pottery to W.
109 6.2.2 Pike Street; or Latimer Avenue near the SNPJ to Youngstown Street. As the radiation problem has caused the area residents more problems than they wish to admitt, the construction of an access route to their sister community would atleast be a small consolation to the temporary closing.

During remedial action, option 3, the estimated projected clean up time would take approximately 86 weeks. Are the winter months
110 6.2.2 calculated in to those 86 weeks when work will no doubt cease? Can we assume that an additional 24 weeks will be added for completion of the job, if the above is the case?

After waiting several years for the DEIS to be released, the fact that little consideration was given to timing, (or possible strageic consideration was given when less people might be less likely to have time to respond), in no way upgraded my ongoing lack of confidence in the Canonsburg remedial action process. It amazes me that we, the residents of the Canonsburg area, were made to wait years for the completion of the DEIS, and as soon as we finally receive it, everything is put on rush! Like cheap wine, maybe if we consume it quickly, we won't have time to dwell on the poor vintage.

As a matter of record, Page 4-40 Sec. 4.12.2, Line 6 should read SLOVENIAN, not Lithuanian. Thank You.

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cc

My name is Joyce Faiella. I am member of a committee representing St. Patrick School in Canonsburg. Other members of our committee are: Reverend Raymond Cercone, Pastor; Sister Elaine Hromulak, Principal; Mrs. Agnes Engel; Mr. Kenneth Krupa; Mr. Francis O'Malley and Dr. Stephen Sawyer. We formed as a group to assess the impact of the clean-up activities at the former Vitro Metals Site on the health and safety of the children and teachers at our school.

We do not specifically support any one alternative over another, except to say that it is our understanding that the clean-up and stabilization of this area has been needed for a long time, and that it is essential that this action be taken for the long-term health and social benefit of the Canonsburg area of which St. Patrick's School is a part.

1 6.2.2 However, since the recommended course of action is to stabilize the material at the site, our following questions and comments are based on that fact. We would recommend that the least amount of contaminated earth be disturbed to minimize the chance of airborne contamination. Also, as noted in the EIS draft, contaminated material should be dampened to further reduce the chance of airborne contamination and all vehicles transporting this material should be adequately covered.

2 6.2.3 Regarding the monitoring of on-site activity as it relates to airborne contamination, we would recommend that the on-site monitors be equipped with alarm systems to notify personnel to stop work when minimal health standards are exceeded. We do not want to be informed at a later date that work continued after healthful limits for children were exceeded, nor do we want to be put in a position of not having protected our children and teachers, if for some reason, this limit is exceeded for a long period of time. While the clean-up

3 6.2.3 activities are in progress, off-site monitoring of conditions should also continue.

It is imperative that monitors be placed in and around the school during remedial action and results of these be given daily; also, that some type of alarm and measuring system be set up in the event that the levels in and around the school increase.

3 6.2.3 Along with the above mentioned systems DOE should work with St. Patrick's School to set up guidelines for evacuation on short-term and long-term basis in the event of an emergency. Mention is made in the Environmental Impact Draft Statement of measures that would be taken if an emergency would arise at the working site but not at the school or nearby areas.

As we read through the Environmental Impact Statement Draft, many questions are raised.

1. Exactly what levels of radon gas and radon daughters are projected to show up in and around St. Patrick's during the clean-up activities? We want to know to what levels our children will be exposed:

   Radon Gas in PCi/l (pico cures per liter)

   4 6.2.5 Radon Daughters in WL (Working Levels)

2. Since children are ten times more susceptible to problems from radiation exposure, what are the long and short-term health effects on the children?

3. What increase in risk of cancer or other health problems are projected in children as a result of the remedial action?

Should not the Environmental Impact Statement Draft have included information regarding questions such as these ... questions pertaining specifically to children? At. St. Patrick's School there are 260 students from ages 5-14 on a daily basis. On weekends there are approximately 600 additional children who study religion at the school. In Chapter 4 (4.12.7) of the Impact Statement entitled AFFECTED ENVIRONMENT, our school is mentioned as being located within one-quarter mile of the site. Is this not a precarious enough position to warrant inclusion of specific guidelines, recommendations and projections concerning St. Patrick's in the final draft of the Impact Statement?

The engineering plans and specific procedures to be followed during the
5 622 clean-up activities are also questioned.

1. Will any or any parts of the buildings be sold as salvage?
2. Will the bentonite (clay) capsule be adequate? Will there
6 622 be any leakage from the capsule in the distant future?
7 622 3. Will the containment area be outside the floodplain?

These are examples of some of the questions that concern us. We, as a committee, expect to be informed of the proposed engineering designs and specific methods to be used to accomplish them. Again, we do not want to be put in the position of having the work finalized and activity begun before we can comment.

The study notes that the site will be "transferred to the DOE and its future use restricted as specified in the NRC license". We need to be informed as to the future use proposed for the site. It is our strong feeling that no use other than storage of the material presently there should be contemplated.
8 622 We are adamant concerning the issue and want the NRC to <u>legally</u> guarantee that no additional radioactive material will <u>ever</u> be brought to the site for storage, disposal or handling.

Further, to insure that this site never again is the health hazard that it
9 623 presently is, we would want monitors and personnel to interpret this data

permanently assigned to the site to insure that it will never again exceed
9 623 the health and public safety standards as developed by the EPA.

The government has the unequivical and absolute responsibility to insure and guarantee to its citizens that they will be protected from actions that endanger their health and welfare, even if the government was not directly responsible for this matter.

On behalf of the students, parents, teachers and administrators of St. Patrick Parish, we would like to thank the Department of Energy for this opportunity to express our feelings concerning the Environmental Impact Statement Draft and the clean-up of the industrial park.

FOR: MORLEY

R.D.2, Box 281A
Sugarloaf, Pa. 18249
January 12, 1983

Donald Hodel, Secretary of Energy
U.S. Department of Energy
Washington, D.C. 20530

Dear Secretary Hodel,

111 6.2.13 It has just come to my attention that the Department of Energy is requesting comment on the remedial action program at Canonsburg, Pa. It is my understanding that DOE failed to publish a federal register notice on the availability of its draft Environmental Impact Statement or on the date and place of the public hearing, therefore, I request that the DOE extend the closing date for written comments on this issue, which affects on people reach far beyond the Canonsburg area.

Please send me a copy of the draft of the Environmental Impact Statement on Canonsburg.

Thank you,

Sue Fracke

Sue Fracke

6-112

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PITTSBURGH REGIONAL OFFICE
2031 FEDERAL BUILDING
PITTSBURGH, PENNSYLVANIA 15222
TELEPHONE: (412) 562-0533

United States Senate
JOHN HEINZ
PENNSYLVANIA

January 11, 1983

Mr. Mark L. Matthews, Lead Project Manager
Uranium Mill Tailings Remedial Action Project
Department of Energy
Albuquerque Operations Office
P.O. Box 5400
Albuquerque, New Mexico 87115

Dear Mr. Matthews:

In 1978, the passage of the "Uranium Mill Tailings Radiation Control Act" (the Federal government) committed to "clean up" twenty-~~one~~ four known sites contaminated by the remains of uranium ore extraction. Today, almost five years later, a very large portion of this radioactive material continues to contaminate the air, ground, and water at these sites, including the one at Canonsburg, Pennsylvania.

The Department of Energy along with the Pennsylvania Department of Environmental Resources and other groups have produced remedial action options in order to find the best methods of clearing the area of radon and radon daughter products. These options may be subject to change even though the Environmental Protection Agency has published their final assessment of the environmental impact of each of the proposed remedial action options. The EPA's delay in releasing such final standards has caused considerable hardship and anguish among the residents of the Canonsburg area.

Although the choice of a remedial action option has not been made and will be preceded by a careful review of all factors, including comments from affected residents and local officials, it is apparent that the stabilization of the contaminated material on site would satisfy most, if not all, of the criteria posited thus far.

The residents of the affected area have a right to expect that the completion of remedial action will clear the environment of harmful radioactive particles. If, however, the DOE can not make such assurances, other alternatives that will alleviate the problem must be found.

It must be made clear to the people of this area that the Federal government is and will be responsible for the results of the remedial action efforts. The swift, safe, complete clean-up of the contaminated sites is nothing less than an obligation incumbent on the government.

Sincerely

John Heinz

John Heinz
United States Senate

JH/dww

January 21, 1983

Mr. James A. Morley, Project Manager
Uranium Mill Tailings Project Office
U.S. Department of Energy
Albuquerque Operations Office
P.O. Box 5400
Albuquerque, New Mexico 87115

Dear Mr. Morley:

Attached are some written comments on the Draft Environmental Impact Statement DOE/EIS-0096-D entitled "Remedial Actions at the Former Vitro Rare Metals Plant Site, Canonsburg, Washington County, Pennsylvania".

The comments are submitted for your consideration in preparation of the final EIS as indicated in the handout at the North Strabane Township Public Hearing on January 12, 1983, and in the cover sheet for the subject report.

We appreciate the opportunity to submit our comments in this matter.

Yours truly,

George W. Leney

G. Leney
243 Whitehall Center, Pittsburgh, PA 15227

Comments on Draft Environmental Impact Statement DOE/EIS-0096-D

"Remedial Actions at the Former Vitro Rare Metals Plant Site, Canonsburg, Washington County, Pennsylvania"
U.S. Department of Energy, November, 1982

George W. Leney is a consulting geologist and Registered Pennsylvania Professional Engineer (PE-025696-E)

I. WASTE MATERIALS NOT ADEQUATELY CHARACTERIZED.

It is necessary to ask for the record:

"Is the Canonsburg site appropriately classified as "uranium mill tailings", or should it be placed in another classification which might require another type of remedial action?"

In discussions at the Canonsburg Umtra Meeting, December 16, 1982, both DOE and Contractor representatives repeatedly referred to the materials at Canonsburg and Burrell as "low-level radioactive waste", and this terminology was also used extensively in news media accounts of the public informational meetings and proposed remedial action. The use of this description in contrast to the classification as "uranium mill tailings" immediately raises the question as to the type of material actually present.

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The DEIS is not enlightening in this regard. The wastes are characterized as "various ores, concentrates, and <u>scrap materials brought from different AEC installations</u>"(p1-3). It notes that "process wastes from this operation and <u>other AEC contract work were stored here</u>." (p2-2)

The wastes at Canonsburg are certainly not normal uranium mill tailings. "Vitro records show that in October, 1948, approximatly 15 tons of uranium oxide (U_3O_8) were being extracted per month from 150 tons of <u>waste received from different AEC installations</u>. Under AEC contract requirements, Vitro retained

its solid process wastes on the site." (p4-4) This recovery of 10% from waste, is about 100 times the grade of normal uranium ores, which average 0.12% U_3O_8. The residues moved to Burrell had 0.097% U_3O_8, or about the same as normal ore, and much more than normal mill tails. It raises the question if the wastes are
112 6.2.4 residues of naturally occurring minerals, or if they include chemical, metallurgical or reactor products that are not in normal mill tailings, and would represent a hazard not ordinarily present.

Contamination with this type of material might require reclassification of the Canonsburg site to one of the other categories of Low-Level Waste, or even as contaminated with High-Level Waste. The site is unacceptable for Low-Level Waste disposal under NRC 10CFR Part 61, or for High-Level Waste, and stabilization would be precluded as an alternative, both from a legal point of view, and in consideration of public health.

The lack of adequate sample data also obscures the choice of alternatives. The amount, distribution, concentrations,
113 6.2.4 equilibrium condition, radioactive half-life, and character of the contaminants are inadequately described. More detailed information might suggest that decontamination is feasible, or that alternative remedial action is preferred. Such detailed geologic and metallurgical exploration is a routine part of the exploration of any uranium ore body, and should be readily possible at this shallow waste dump.

II. ENCAPSULATION NOT A PROVEN OR NECESSARILY DESIRABLE TECHNIQUE.

Encapsulation represents an attempt to create a low permeability medium that will effectively seal off the waste from ground water

movement. Although the use of clay liners in ponds or settling basins is not new, its use in encapsulation of radioactive wastes, which will generate heat, gases, and acid solutions to attack the
114 6.2.2 clay, has not been tried. Experience with storage of low-level waste in natural mediums of low permeability has been poor. The cover either cracks or leaks, and the capsule fills with water creating a "bathtub effect". Eventually the capsule is breached or the bathtub overflows releasing plumes of highly contaminated water saturated with waste elements.

The problem was discussed at several recent symposia sponsored by the U.S. Nuclear Regulatory Commission and the Oak Ridge National Laboratory. Observations from some of the papers were:

<u>G. Lewis Meyer, Office of Radiation Programs, U.S. Environmental Protection Agency</u>

"Three disposal sites in the humid eastern United States have over 20 feet of clay-rich overburden with very low permeability. However, experience at them has not been good---primarily because site engineering did not keep rain water from infiltrating into the trenches. Infiltrating rain water has soaked the wastes, formed radioactive leachates, and overflowed from the trenches to ground surface. At another disposal site, also in humid eastern United States, which has a more permeable disposal medium, no significant problem has been encountered with the collection of leachate in the trenches or with overflow of the leachate."

<u>Patrick G. Tucker, U.S. Army Engineers Waterway Experiment Station</u>

"Subsidence, the "bathtub effect", and the infiltration of ground water into the disposal trench have cast doubts on the ability of some facilities to control the movement of their buried radionuclides."

<u>John B. Robertson, U.S. Geological Survey</u>

"At the Oak Ridge site, raising the ground surface by fill material actually induced the water table upward into the waste in some cases. (Webster, 1979)."

Thomas M. Johnson, State Geological Survey Division, Illinois Department of Energy and Natural Resources

"A study funded by the U.S. Nuclear Regulatory Commission is underway to evaluate the potential use of layered trench covers to minimize infiltration at low-level radioactive waste disposal sites."

Amir A. Mitry and Michael A. Corbin, Roy F. Weston, Inc.

"Several concepts and control options are presented. These included chemical fixation, grouting, bentonite, slurry barrier, hydrologic isolation, impermeable covers and liners, ion exchange barrier, etc. A total containment concept includes the following (1) Installation of clay liner ----- (2) Installation of complex covers consisting of 1) clay layer, 2) sand or gravel layer, 3) soil layer, 4) vegetation cover."

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It is clear that the encapsulation proposed for Canonsburg is an experimental concept, and not a proven technique. Encapsulation has not worked in natural low-permeability mediums, and Canonsburg would be the first test if a man-made liner will work. Since it is experimental, evaluation depends on engineering calculations and intuitive judgements. In order to be a success, integrity must be maintained for whatever period of risk is assigned. Engineering calculations can determine infiltration under some assumed condition, but it is anybody's guess as to the probability of breaching due to erosion, cracking from swelling, compaction or subsidence, shrinkage or dessication, intrusion by plant roots or burrowing animals, and inadvertent or deliberate human intrusion. Success depends on the egress of infiltrating ground water at the same rate as entry. An induced or natural rise in the water table, already at the level of the capsule floor, will limit ground water escape, and breaching or overflow will release a plume of highly contaminated water to the creek or bed rock water table.

Assuming encapsulation were a complete success, one may still question if it is a desirable alternative. The principle radionuclides measured (Table F.1-2), all have long half lives, U_{238}= 4.5 billion years, U_{235}= 710 million years, U_{234}= 248,000 years, and Ra_{226}= 1620 years. Losses of the U_{234} and Ra_{226} daughters are continuously replaced by new disintegrations of the parents. Whatever concentration of these materials is brought together in the capsule is guaranteed to remain forever,

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or at least until the repository is breached and erosion scatters it down Chartiers Creek. As long as it is sealed in the capsule, nothing much will change, or improve. The choice of a time frame for institutional maintainence and monitoring is a purely arbitrary decision that beyond a certain number of years we are unable to predict what will happen, so there is no use worrying about it.

If the Canonsburg wastes are entirely residues of natural ores, they represent concentrations of minerals and elements already present in the soils, rocks, water, and air in the area. The amounts that occur in nature are not small. Uranium averages 10-20 parts per million in the black shales under most of Ohio, and about 70 parts per million in the Chattanooga shale of Tennessee. It is about one third as common as lead. In the rocks as Canonsburg, it probably averages 2-4 parts per million, which yields 100,000-250,000 tons of uranium within a radius of 1 24 miles to a depth of one mile. This is 300-1000 times as much as could conceivably be present on the site. The alternative to decontamination should be to disperse the

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radionuclides and return them to their natural environment as quickly as possible, consistent with the health and safety of the residents, and in compliance with the regulations designed to protect them. It is the only way in which there will ever be any light at the end of the tunnel.

In this view, encapsulation is an unsuitable and undesirable alternative. It would be better to demolish the buildings and bury them with contaminated surface soils under sufficient cover to eliminate direct surface radiation and the escape of
116 6.2.1 gaseous radon daughters. Ground water percolation should be allowed to gradually remove the contaminants in solution and disperse them in the natural environment, from whence they came. Monitoring would be the same as under the encapsulation alternative.

Such a system is already effectively in operation in Area B and at Burrell, and seems to be working well. At Canonsburg there is no surface water or stream sediment contamination in Chartiers Creek (p 4-33), and the proposed EPA ground water quality standards are already being met. Waste in water is diluted at least 1000 fold after mixing with the Ohio River (p 4-18). At Burrell, if the 1977 and 1981-82 data are correct, ground water has been replaced at least forty times, and percolation has reduced the Ra_{226} concentration by a factor of 3, and U_{238} by a factor of 24 in just five years from 1977 to 1982 (p A.2-10). Such data offers the hope that natural processes could safely eliminate the contamination within the life span of a few generations. Such hopes would be utterly destroyed by encapsulation. Even if it worked, the capsule would preserve these materials, dangerously concentrated, and and lurking there, just ten feet below the surface, forever.

III. COST DATA ARE POORLY ORGANIZED AND MISLEADING.

Cost estimates to stabilize or decontaminate both Canonsburg and Burrell are presented in Tables A.4-2, A.4-3, A.4-4, and A.4-5, and are used to estimate costs of alternatives 2, 3, 4, and 5 in Table A.4-1.

We question items of costing as follows:

1. Alternative 2 is to decontaminate Burrell and encapsulate its waste with the Canonsburg waste at Canonsburg. Total costs appear to be overstated by about $4,200,000.

   a. Costs for hauling 80,000 yd^3 to Canonsburg are taken as $2,080,000, but are given as $696,000 in the transportation appendix (p I-35)

117 6.2.11 b. "Material filling" to encapsulate 5 acres with Burrell waste is $800,000 (Table A.4-2), compared to only $80,000 for 3 acres at Canonsburg. This appears to overstate costs by about $700,000.

   c. After decontaminating Burrell, monitoring costs should be less than in alternative 3, and we see no obvious reason why legal and administrative costs would increase from $1,656,000 to $2,800,000. The result seems to be to overstate costs by $2,116,000.

2. Alternative 4 is to decontaminate both Canonsburg and Burrell and encapsulate the wastes at Hanover. Costs appear to be overstated by $7,127,000.

   a. Burrell costs for transportation and material filling appear to be overstated by $1,384,000 and $700,000 as in items 1a and 1b above.

118 6.2.11 b. Hanover site preparation costs of $1,500,000 include $500,000 from Table A.4-3 for Burrell waste (50 acres) and $1,000,000 from Table A.4-5 for Canonsburg waste (100 acres @ $10,000/a). Since the Hanover site is only 50 acres, costs appear to be overstated by 100 acres = $1,000,000

   c. Costs of hauling 250,000 yd^3 from Canonsburg to Hanover are given as $2,000,000 compared to $1,050,000 in the transportation index (p I-35). Costs appear to be overstated by $950,000.

118 6.2.11 d. Costs for monitoring at Hanover should be the same or less than in alternative 3, and appear to be overstated by at least $3,093,000.

3. Alternative 5 is to encapsulate the Canonsburg materials at Hanover, and stabilize Burrell. Costs appear to be overstated by $3,496,000.

a. Total cost to encapsulate Canonsburg waste at Hanover is the same as alternative 4, which overstates them by $950,000 as in 2c above.

119 6.2.11 b. Hanover costs include $1,000,000 for site preparation which overstates them by $500,000 as in 2b above.

c. Monitoring costs to monitor Burrell and Hanover should be no more than alternative 3, and are overstated by $2,046,000.

IV. LACK OF ENGINEERING SUPPORT TO COST DATA.

Independent of treatment of cost data, the real weakness of costing information is that they lack engineering support.
120 6.2.11 At Canonsburg, estimates are based on handling 23,985 yd^3 of contaminated soils, 4700 tons of contaminated steel, and 18,000 yd^3 of demolition debris, to be placed in a 3 acre capsule. The estimates rise to 250,000yd^3 for decontamination. This amounts to 8.4 ft over the entire site. No data are presented to support these numbers. Values of 140,000 yd^3, 34,000 yd^3 and 76,000 yd^3 in areas A, B, and C correspond to depths of 7.9 ft, 4.7 ft, and 15.7 ft. These are larger numbers than would be suggested by an average depth of contamination of 4.0 ft in A., and an average depth of 10-12 feet to Chartiers Creek in area C. Estimates were based on meeting an EPA proposed standard of 2 pCi/m^2sec. This has been raised to 20 pCi/m^2sec in the final standard. The effect will be to drastically reduce the 250,000 yd^3 figure, perhaps to as little as 25,000 yd^3. Volumes could also be minimized by in situ sorting of contaminated soils during excavation.

Such a change would drastically alter the cost data and evaluation of alternatives.

V. GENERAL COMMENT

121 6.2.8 A. The figures for soil loss after remedial action seem unreasonably low. Calculations showing one-eighth inch loss in a thousand years resulted from changing the soil cover to reduce erosion by a factor of 150 times.

122 6.2.5 B. Health impacts would be more meaningful if calculated for a smaller area and downwind from the site. Almost all health impacts will be in this area, and probably should not be averaged over the larger population.

C. The Vitro site has been there for seventy-two years.
123 6.2.5 An evaluation of actual health impacts could have been made as an alternative, and for comparison with theorectically calculated data from dosage rates.

124 6.2.2 D. Appendix H (p H-7,10,13) suggests noise levels from the proposed action which have the potential for hearing damage outdoors, would be above acceptable levels in residences, and would be likely to cause widespread complaints. A reduced scale of operations is indicated.

<u>CONCLUSIONS AND SUGGESTIONS FOR CONSIDERATION</u>

I. Characterization.

113 6.2.4 We believe a more rigorous characterization of the contaminated areas at Canonsburg is necessary before a meaningful calculation of impacts, costs, and selection of alternatives is possible.

This should include detailed radiological and soils mapping on
a survey grid at a scale of no more than fifty feet to the inch.
Contaminated areas should be systematically sampled with auger,
split spoon, or drill holes to bed rock. Holes should be close
spaced to define each contaminated area and should have radio-
113 active logs with radon gas and alpha radiation determinations
6.2.4 as necessary. Samples from holes should be analyzed for chemical,
mineralogical, and radioelement composition to determine the
exact nature of nature of contaminants, probable half-life, and
state of equilibrium. Vitro and AEC records should be examined
to determine the types and amounts of waste deposited at the
Canonsburg site.

II. Classification.

If the detailed characterization revealed the presence of waste elements or minerals not naturally occurring in uranium ores or mill tailings, or in excessive amounts, the site should be appropriately reclassified. Examples might be chemical or metallurgical process waste, toxic waste, other low-level radioactive waste, high level wastes, or military wastes. Presence of these materials might preclude stabilization as an alternative.

III. Remedial Action.

The history of the Canonsburg site is one of temporary
expedients which soon prove to be unsatisfactory and require
125 further remedial action within a few years. We view encapsulation
6.2.11 as one more of the same. It requires that the site be restricted
from other activity, and that it be maintained and monitored for
as long as Canonsburg remains an inhabited area. The health

concerns of the residents will persist, property values will
remain depressed, industry will avoid the area or relocate
elsewhere, and the population will gradually be driven away.
125 We believe these "societal costs" should be factored into the
6.2.11 choice of remedial actions, and will show encapsulation to be
an expensive alternative.

We further believe it is unreasonable to expect the site
and capsule to remain intact for anything like the time frame
126 visualized for institutional maintainence. We anticipate
6.2.2 continuing and substantial expense for repairs, maintainence,
monitoring, and further remedial actions.

We also consider it undesirable to concentrate the most
highly radioactive wastes within a small capsule. It is a
certainty that the capsule will be breached before any significant
127 decline in radioactivity, and when it is, the higher concentrations
6.2.2 will present a greater hazard to public health. Concentration
may also violate the new EPA standard that Ra_{226} may not exceed
15 pCi/gm over 15 cm thick layers more than 15 cm below the
surface.

128 We suggest stabilization at Burrel, and decontamination of
6.2.1 Canonsburg as the favored alternative. Arguments are:

1. Burrell presents no demonstrated health hazard for the forseeable future, it has no alternative residential or commercial use except for land fill, and natural ground water movement appears to be rapidly dissipating the remaining contaminants.

2. Detailed characterization of the Canonsburg wastes is expected to confirm that they are not normal "uranium mill tailings" and require reclassification in some other category.

Reclassification may preclude stabilization as an alternative.

3. Detailed characterization may also demonstrate that the volume of contaminated materials is much less than the 250,000 yd^3 estimated for decontamination.

4. Relaxation of the final EPA Standards 40CFR Chapter I, Subchapter F, Part 192 should also reduce the volume of material that it is necessary to move for decontamination.

5. Better cost estimates from detailed characterization will reduce the difference between stabilization and decontamination alternatives.

6. When overall "societal costs" are considered, decontamination is the most desirable alternative.

7. Encapsulation of greater than 100 pCi/gm waste in a concentrated area may be prohibited under new final EPA standards.

We do not, however, believe that Hanover is an acceptable alternative site. If detailed characterization precludes stabilization at Canonsburg, it may also eliminate Hanover, and encapsulation might still violate the new EPA standards. Hanover may not be acceptable for Low-Level Waste disposal under NRC regulations.

Neither do we believe that Pennsylvania should accept a ruling that it is illegal to move the waste across state boundaries,
129 or that it is too expensive to ship them to an acceptable site.
6 2 1 Having shipped them in, it seems unreasonable to let the government slam the door and leave Canonsburg to cope with them.

If it is truly impossible to send them to a current repository, a change in classification to "Low-Level Waste", which may be

mandated by detailed characterization, would require them to be moved to a licensed "Low-Level Waste Repository". If a currently
129 acceptable repository is not accessible, they may be left in
6.2.1 place until one is. The recent Low-Level Waste Repository Act (Public Law 96-573) requires the designation of new repositories by 1986. The regulations for selection, licensing, maintainence, and monitoring come from the U.S. Nuclear Regulatory Commission, and are much more stringent than for UMTRA sites. Large amounts of highly radioactive debris will also be accumulated in the near future, from decommissioning of the experimental reactor at Shippingport. Provision might be made to dispose of Canonsburg wastes with them.

If decontamination is refused, it appears the second best alternative would be to demolish the buildings and store the
118 debris, along with contaminated surface soils from Area A, in
6.2.11 the depression along Ward Street. The site should then be graded and covered with sufficient clean fill to eliminate the health hazards from direct surface radiation and radon emissions. This type of remedial action is effectively in operation at present in Area B, and appears to be working well. Ground water and surface water off-site is not contaminated, and additional clay fill with soil cover should reduce ground water infiltration. Contaminated soils on the flood plain in Area C do not appear to be a problem. They have already withstood the effect of hurricane Agnes, considered to be a 1000 year storm (p 4-8,19), and there is no assurance that moving them would make them less vulnerable.

The philosophy behind these suggestions is to eliminate the health hazards, while permitting percolation of ground water to gradually disperse the radioactive wastes and return them to the natural environment that they were originally derived from.

We recommend these comments and observations for your consideration.

G. W. Leney
January 20, 1983

Rec'd 1-24-83

THE PENNSYLVANIA STATE UNIVERSITY
104 DAVEY LABORATORY
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College of Science
Department of Physics

Area Code 814

18 January 1983

Mr. Richard H. Campbell
Manager
Uranium Mill Tailings Remedial Action Project
U.S. Department of Energy
Albuquerque Operations Office
5301 Central Ave, N.E. , Suite 1700
Albuquerque, New Mexico
87108

Dear Mr Campbell:

Enclosed are my comments on the Draft Environmental Statement related to the Canonsburg site, DOE/EIS-0096-D. Please note that the calculations and positions taken herein do not necessarily reflect the position of the Pennsylvania State University.

I hope that this information is used in developing the Final Environmental Statement, and your choice for action.

Would you please send me a copy of the Final EIS when it is available.

Sincerely,
William A. Lochstet

Wm. A. Lochstet

An Evaluation of
Radioactive Waste
at Canonsburg, Pa
by
William A. Lochstet, Ph.D.
The Pennsylvania State University*
January 1983

The Department of Energy has presented a draft environmental impact statement on the "Remedial Actions at the Former Vitro Rare Metals Plant Site, Canonsburg, Pa." (Ref. 1). The hazard present is partially depleted uranium mill tailings and other tailings at two sites, one at Canonsburg, and the other in nearby Burrell Township. The department (DOE) has chosen to present a report which ignores the real hazard of the situation even though this was demonstrated at the "Scoping Meeting" held in Canonsburg on 3 June 1981. In particular, DOE presents the worst possible environmental impact to be the death of only 5.4 people in the next 32.5 years, which will continue if no action is taken.

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At this death rate of 0.16 per year there is no discussion of how long it will last, or what the possible total might be. Since the major hazard is derived from uranium-238, it might be reasonable to consider one half life of 4.5×10^9 years, for a total of 747 million dead. The lack of any number of deaths greater than 10 implies a clear bias.

Similarly, DOE refuses to consider the deaths of people living further then 2 kilometers (1.24 miles) from the site in question (Ref. 1, P. 1-21, Sec. 1-5).

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In 1976 Pohl pointed out (Ref. 2) that the thorium-230 in uranium mill tailings decays to radium-226, which in turn decays to radon-222 with a time scale determined by the 80,000

* The calculations and opinions presented here are my own, and not necessarily those of the Pennsylvania State University. My affiliation is given here for identification purposes only.

year half life of the thorium-230. Later that same year, the NRC Staff pointed out in the GESMO proceeding (Ref. 3) that it is important to consider that the uranium-238 in mill tailings decays thru several steps to radon-222. It is necessary to consider the health effects of this radon generation, in order to find the total environmental impact, rather than merely a description of a way to meet the regulations. The requirement of NEPA is an evaluation of the impacts.

First consider the consequences of no action. At present the Canonsburg site is emitting radon at a rate of 2158 Ci/year, and the Burrell site is emitting radon at a fate of 111 Ci/year (Ref. 1, App. F). As a result of the extraction processes, these materials are not in secular equilibrium. This is due to
the removal of radium from some of the ores and uranium from others. 131
It is here assumed that the uranium recovery was 90% efficient, 6.2.5
131 so that 10% of the uranium remains at the sites. Thus, 10%
6.2.5 of the radon emissions are in secular equilibrium with the
parent, uranium-238, and will continue with a time scale determined by its half life. Thus, starting at 227 Ci/year, a total of 1.5×10^{12} curies of radon-222 will be released(1.5 trillion curies).

The population at risk is the entire population living down wind from the site, not merely those living within 1.24 miles. It is clearly not possible to predict the U.S. population many thousands of years into the future. That does not excuse us from a reasonable attempt. A reasonable first estimate is the present population in its present distribution. The NRC Staff (not some wild - eyed crazy) has done this, using a U.S. population of 300 million for radon released from a western state(Ref. 4). Since people live very far apart in western states, this assumes few residents within a few tens of miles, adn thus, does not include the people within the 1.24 miles considered in the Draft.

The NRC result is that the release of one curie results in a total of 0.56 person-rem to the bronchial epithelium, for the total population. After considering the state by state distribution of population to the easterly directions of such sites, it is here estimated that release of radon from a site near Pittsburgh would result in about half as much exposure or 0.28 person-rem. However, to be safe, one third(0.56/3) , or 0.19 person - rem will be used here. The result is $1.5 \times 10^{12} \times 0.19$, or 2.7×10^{11} person-rem to the bronchial epithelium.

The Draft chooses to use a risk factor of 20 deaths per million person-rem to the bronchial epithelium from radon-222 and succeding isotopes. This is probably too small, but will be used here. The result is $2.7 \times 10^{11} \times 20/10^{6}$ or 5.5 million deaths. It would certainly not be appropriate to consider the "no action" alternative. This very optimistic estimate ignores the effects of erosion. Rain will fall, soil will wash away, and chartiers creek will erode away at the base of the site. The result is less soil cover, and higher radon emissions, and thus more deaths.

The Draft (Ref. 1) considers four remedial action alternatives. The expected radon emissions are listed in Appendix F.2 for the various sites. The result would be a radon emission rate of 7.6 to 10.1 Curie per year, total for the sites involved. The consequences of a nominal starting rate of 10 Ci/year will be considered here as representative of these alternatives.

As before a uranium extraction efficiency of 90% would imply that 10% of the 10 curie per year, or one curie per year would be in secular equilibrium with the uranium-238 parent and will continue at that time scale. The result , is 6.5×10^{9} curies of radon released. For the population considered previously, receiving 0.19 person-rem per curie, the dose is 1.21×10^{9}

person-rem to the bronchial epithelium. Using the DOE risk factor of 20 deaths per million person-rem, the result is 24,000 deaths. Thus , the proposed remedial actions reduce the death total from
131 five million to twenty four thousand. This is certainly justification
6.2.5 for not taking no action. The cost of this program would be $45 million, or less (Ref. 1, App. A.4).

The NRC has a principle of as low as reasonably achievable (ALARA) which is put forth in the law at 10 CFR 50 Appendix I. This is used to determine how much money should be spent to improve a control measure to decrease radiation exposures. The rule says that efforts can stop when it costs $1000 to reduce the population exposure by one person-rem to the whole body.
132 The DOE risk factor for whole body exposure is 120 deaths per
6.2.1 million person-rem(Ref. 1, P. F.3-4). Combined with the NRC rule equates 120 deaths with 1,000,000 x $1000, or a billion dollars. This means that a billion dollars should be spent if it will save over 120 lives. The death toll from the alternatives presented is 24,000, which would imply $200 billion might be spent to save all these lives. Since the DOE has not considered this, they have not satisfied the law (10 CFR 50).

It is clear that DOE should consider doing the cleanup properly, rather than pushing a little dirt over the problem and going away. It would appear that that was the procedure used in
133 1965-1966 (Ref. 1, P.4-4) and found to be unacceptable in 1977.
6.2.2 If this procedure is used again, it would be expected that one of the alternatives (2-5) would be completed by 1987 and found unacceptable by the year 1999.

A better location should be found for the waste material. The locality of the present site (greater Pittsburgh) is too
134 densely populated, and will continue to be too densely populated
6.2.1 to justify shallow land burial of this material. It might be possible

to find a location with stable geology that would allow deep
134 geological disposal. I understand that DOE is looking for such
6.2.1 a site. Something similar to the Waste Isolation Pilot Plant site in New Mexico. The WIPP site has been shown to be inadequate, so it cannot be used. Certainly this could be done within a $200 billion budget. The cost of transportation can
135 also be justified. It would also be in the national interest
6.2.1 to use rail rather than truck due to the greater fuel efficiency of rail.

The excavation of the sites as outlined would seem to lead to the loading and dumping of dry material in the open. This may be condoned in an open area in the west, but is not appropriate in a site with dwellings just across the Conrail tracks. It is suggested that a tent be placed over the excavation area as has been done for other exhumations of buried low level radioactive waste. It would also seem prudent to keep the
136 material wet and move mud rather than dry material. This would
6.2.2 generate less dust. It is very important that the contamination not be spread over a larger area due to the work to be done.

It is stated on page 3-9 of the Draft (Ref. 1) that the Wilson Avenue and George Street residences are uncontaminated.
137 One of these houses has a contaminated chimney(Ref. 5).
6.2.4

Erosion must be considered more carefully. The erosion of Chartiers Creek at Canonsburg and the Conemaugh River at Burrell Township will eventually carry away the material presently there. The validity of this is obvious if you compare this to the Grand
138 Canyon which is over a mile deep, due totally to erosion.
6.2.8 The calculations of Appendix A.5 (Ref. 1) do not seem to have considered stream erosion, gullying , or the effects of all terrain vehicles (dirt bikes).

The document presented by DOE (Ref. 1) sets forth the way in which the Department intends to meet certain existing or proposed regulations, such as the EPA limits for mill tails. It does not assess the full environmental impact of the proposed action as is required by NEPA. NEPA requires an honest and reasoned attempt to evaluate the full environmental and health impact of these wastes. This must go beyond 1000, or even 1,000,000 years, because the hazard will still be there. This evaluation must also go beyond 2 km (1.24 miles) because the hazard does not stop at this or any magical boundry. It was shown in the case of reactor accidents that the health effects are greater for a larger population farther away with less dose per person, because there are so many more persons (Ref. 6).

It is hoped that DOE meets its statuatory requirements under NEPA and ALARA.

References

1 "Draft Environmental Impact Statement, Remedial Actions at the Former Vitro Rare Metals Plant Site, Canonsburg, Washington County, Pennsylvania", DOE/EIS-0096-D, U.S. DOE, (November 1982)

2 R.O. Pohl, "Health Effects of Radon-222 from Uranium Mining", Search, 7 (5), 345-350 (August 1976).

3 "NRC Staff's Written Answers to Questions on Chapter IV F and G (Including 7 Answers Pertaining to IV E)" NRC Staff before the GESMO Hearing Board, 13 December 1976, Docket No RM-50-5.

4 Affidavit of Dr. R. L. Gotchy, NRC Staff, "Appendix", "Radiological Impact of Radon-222 Releases", NRC, in the matter of Three Mile Island Unit 2 operating license, (January 20, 1978).

5 Private Communication, Resident, 3 June 1981

6 "Report to the American Physical Society by the Study group on light-water reactor safety", H.W. Lewis, et al., Reviews of Modern Physics, Vol 47, Supp No 1, Summer 1975

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January 6, 1983

Mr. James Morley, Director
Uranium Mill Tailings Project Office
United States Department of Energy
Albuquerque Operations Office
Post Office Box 5400
Albuquerque, New Mexico 87115

Dear Mr. Morley:

On behalf of Southwest Research and Information Center (SRIC) we are hereby requesting an extension of time for submission of both oral and written comments on the Draft Environmental Impact Statement (DEIS) pertaining to the Canonsburg, Pennsylvania inactive uranium mill tailings processing site. Developed pursuant to the Uranium Mill Tailing Radiation Control Act of 1978 (UMTRCA), the DEIS contains proposed remedial action to minimize or eliminate health hazards resulting from exposure of the public to residual radioactive materials.

SRIC has demonstrated a longstanding concern with the environmental, health, and safety problems associated with uranium mill tailings. Moreover, SRIC, through a variety of advocacy activities both legislative and regulatory, has played an active role in this region and at the national level to ensure maximum protection of affected communities from the adverse effects of exposure to uranium mill tailings. It is for these reasons that we are so concerned about the Canonsburg, Pennsylvania situation.

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6.2.13
We believe that an extension of the comment period is essential to secure meaningful public participation on the DEIS for the following reasons.

1. Requirements for public participation under both UMTRCA and NEPA will be violated if our request for an extension is denied.

Both the National Environmental Policy Act (NEPA) and UMTRCA presuppose active public involvement in governmental decision-making that affects the environment. Specifically, Section 111 of UMTRCA mandates public participation. Section 111 provides as follows:

> In carrying out the provisions of this title, including the designation of processing sites, establishing priorities for such sites, the selection of remedial actions, and the execution of cooperative agreements, the

> Secretary, the Administrator and the Commission shall encourage public participation and, where appropriate, the Secretary shall hold public hearings relative to such matters in the States where processing sites and disposal sites are located [emphasis added].

See also Council on Environmental Quality Guidelines for NEPA requiring an agency that has prepared a DEIS to "request comments from the public, affirmatively soliciting comments from those persons or organizations who may be interested or affected." 40 C.F.R. §1503.1 (a)(4)(1981). The public notice on the Canonsburg DEIS in fact fails to "encourage public participation."

The notice appeared in the Federal Register on December 8, 1982. 47 F.R. 55305 (1982). The notice omitted any mention of the public hearing scheduled for January 11-12, 1983. The notice only indicates that comments must be submitted by January 24, 1983. Because the December 8, 1982 notice nowhere informs the public about the scheduled hearing date, it is hard to see how the Department has met UMTRCA's public participation requirement, at least as to the proposed public hearing. Furthermore, the Council on Environmental Quality Guidelines also make it clear that the notice in the Federal Register should have included the scheduled hearing date. 40 C.F.R. §§1506.6 (a), (b) (1981).

In addition, the timing of release of the DEIS was simply unfortunate because it coincided with the Christmas holidays. Thus, many concerned and effected individuals never learned about the public hearings until after January 1, 1983. They should not be denied an opportunity to be heard.

2. Because the decisions made regarding the Canonsburg site hold such significant precedential import for the entire DOE remedial action program, maximum public involvement is even more critical than it would be otherwise.

Canonsburg, Pennsylvania is the first of twenty-four DOE sites designated for remedial action pursuant to UMTRCA. This is the first opportunity granted the public to comment on a DOE remedial action plan. Whatever is decided in Canonsburg will inevitably serve as a precedent for remedial action programs at the other twenty-three sites. Therefore, it is absolutely critical that the agency permit a full airing of public views so that as many considerations as possible are taken into account in the final design of this remedial action program.

3. An extension of time will not adversely affect the UMTRA Master Site Schedule. According to the UMTRA Project Status Review presented at the Grand Junction, Colorado meeting on October 26-27, 1982, the completion of the NEPA process for Canonsburg was scheduled for the middle of the second quarter of 1983 (see attachment). Thus, the completion of the comment period by January 24, 1983 puts DOE well ahead of

Mr. James Morley
January 6, 1983
Page Three

schedule. We submit that a short extension of time will not compromise DOE's schedule and will inestimably benefit the entire planning process by allowing for the meaningful participation of concerned citizens.
Based on the foregoing reasons, we propose the following:

1. Extend the comment period from January 24, 1983 to February 24, 1983.

2. At the close of the hearing scheduled for January 11-12, 1983, recess the hearing and reconvene it on February 1-2, 1983 to enable those who have not been given adequate notice an opportunity to provide oral testimony.

We believe this proposal gives all interested parties, including those prepared to testify on January 11-12, 1983 the opportunity to have their views known. We appreciate your consideration of this important matter.

Sincerely,

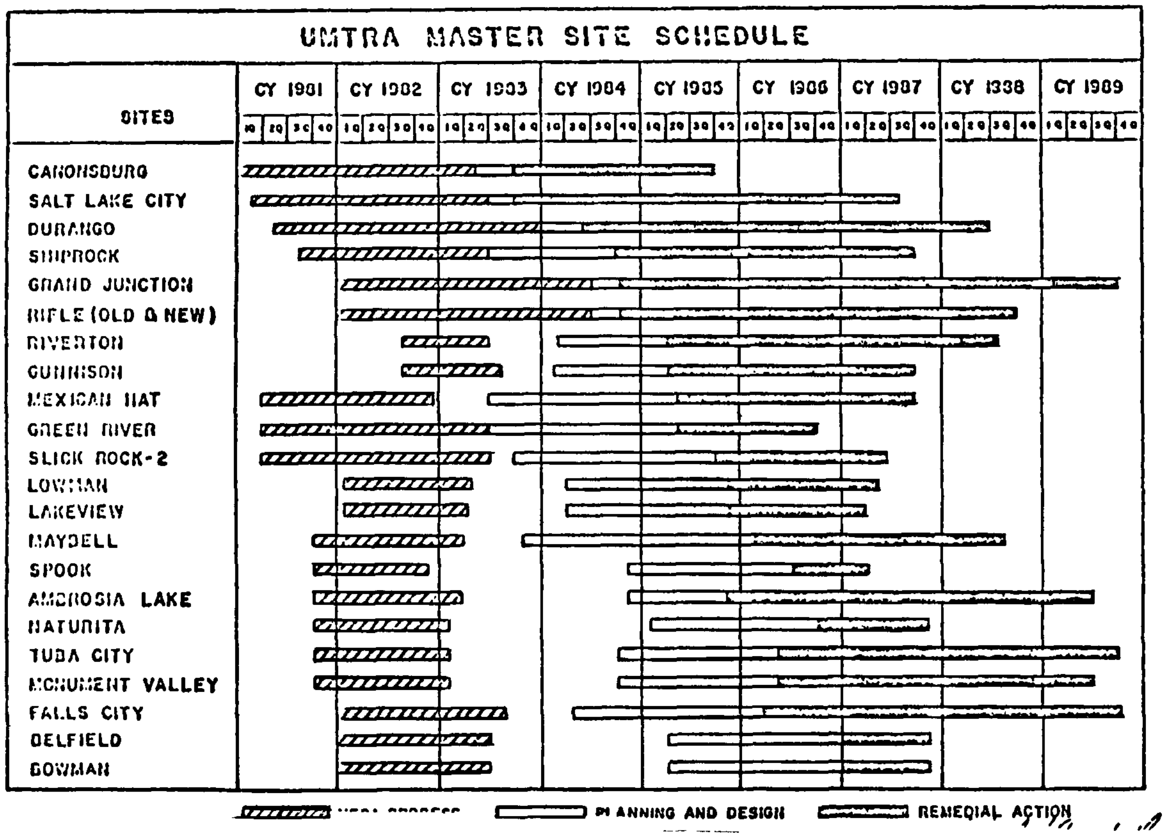
Carol Oppenheimer
CAROL OPPENHEIMER
Staff Attorney

CO/ms

cc: Mr. Robert McNeill, Secretary
New Mexico Department of Health and Environment

Senator Jeff Bingaman

Representative Bill Richardson



(c) While work on a required program environmental impact statement is in progress and the action is not covered by an existing program statement, agencies shall not undertake in the interim any major Federal action covered by the program which may significantly affect the quality of the human environment unless such action:

(1) Is justified independently of the program;

(2) Is itself accompanied by an adequate environmental impact statement; and

(3) Will not prejudice the ultimate decision on the program. Interim action prejudices the ultimate decision on the program when it tends to determine subsequent development or limit alternatives.

(d) This section does not preclude development by applicants of plans or designs or performance of other work necessary to support an application for Federal, State or local permits or assistance. Nothing in this section shall preclude Rural Electrification Administration approval of minimal expenditures not affecting the environment (*e.g.* long leadtime equipment and purchase options) made by nongovernmental entities seeking loan guarantees from the Administration.

§ 1506.2 Elimination of duplication with State and local procedures.

(a) Agencies authorized by law to cooperate with State agencies of statewide jurisdiction pursuant to section 102(2)(D) of the Act may do so.

(b) Agencies shall cooperate with State and local agencies to the fullest extent possible to reduce duplication between NEPA and State and local requirements, unless the agencies are specifically barred from doing so by some other law. Except for cases covered by paragraph (a) of this section, such cooperation shall to the fullest extent possible include:

(1) Joint planning processes.

(2) Joint environmental research and studies.

(3) Joint public hearings (except where otherwise provided by statute).

(4) Joint environmental assessments.

(c) Agencies shall cooperate with State and local agencies to the fullest extent possible to reduce duplication between NEPA and comparable State and local requirements, unless the agencies are specifically barred from doing so by some other law. Except for cases covered by paragraph (a) of this section, such cooperation shall to the fullest extent possible include joint environmental impact statements. In such cases one or more Federal agencies and one or more State or local agencies shall be joint lead agencies. Where State laws or local ordinances have environmental impact statement requirements in addition to but not in conflict with those in NEPA, Federal agencies shall cooperate in fulfilling these requirements as well as those of Federal laws so that one document will comply with all applicable laws.

(d) To better integrate environmental impact statements into State or local planning processes, statements shall discuss any inconsistency of a proposed action with any approved State or local plan and laws (whether or not federally sanctioned). Where an inconsistency exists, the statement should describe the extent to which the agency would reconcile its proposed action with the plan or law.

§ 1506.3 Adoption.

(a) An agency may adopt a Federal draft or final environmental impact statement or portion thereof provided that the statement or portion thereof meets the standards for an adequate statement under these regulations.

(b) If the actions covered by the original environmental impact statement and the proposed action are substantially the same, the agency adopting another agency's statement is not required to recirculate it except as a final statement. Otherwise the adopting agency shall treat the statement as a draft and recirculate it (except as provided in paragraph (c) of this section).

(c) A cooperating agency may adopt without recirculating the environmental impact statement of a lead agency when, after an independent review of the statement, the cooperating agency concludes that its comments and suggestions have been satisfied.

(d) When an agency adopts a statement which is not final within the agency that prepared it, or when the action it assesses is the subject of a referral under Part 1504, or when the statement's adequacy is the subject of a judicial action which is not final, the agency shall so specify

§ 1506 4 Combining documents.

Any environmental document in compliance with NEPA may be combined with any other agency document to reduce duplication and paperwork

§ 1506 5 Agency responsibility

(a) *Information* If an agency requires an applicant to submit environmental information for possible use by the agency in preparing an environmental impact statement, then the agency should assist the applicant by outlining the types of information required The agency shall independently evaluate the information submitted and shall be responsible for its accuracy If the agency chooses to use the information submitted by the applicant in the environmental impact statement, either directly or by reference, then the names of the persons responsible for the independent evaluation shall be included in the list of preparers (§ 1502 17) It is the intent of this paragraph that acceptable work not be redone, but that it be verified by the agency

(b) *Environmental assessments.* If an agency permits an applicant to prepare an environmental assessment, the agency, besides fulfilling the requirements of paragraph (a) of this section, shall make its own evaluation of the environmental issues and take responsibility for the scope and content of the environmental assessment.

(c) *Environmental impact statements.* Except as provided in §§ 1506 2 and 1506 3 any environmental impact statement prepared pursuant to the requirements of NEPA shall be prepared directly by or by a contractor selected by the lead agency or where appropriate under § 1501 6(b), a cooperating agency It is the intent of these regulations that the contractor be chosen solely by the lead agency, or by the lead agency in cooperation with cooperating agencies, or where appropriate by a cooperating agency to avoid any conflict of interest Contractors shall execute a disclosure statement prepared by the lead agency, or where appropriate the cooperating agency, specifying that they have no financial or other interest in the outcome of the project. If the document is prepared by contract, the responsible Federal official shall furnish guidance and participate in the preparation and shall independently evaluate the statement prior to its approval and take responsibility for its scope and contents. Nothing in this section is intended to prohibit any agency from requesting any person to submit information to it or to prohibit any person from submitting information to any agency

§ 1506 6 Public involvement.

Agencies shall (a) Make diligent efforts to involve the public in preparing and implementing their NEPA procedures.

(b) Provide public notice of NEPA-related hearings, public meetings, and the availability of environmental documents so as to inform those persons and agencies who may be interested or affected.

(1) In all cases the agency shall mail notice to those who have requested it on an individual action

(2) In the case of an action with effects of national concern notice shall include publication in the FEDERAL REGISTER and notice by mail to national organizations reasonably expected to be interested in the matter and may include listing in the *102 Monitor* An agency engaged in rulemaking may provide notice by mail to national organizations who have requested that notice regularly be provided Agencies shall maintain a list of such organizations

(3) In the case of an action with effects primarily of local concern the notice may include

(i) Notice to State and areawide clearinghouses pursuant to OMB Circular A-95 (Revised)

(ii) Notice to Indian tribes when effects may occur on reservations

(iii) Following the affected State's public notice procedures for comparable actions.

(iv) Publication in local newspapers (in papers of general circulation rather than legal papers)

(v) Notice through other local media

(vi) Notice to potentially interested community organizations including small business associations

(vii) Publication in newsletters that may be expected to reach potentially interested persons

(viii) Direct mailing to owners and occupants of nearby or affected property

(ix) Posting of notice on and off site in the area where the action is to be located

(c) Hold or sponsor public hearings or public meetings whenever appropriate or in accordance with statutory requirements applicable to the agency Criteria shall include whether there is

(1) Substantial environmental controversy concerning the proposed action or substantial interest in holding the hearing

(2) A request for a hearing by another agency with jurisdiction over the action supported by reasons why a hearing will be helpful If a draft environmental impact statement is to be considered at a public hearing the agency should make the statement available to the public at least 15 days in advance (unless the purpose of the hearing is to provide information for the draft environmental impact statement)

(d) Solicit appropriate information from the public

(e) Explain in its procedures where interested persons can get information or status reports on environmental impact statements and other elements of the NEPA process.

(f) Make environmental impact statements, the comments received, and any underlying documents available to the public pursuant to the provisions of the Freedom of Information Act (5 U S C 552), without regard to the exclusion for interagency memoranda where such memoranda transmit comments of Federal agencies on the environmental impact of the proposed action Materials to be made available to the public shall be provided to the public without charge to the extent practicable, or at a fee which is not more than the actual costs of reproducing copies required to be sent to other Federal agencies, including the Council

§ 1506 7 Further guidance

The Council may provide further guidance concerning NEPA and its procedures including

(a) A handbook which the Council may supplement from time to time, which shall in plain language provide guidance and instructions concerning the application of NEPA and these regulations

(b) Publication of the Council's Memoranda to Heads of Agencies

(c) In conjunction with the Environmental Protection Agency and the publication of the 102 Monitor, notice of

(1) Research activities

(2) Meetings and conferences related to NEPA, and

(3) Successful and innovative procedures used by agencies to implement NEPA

§ 1506 8 Proposals for legislation

(a) The NEPA process for proposals for legislation (§ 1508 17) significantly affecting the quality of the human environment shall be integrated with the legislative process of the Congress. A legislative environmental impact statement is the detailed statement required by law to be included in a recommendation or report on a legislative proposal to Congress. A legislative environmental impact statement shall be considered part of the formal transmittal of a legislative proposal to Congress, however, it may be transmitted to Congress up to 30 days later in order to allow time for completion of an accurate statement which can serve as the basis for public and Congressional debate The statement must be available in time for Congressional hearings and deliberations

(b) Preparation of a legislative environmental impact statement shall conform to the requirements of these regulations except as follows

(1) There need not be a scoping process

(2) The legislative statement shall be prepared in the same manner as a draft statement, but shall be consid

ered the "detailed statement" required by statute; *Provided*, That when any of the following conditions exist both the draft and final environmental impact statement on the legislative proposal shall be prepared and circulated as provided by §§ 1503.1 and 1506.10.

(i) A Congressional Committee with jurisdiction over the proposal has a rule requiring both draft and final environmental impact statements.

(ii) The proposal results from a study process required by statute (such as those required by the Wild and Scenic Rivers Act (16 U.S.C. 1271 et seq.) and the Wilderness Act (16 U.S.C. 1131 et seq.)).

(iii) Legislative approval is sought for Federal or federally assisted construction or other projects which the agency recommends be located at specific geographic locations. For proposals requiring an environmental impact statement for the acquisition of space by the General Services Administration, a draft statement shall accompany the Prospectus or the 11(b) Report of Building Project Surveys to the Congress, and a final statement shall be completed before site acquisition.

(iv) The agency decides to prepare draft and final statements.

(c) Comments on the legislative statement shall be given to the lead agency which shall forward them along with its own responses to the Congressional committees with jurisdiction.

§ 1506.9 Filing requirements.

Environmental impact statements together with comments and responses shall be filed with the Environmental Protection Agency, attention Office of Federal Activities (A-104), 401 M Street SW., Washington, D.C. 20460. Statements shall be filed with EPA no earlier than they are also transmitted to commenting agencies and made available to the public. EPA shall deliver one copy of each statement to the Council, which shall satisfy the requirement of availability to the President. EPA may issue guidelines to agencies to implement its responsibilities under this section and § 1506.10 below.

§ 1506.10 Timing of agency action.

(a) The Environmental Protection Agency shall publish a notice in the FEDERAL REGISTER each week of the environmental impact statements filed during the preceding week. The minimum time periods set forth in this section shall be calculated from the date of publication of this notice.

(b) No decision on the proposed action shall be made or recorded under § 1505.2 by a Federal agency until the later of the following dates:

(1) Ninety (90) days after publication of the notice described above in paragraph (a) of this section for a draft environmental impact statement.

(2) Thirty (30) days after publication of the notice described above in paragraph (a) of this section for a final environmental impact statement.

An exception to the rules on timing may be made in the case of an agency decision which is subject to a formal internal appeal. Some agencies have a formally established appeal process which allows other agencies or the public to take appeals on a decision and make their views known, after publication of the final environmental impact statement. In such cases, where a real opportunity exists to alter the decision, the decision may be made and recorded at the same time the environmental impact statement is published. This means that the period for appeal of the decision and the 30-day period prescribed in paragraph (b)(2) of this section may run concurrently. In such cases the environmental impact statement shall explain the timing and the public's right of appeal. An agency engaged in rulemaking under the Administrative Procedure Act or other statute for the purpose of protecting the public health or safety, may waive the time period in paragraph (b)(2) of this section and publish a decision on the final rule simultaneously with publication of the notice of the availability of the final environmental impact statement as described in paragraph (a) of this section.

(c) If the final environmental impact statement is filed within ninety (90) days after a draft environmental impact statement is filed with the Environmental Protection Agency, the

RÉC'D 1-24-83

University of Pittsburgh

SCHOOL OF LAW
Environmental Law Council

January 20, 1983

Project Manager
Uranium Mill Tailings Remedial Action Project
United States Department of Energy
Albuquerque Operations Office
5301 Central Avenue NE
Suite 1700
Albuquerque, NM 87108

Gentlemen:

Enclosed please find my written comments on the Draft Environmental Impact Statement on Proposed Remedial Action at the Former Vitro Rare Metals Plant Uranium Mill Tailings Site, Canonsburg, Pennsylvania.

I hope that you will give full consideration to the issues raised in this statement. I feel that they point out some important deficiencies in this DEIS which go to the very heart of the NEPA process and the National Nuclear Waste Management Program.

Cooperatively yours,

Lawrence I. Sperling

Lawrence I. Sperling

PITTS PA 15260

Statement of Lawrence Sperling,

President, Environmental Law Council,

University of Pittsburgh School of Law,

in response to the Department of Energy's Draft Environmental

Impact Statement Proposing Remedial Actions at the Former

Vitro Rare Metals Plant Uranium Mill Tailings Site,

Canonsburg, Pennsylvania.

January 12, 1983

My name is Lawrence Sperling and I am president of the Environmental Law Council, an organization of students at the University of Pittsburgh School of Law which studies issues of environmental law and assists members of the local community in working toward environmental protection.

I appreciate the opportunity to say a few words this evening in response to proposals outlined in the Draft Environmental Impact Statement for remedial action at the Canonsburg Uranium Mill Tailings site.

THE NEED TO ENSURE PUBLIC CONFIDENCE

The preparation of Draft Environmental Impact statements and the hearing of public responses are required by the National Environmental Policy Act of 1969 and subsequent regulations promulgated by the Council of Environmental Quality. A fundamental purpose of these NEPA proceedings is to ensure the confidence of the public that proposed federal actions will not create serious adverse consequences on public health and the human environment. In addition, the Uranium Mill Tailings Control Act of 1978 which has directed the Department of Energy to take remedial action at the Canonsburg site calls for public participation in the decisionmaking process for similar reasons.

The Department of Energy's National Nuclear Waste Management policy recognizes this need to ensure public confidence in its handling of nuclear wastes. DOE's Nuclear Waste Management Program Summary Document states that before constructing a nuclear waste disposal facility, "The public must be convinced that the disposal method is safe, that the local communities will not be

exposed to radiation or threatened with nuclear contamination, and that property values will not be significantly depressed by a waste facility." (DOE/NE-0008 March 1980, p.215) The Draft Environmental Impact Statement under review today fails to accomplish this task in several respects.

INADEQUACY OF BASIC PUBLIC HEALTH ASSUMPTIONS

The confidence of the local community in the competency of federal agencies to permanently isolate these wastes and contaminated materials from their environment has been shattered by the severity of the current situation. Citizens of Canonsburg and Strabane live in daily fear of exposure to radiation, contamination of property, cancer, chromosome damage, etc. Yet, as we have heard this evening DOE from the start bases its very
33 assumptions about the current public health effects on studies
6.2.5 which are incomplete, inaccurate, and which have not been made available to the public. Our first recommendation is that, in light of the current and continuing local health hazard created by the Canonsburg site, DOE and other appropriate agencies take immediate actions to protect the public by conducting complete,
139 authoritative radiological surveys of the surrounding areas,
6.2.5 including analysis of blood samples of residents for radioactive contamination, and effect evacuation of residents within a radius in which any significant contamination is detected. These steps should be taken immediately, prior to the initiation of remedial action.

AN ISSUE OF NATIONAL CONCERN

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6 2.13
The failure of DOE to base its public health assumptions on authoritative, available studies is indicative of a failure throughout the DEIS to meet the goal of improving public knowledge of, participation in, and confidence in the nuclear waste management program; a goal called for in the Program Summary Document. Because the Canonsburg remedial action project is at the forefront of a long list of mill tailings and Manhattan Engineer District sites across the country which require remedial action, it is imperative that this stated policy goal be fully met.

LONG-TERM HAZARDS OF MILL TAILINGS COMPARED TO OTHER NUCLEAR WASTES

A major influence on DOE's nuclear waste management program was the 1979 Report to the President by the Interagency Review Group on Nuclear Waste Management. This report summarizes and analyzes alternatives for disposing of all types of nuclear waste. Its conclusions on uranium mill tailings state the following:

> Due to the long half-life of thorium-230, the parent of radium, the quantity of radon and radium in the tailings will diminish by only one-half in roughly 80,000 years. The relative magnitude of actinide elements in mill tailings, high level wastes, and transuranic wastes, per unit of energy generated, suggests that all these wastes streams may present problems of comparable magnitude for the very long term, that is, beyond a period of a thousand years. By virtue of their presence at the surface, the actinide elements in mill tailings may constitute a greater potential problem than those in deeply buried HLW and TRU wastes. Thus, disposal of these tailings must be managed as carefully as that for high level wastes and transuranic wastes." (E 1.28 TID-29442 pp. 80-81; emphasis added.)

FAILURE TO ADDRESS IRG CONCLUSIONS

While DOE claims that this Interagency Review Group Report to the President "helped mold DOE programs into their present form" (Program Summary Document, p. 11), DOE has apparently never addressed or rebutted this recommendation on mill tailings in a publicly available policy document, and instead chooses to ignore it. The Department has developed a nuclear waste management policy which favors eventual disposal of high-level and transuranic wastes in deep geologic depositories. For example, while transuranic wastes are currently being shipped to New Mexico for disposal in salt domes under the Waste Isolation Pilot Project, DOE proposes the "permanent disposal" of uranium mill tailings in a simple clay structure just a few feet below the surface.

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To ensure public confidence in the proposal submitted in this EIS, it is imperative at the very least that DOE, in its final EIS, address this statement made in the Interagency Review Group report, and develop a proposal engineered to ensure that the mill tailings in Canonsburg will be treated with the same degree of long-term care as DOE would treat high-level and transuranic wastes.

NEED TO ADDRESS MONITORING ISSUES

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6.2 1
In light of the Interagency Review Group recommendations, any on-site or local stabilization of mill tailings should be treated as monitored, retrievable, temporary storage. Meanwhile, DOE should analyze the legal and technical issues involved in, and make proposals for, the siting of a central, permanent repository for all wastes covered in the Remedial Action Program.

Moreover, this DEIS conspicuously lacks any detailed
36 6.2.1 discussion of long-term monitoring of the site. While it is true that a monitoring license must be obtained from NRC, this requirement does not mitigate the importance of analyzing monitoring systems in this EIS, for several reasons. First of all it seems logical that an adequate monitoring system should be incorporated in the engineering design of the containment facility itself, especially if the facility is below ground, where there is a substantial risk that the integrity of the capsule may be disrupted without detection.

Furthermore, monitoring systems will affect the overall cost of the project, and possibly influence the choice of alternatives. Finally, an EIS for proposed remedial action at an existing nuclear waste site which fails to adequately guarantee the long-term safety of the community from radioactive contamination fails to achieve its fundamental purpose of ensuring public confidence.

NEED TO ADDRESS TEMPORARY NATURE OF PROPOSED ACTION

Furthermore, while the DEIS fails to discuss how long the proposed encapsulation is expected to last, there are indications
37 6.2.2 that water will begin to leach through the system within a few very short years. EPA's final standards for this project call for stabilization for at least 200 years. The adequacy of this standard is questionable in light of the Interagency Review
140 6.2.4 Group's conclusions about the long-term potential hazard of mill tailings. Yet, it is doubtful that the proposed system will even meet EPA's standard. Thus, in addition to the need to incorporate

monitoring systems into the design, the final EIS should reckon with the temporary nature of any on-site stabilization technique and include a consideration of the steps necessary to re-stabilize, or totally decontaminate the site in the event of either a future malfunction in the containment system or the siting of a permanent depository.

FAILURE TO EXAMINE ALTERNATIVES

In light of the potential inadequacy of the clay-lined capsule, it is particularly conspicuous that the EIS fails to examine engineering alternatives for the encapsulation of the wastes. Instead, the DEIS meets NEPA's mandate of assessing alternatives by playing a shell game. The type of shell is a foregone conclusion--the only alternatives examined are where to put the shell. Without an examination of actual design alternatives the DEIS again fails in its purpose of ensuring public confidence that the proposed action is truly in the interests of the public health of the local community. A proper analysis should examine the long-term integrity of a variety of
38 6.2.1 possible materials, and of alternative designs which include monitoring systems, and should make clear how long each alternative is expected to last.

CURSORY DISMISSAL OF ABOVE-GROUND OPTION

Many experts and laymen alike have suggested the possibility that an above-ground storage facility will expedite adequate
39 6 2.1 monitoring and decrease the possibility of undetected de-stabilization, while providing a safe method for eventual decontamination. The advantages of such an option and the savings

in monitoring costs may well outweigh the added construction costs and aesthetic detractions, and should at least be examined as a
39 reasonable alternative, rather than dismissed cursorily, in order
6.2.1 to ensure public confidence that the ultimate proposal is not chosen merely because it is the cheapest.

In conclusion, I hope that the Department of Energy will give these comments thoughtful consideration. The Canonsburg remedial action project will set the stage for the clean up of mill tailings and Manhattan Project sites around the country. A failure to fully address the issues raised at this stage of the project will engender in the local communities near these sites, and in the American public as a whole an overwhelming apprehension that the DOE will place costs above the well-being of the public in the National Nuclear Waste Management Program.

"BIG MAC"

Canon - McMillan School District

PHONE 412 746 2940

OFFICE OF THE SUPERINTENDENT
1 NORTH JEFFERSON AVENUE
CANONSBURG, PENNSYLVANIA 15317

DR. DONALD STRANG
SUPERINTENDENT

DR. JAMES S. JOHNSTON
ASSISTANT SUPERINTENDENT

LOUIS J. POPIOLKOWSKI
ADMINISTRATIVE ASSISTANT

JOHN G. FRANJIONE
SECRETARY
BOARD OF SCHOOL DIRECTORS

January 21, 1983

Mr. James A. Morley, Project Manager
Uranium Mill Tailings Project Office
U. S. Dept. of Energy
Albuquerque Operations Office
P. O. Box 5400
Albuquerque, New Mexico 87115

Dear Mr. Morley:

Enclosed please find some comments and questions concerning the possible remedial action at the Vitro Rare Metals Site in Canonsburg, Pennsylvania. As Superintendent of the Canon-McMillan School District I am very anxious to work with you during the remedial action that is being planned at this site. I would specifically request a reply to the questions that I have raised on the enclosed papers.

I would be very glad to meet with you or any representative that you would designate to discuss the manner that I can work with you in protecting the safety of the school children during this remedial action.

Sincerely,

CANON-McMILLAN SCHOOL DISTRICT

Donald W. Strang

Donald W. Strang
Superintendent of Schools

DWS/sae

Enclosure

CANON-McMILLAN SCHOOL DISTRICT
STATEMENT OF DR. DONALD W. STRANG
SUPERINTENDENT OF SCHOOLS
JANUARY 20, 1983

My name is Donald W. Strang. I am the superintendent of the Canon-McMillan School District. I have read the Environmental Impact Statement of November 1982 on the **REMEDIAL ACTIONS AT THE FORMER VITRO RARE METALS PLANT SITE,** Canonsburg, Washington County, Pennsylvania. My concern is for the safety of the children who attend our schools, located in close proximity to the project during the proposed remedial actions planned for this site.

After reading the Affidavit of John W. Gofman, as it relates to persons exposed to ionizing radiation and its effects, expecially on young people, my concerns become even more grave. We have the following buildings located within the one mile radius of the site described on page 6 - 6 of the Impact Statement. This year we have an approximate student population of 2,543 children in these buildings. Enrollment is as follows:

Hawthorne Elementary	-	138
South Central Elementary	-	410
Jr. High at Canonsburg	-	795
Canon-McMillan Senior High	-	1,200

Many of the children live within the one mile radius of the site. However, for the 180 days of school we transport children to the junior high school and the senior high school who live a substantial distance from the site.

We are anxious to work with you during this remedial action to insure that our students are not exposed to harmful radiation during the uncovering and encapsulation of the radio active material.

Another concern that I wish to express is that on certain fall evenings we bring crowds of approximately 5,000 persons to view athletic contests. The majority of these persons live well outside the mile radius of the site. The stadium, where the events occur, is within one half mile of the site.

Before a final decision is made, will you provide a written response to the following questions,-and have a representative meet with me so that we may coordinate our efforts for the safety of persons involved?

QUESTION # 1

When the materials are exposed to the air, what increased amount of radiation will escape into the environment? What efforts are being
141 taken to control the spread of radiation beyond the immediate work
6.2.3 site?

QUESTION # 2

Is it feasible to construct a temporary building over the site to
142 maintain any radiation that escapes from spreading over the surround-
6.2.2 ing area?

QUESTION # 3

Would it be possible to schedule the uncovering of the radiation
143 material to the summer months, June 5 through August 30, when
6.2.2 schools are not in session?

QUESTION # 4

What monitoring of radiation will be provided at the site? Can
144 the schools be provided with monitoring devices that will alert
6.2.3 us to increased levels of radiation?

QUESTION # 5

Would it be wise to develop an emergency evacuation plan to take the students home if we are alerted to an increase in radiation?
145 Such a plan would be feasible from our point of view, since we
6.2.3 do have school buses that could be used to evacuate the area.

QUESTION # 6

Most evening events which attract large numbers of people to the
146 stadium usually occur on Fridays. Could the remedial work be
6.2.2 scheduled in such a way to avoid the uncovering of the material,

QUESTION # 6, cont.

146 and possibly releasing radiation, to time when events are not
6.2.2 scheduled at the stadium?

We recognize that the impact of radiation at the site and to the surrounding areas will be directly related to the period of work at the site. Our concerns simply stated are:

1. we would like to be assured that all precautions are taken that address the hazards you name in your study;
2. we would like to be assured that all precautions are taken to monitor the site and the schools in the immediate area, and that in the event of substantial increase in the level of radio activity that we are alerted to move the children from the area.

DAVID W SWEET MEMBER
BOROUGH BUILDING ROOM 206
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HOUSE OF REPRESENTATIVES
COMMONWEALTH OF PENNSYLVANIA
HARRISBURG

COMMITTEES

MINES & ENERGY MANAGEMENT
MINORITY VICE CHAIRMAN
INSURANCE
JUDICIARY

PENNSYLVANIA PUBLIC TELEVISION COMMISSION
TASK FORCE ON DECEDENT'S ESTATES

STATEMENT OF STATE REPRESENTATIVE DAVID W. SWEET:

Public Hearing, January 12, 1983—Draft Environmental Impact Statement, Remedial Action at Former Vitro Site, Canonsburg, PA

Ladies and Gentlemen,

We are nearing the end of what has been a long and frustrating history of bureaucratic decision-making. Soon, a key decision will be made, and remedial action will commence at the Industrial Park site.

This all started for me during my first year in office, 1977, when I received a phone call from a DER official advising that "routine" monitoring of the site would take place shortly. The results and ensuing events are all too well-known and anything but routine.

A brief chronology of events reveals an unbelieveable amount of paper-shuffling, buck-passing and inaction.

The United States Congress passed the Uranium Mill Tailings Act, effective November 8, 1978.

It took one year for the Secretary of Energy to decide that the Vitro site should be given a "high priority". It was not until 23 months later that the cooperative agreement between the federal and state governments was signed. Standards from the federal Environmental Protection Agency were not adopted until December of 1982, more than <u>four years</u> after the Tailings Act was passed.

During this period, the Canonsburg and Strabane communities have been beset with confusion, frustration, bitterness and a resigned sense of powerlessness. It is with all these emotions and sentiments that I come here tonight.

Our community is confronted now with a fait accompli. We trusted the system during the pre- and post-World War II periods of nuclear research and were left with an unsafe dump. We trusted again over the last few years and have again found that faith unrewarded.

It would be futile and counter-productive at this point to attempt to block the adoption of recommendation Three, which calls for on-site stabilization. Such delay would only drive up the costs, continue the uncertainty and jeopordize the chances for <u>any</u> remedial action. However, we will be left with a legacy of litigation, doubt and the very real possibility that the future is being mortgaged to settle today's debts.

The burden of proof is on the federal government. Many people, including myself, still have reasonable doubts.

Several questions and problems arise, some of which can only be resolved by amendments to the federal law.

1.) Only Washington County locations were surveyed for possible off-site deposit. We were forced into a fracas with our neighbors. Surely other less populated areas of Pennsylvania would have been more appropriate. But none were suggested by DER. (The Act, at 42 USC§7916, prohibits the transportation of the tailings to another state, unless either the governor of <u>that</u> state approves or the state already contains one of the targetted sites. The closest such state is Idaho.)

2.) Federal legal interpretations of what constitutes
fair market value for contaminated properties have
14 6.2.12 been grossly unfair, resulting in extended and
costly litigation.

3.) The federal statute fails to provide for sufficient health screening, medical benefits, job training and other social service needs. The bureaucratic interpretations of the law have been extremely narrow and miserly. Again, litigation is the result.

4.) Despite all the talk, studies and reports, we are
still uncertain as to dangers to which residents
147 have already been exposed, future hazards to be
6.2.5 caused by clean-up efforts, and the ultimate safety
of the area following "stabilization".

5.) We are asked to calmly accept a recommendation to
leave thousands of tons of waste material in our
community, protected only by a relatively untested
148 technology that may or may not hold up in the decades
6.2.2 ahead. (See a report dated November 1982 by the Sierra
Club for a discussion of a number of failed attempts to
secure low-level radioactive materials.)

I cannot help but conclude that the decision to recommend
the stabilization option is based on non-scientific factors.
15 The draft EIS all but admits that fiscal concerns, as well as
6.2.1 the public outcry in Hanover Township, led to today's recommendation.

The task to be undertaken is massive. Thousands of tons of material must be excavated; hundreds of thousands of gallons of water

pumped and treated; bentonite liner placed underground; and hundreds of trucks loaded, unloaded and driven thousands of miles. More than two years' work lies ahead.

To say stop or to urge another option would be like throwing sand against the wind. The current federal administration cares little for this area or its people. Delay would threaten the entire project's funding from Washington, D.C.

Therefore, we in Canonsburg and Strabane must go along, with some pursuing collateral remedies in the courts. Yet, the burden of proof has <u>not</u> been met. We are left with only faith that the job will be done right. Faith was defined by St. Paul as "the evidence of things unseen; the substance of things hoped for."

I hope your draft EIS is accurate, that the work is done quickly and safely, and that no leaching or contamination of water supplies occurs. None of us want to face our children and grandchildren years hence, after all the federal officials have long gone, and explain why we allowed this problem to go unsolved.

JAMES G TERRILL, JR AND ASSOCIATES
Environmental Engineers

Professional Engineer
Civil / Sanitary
Diplomate
American Academy of
Environmental Engineers

Diplomate
American Academy of
Industrial Hygiene
Certified Health Physicist,
American Board of
Health Physics

January 22, 1983

Project Manager
Uranium Mill Tailings Project Office
Albuquerque Operations Office
U S Dept of Energy
P O Box 5400
Albuquerque, New Mexico 87115

Dear Sir

Attached are more detailed notes on the D E I S, dated November, 1982, for Remedial Actions related to the former Vitro Rare Metals Plant Site, Canonsburg, Pennsylvania.

The option you have selected seems reasonable, even though I can't follow the relative emphasis you gave the various items in the matrix To me, the important item is health impacts These should probably be so small after remedial actions are taken through any of the options, that current interest should focus on getting the remedial actions completed

Sincerely,

James G Terrill, Jr

JT at
Enclosure

4111 Dundee Drive, Murrysville Pa 15668 *Telephone* (412) 325-1770

NOTES ON DRAFT ENVIRONMENTAL IMPACT STATEMENT
ON REMEDIAL ACTIONS AT THE FORMER VITRO RARE METALS PLANT SITE -
CANONSBURG, WASHINGTON, COUNTY, PENNSYLVANIA
DATED NOVEMBER 1982

1 Health Concerns

The draft conscientiously followed the outline for a standard EIS In
doing this it minimized the coverage of the principle concern--health
effects, which has been the dominating reason for consideration of the
remedial action Starting with the Index, 'health is not mentioned as
a major item, but only as a sub-item under "radioactivity ' The same
general comment is true of the "Table of Contents " Throughout the
document, health effects are actually "calculated" health effects I
could discover no references or summaries related to the studies of the
149 University of Pittsburgh No mention of health studies made by health
6 2 5 agencies or officials was found The authors of the referenced documents
are largely physicists and health physicists Even data which must be
available on the vital statistics of the communities is lacking What
explanation would be available if the cancer incidence actually increased
regardless of the actions taken by DOE? DOE would be caught without
an explanation Some effort should be made to define the limits of the
incidence of diseases as well as cancer deaths related to radiation and
other factors in view of the general health conditions of the community
Both upper and lower limits should be considered If time is of the
essence, provision for future health evaluations as well as radiation
monitoring should be made and budgeted

Please do not express the number of cancer deaths in terms of fractions
150 Round off the figures, and allow a range 0-10 or 10-20 Find a way
6 2 5 to express the incidence of cancer in terms other than death Many
people have cancer who do not die of cancer, but are exposed to surgery,
chemotherapy, diagnosis, expense and anxiety There are numerous
organized groups who consider cancer in a much broader way than death
Information and suggestions on this can be obtained from the National
Cancer Institute

2. Measurements

Some methods of measurements are sufficiently standardized so the limiting concentrations of radioactivity and exposures to external radiation have real meaning in the field. However, even these should be spelled out in reference documents that are generally available as well as in government documents and reports. Probably some of the people active in this program as well as the professionals generally, will get mixed up when you refer to the several EPA standards. This is supposed to be a public document. In the public's frustrations to follow the logic of the draft, they may turn to legal processes to contest the project.

151 6.2.4 In many places in the report references are made to radon-222 release of 2 picocuries per square meter per second? I have no specific quarrel with the number but how do you propose to measure this in the field? I know that this type of measurement was once considered, but found impractical in the uranium mines, and the professionals shifted emphasis to the "working level" concept which could be measured in the field.

For soils, waste and other solids the term picocuries per gram is used. Per gram of what? (For example, Pg. 1-16.) Per gram of radioactive concentrates; per gram of radioactive and nonradioactive materials; per gram of a mixture of miscellaneous materials? Should all materials
152 above a certain size be excluded; what size samples should be taken; and
6.2.4 how many samples should be taken per acre, per acre foot, etc? All of these things as well as the EPA number will have to be considered at sometime, in the field if not in the EIS, if the remedial actions are to meet estimated costs or even to determine the final costs of the project, which may involve multiple cost-plus contracts. Somewhere down the line systematic reports for payments will be necessary, or "all" material rather than "contaminated material" buried deeper than 6 feet, would be stabilized in place by covering the entire site with a layer of uncontaminated fill up to 6 feet thick. (See Pg. 1-16.) Perhaps a cover of 6 feet might be a good approach anyway, and cost estimates relying on this methodology might be in order.

3. Costs

In the cost presentations I think all identifiable costs should be listed. This is particularly desirable since DOE personnel have indicated
153 that this project and the Salt Lake City project will be used as models
6.2.11 for remedial actions at about twenty more sites. Complete cost data would also indicate to the public the degree of concern of the Federal government related to the sites more comprehensively. Examples of items not included, and related costs picked up at the meeting in Pittsburgn are:

Development of methodology	$1.8 Million
Development of Env. Impact Statement	0.8 Million
Cost of land purchased by the State but $650,000 has been paid by the State as a downpayment	? 0.65 Million
Cost of public meetings, interaction with NRC, etc.	?
Cost of cleaning about 100 houses in the vicinity of the plant. This is currently underway but no costs were given--for the present say $10,000 per house for cleaning and since they talked about then purchasing the property at say $40,000. The work is underway but no houses have been certified as clean to date.	~4.0 Million
Monitoring and maintenance, in perpetuity	(no cost given)
Health Monitoring (an additional item)	?
TOTAL	$7.25 Million Plus

154 6.2.11 Incidentally, on Page A.4-7, a unit cost for grading is given as $22.50 per square foot. If this isn't an error an explanation is in order.

Encapsulation

155 6.2.2 While your draft EIS was being reviewed, a NRC, Office of Regulatory Research document entitled, "Draft Regulatory Guide and Value/Impact Statement; Design, Installation and Inspection of Seepage Control Liners at Uranium Recovery Facilities" came to my attention. It is dated November 1982, Contact H. Graves (301)443-5892. It would seem that some reference to this should be made in the Final EIS. Perhaps, based upon your experience, both DOE and NRC could benefit from discussions. I can find no reference to this in your draft EIS. Likewise, I can find no reference to Bentonite in the NRC draft.

156 6.2.2 Reconsideration of Bentonite (Pg. A.1-11) or a reference to justify its use would be appropriate. The cost of Bentonite is given as $543.00 per ton. I am familiar with its use to minimize seepage, but I am not familiar with its use to control radon. If research or experience data shows that the Bentonite will materially affect the estimates for radon emission and hence cancer deaths, the extra expense may be justified. Otherwise, dependence upon clean local clays is probably preferable. Indirectly, the NRC draft referenced above seems to support this view. Apparently, DOE doesn't think the leachate factor is an important consideration from a health viewpoint so why not forget the Bentonite?

I hope these limited comments will be helpful to the DOE.

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

ER 83/1

FEB 4 1983

Richard H. Campbell, Manager
Uranium Mill Tailings Remedial Action Project
U.S. Department of Energy
5301 Central Avenue, N.E., Suite 1700
Albuquerque, New Mexico 87108

Dear Mr. Campbell:

We have reviewed the draft environmental impact statement for Remedial Actions at the Former Vitro Rare Metals Plant Site, Canonsburg, Washington County, Pennsylvania, and have the following comments.

The final statement should address more clearly the fate of pollutants already in ground
water beneath the Canonsburg site. For example, it is not clear whether the plan
includes treating ground water withdrawn from the shallow aquifer until such time as the
157 proposed Environmental Protection Agency standards are satisfied for the water still in
6.2.9 the aquifer.

Because the Canonsburg site is an area extensively mined for coal as noted on page 1-19,
we believe that the final statement would benefit from additional information concerning
158 mine subsidence that may affect the structural and hydrologic integrity of the site. The
6.2.7 propagation of mine-roof collapse fissures associated with mine subsidence may increase
the hydraulic connection of ground- and surface-water sources, which in turn may affect
the migration of contaminated water to other ground-water bodies and to surface water.

We believe the draft statement adequately addresses impacts on fish and wildlife resources within the proposed project area.

We hope these comments will be helpful to you in the preparation of a final statement.

Sincerely,

Bruce Blanchard, Director
Environmental Project Review

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
6TH AND WALNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

February 4, 1983

Mr. James Morley
Project Manager
Uranium Mill Tailings Project Office
U.S. Dept. of Energy
Albuquerque Operations Office
Albuquerque, NM 87115

Dear Mr. Morley:

Thank you for the opportunity to comment on the Draft EIS for the Canonsburg Remedial Actions at the Former Vitro Rare Metals Plant Site. In accord with Section 309 of the Clean Air Act, please find attached our comments on technical aspects of the project. EPA appreciates also your compliance with NEPA in sending us the draft EIS for review. While DOE has done considerable work in dealing with many of the environmental problems, parts of the project have raised some questions voiced by reviewers within the Agency. We have given the Draft EIS a rating of ER-2 which means that we have Environmental Reservations due to insufficient information and more information is needed to address our concerns. A schedule of the EPA ratings is enclosed for your information.

We appreciate the fact that some of the technology slated for use in this project requires further design refinements. However, some other areas are insufficiently detailed even though technology to resolve questions is well known. We understand that DOE is publishing reports covering design and evaluation (as discussed in paragraph 3 below), in accord with agreements with cooperating agencies, that may cover many of these concerns. On the other hand, EPA is not satisfied that all technical issues have been thoroughly examined in the Draft EIS for the following areas of concern: radiation, groundwater, air pollution, and floodplains and surface runoff. Under radiation, our comments center on the use of statistics and are not expected to materially change the course of the project or the alternative selected. Our comments on groundwater relate to problems with conflicting data which we understand will be resolved during the Final EIS process and the additional technical evaluation underway. The air pollution section of our technical comments involve the implications of control technology, but these too are not expected to affect the orderly progress of the project. The main point with the alternatives discussion that follows is the encapsulating technology, primarily placement. It appears that DOE may be able to address our concerns through optimization of the selected alternative

through refinement of the final design. Two main concerns relate to the floodplain and surface runoff questions: they are any anticipated adverse effects created by the oxidation of pyritic minerals and runoff or seeps from the areas where low level wastes are to be buried.

Since this Document has been published, new EPA standards have appeared in the Federal Register (40 CFR 192) and should be reflected in the Final EIS. It is important to note that the new EPA regulations specify a range of performance standards rather than strict requirements. For example, the target longevity of a remedial action is 1000 years while a 200 year span would be acceptable under limited circumstances. The Final EIS should specify
159 6.2.4 the performance expected from this Remedial Action rather than merely saying that they will be met.

The Final EIS should be completed on schedule so that the project can be completed in a timely fashion regardless of some evaluations that may span the time frame of its publication. We understand that DOE is preparing documents covering areas represented by but not limited to this list in accord with the agreement mentioned in the second paragraph above: 1) Leachate quality assessment; 2) Adjustments in the encapsulating design, location as well as other remedial measures and evaluations; 3) Groundwater implications: status of contaminants and quality; 4) Surface water: long term monitoring and sediment analyses; 5) Long term area security and land use controls. Meetings between DOE, its contractor and EPA during the preparation phase of the Final EIS should suffice to address many of these questions.

EPA's specific technical comments are attached. Thank you again for the opportunity to review and comment on this important EIS. We look forward to working closely with you in the future to resolve our questions. If you or your staff have any questions regarding the technical aspects of our comments, please do not hesitate to contact either me or Bob Davis (597-4388) of my staff.

Sincerely yours,

Stanley L. Laskowski
Deputy Regional Administrator

Enclosure

Definition of Codes for the General Nature of EPA Comments

Environmental Impact of the Action

LO—Lack of Objections

EPA has no objections to the proposed action as described in the draft impact statement or suggests only minor changes in the proposed action.

ER—Environmental Reservations

EPA has reservations concerning the environmental effects of certain aspects of the proposed action. EPA believes that further study of suggested alternatives or modifications is required and has asked the originating Federal agency to reassess these aspects.

EU—Environmentally Unsatisfactory

EPA believes that the proposed action is unsatisfactory because of its potentially harmful effect on the environment. Furthermore, the Agency believes that the potential safeguards which might be utilized may not adequately protect the environment from hazards arising from this action. The Agency recommends that alternatives to the action be analyzed further (including the possibility of no action at all).

Adequacy of the Impact Statement

Category 1—Adequate

The draft impact statement adequately sets forth the environmental impact of the proposed project or action as well as alternatives reasonably available to the project or action.

Category 2—Insufficient information

EPA believes that the draft impact statement does not contain sufficient information to assess fully the environmental impact of the proposed project or action. However, from the information submitted, the Agency is able to make a preliminary determination of the impact on the environment. EPA has requested that the originator provide the information that was not included in the draft statement.

Category 3—Inadequate

EPA believes that the draft impact statement does not adequately assess the environmental impact of the proposed project or action, or that the statement inadequately analyzes reasonably available alternatives. The Agency has requested more information and analysis concerning the potential environmental hazards and has asked that substantial revision be made to the draft statement.

If a draft impact statement is assigned a Category 3, ordinarily no rating will be made of the project or action, since a basis does not generally exist on which to make such a determination.

Technical Comments

Draft EIS for the Remedial Actions at the
Former Vitro Rare Metals Plant Site, Cannonsburg, PA

General Comments

160 6.2.3 On page two of the Cover Sheet and in the sixth paragraph on page 3-21, long-term monitoring is mentioned. The specifics of post-stabilization and post-decontamination environmental monitoring programs, in accord with NRC regulations, if planned, should be detailed and compared to pre-operational conditions. EPA would like to have the opportunity to comment on these plans. They also should be detailed in the FEIS. The FEIS should also specify what measures will be taken if monitoring discloses an increase in groundwater contamination.

161 6.2.4 As stated in the cover letter of these comments, new standards have been promulgated since the Draft EIS was published. These new standards are substantially different from proposed standards they replaced and so must be reflected in the Final EIS. If DOE decides upon the alternative preferred in the EIS and has a specified level of performance and longevity of the remedial action, then the FEIS should include the way in which the new standards will be met.

Radiation

Comments mainly center on the use of statistics in reporting radiation concerns regarding the health issues, but some concerns have been noted regarding the completeness of the technical work. EPA reviewers acknowledge the fact that computer codes and multipliers follow a rapidly changing state-of-the-art, and any re-run of these would not be expected to materially change the feasibility of the project or the selection of alternatives. The remarks below should be read in that light. These are merely items that EPA would prefer to see explained or documented.

162 6.2.5 Impacts of expected deaths for the status quo option are given only for persons now living. The effect on those yet to be exposed is ignored. It should be clearly stated that the true impact of the status quo is much larger for long time spans.

163 6.2.5 Page 1-22, Table 1-3: It should be explained why the status quo (8300 man-rems) results in more cancer deaths than the 12000 man-rem short-term exposure for remedial action. The reason is the latter dose is a whole-body dose while the former is a dose to the lungs.

164 6.2.4 Page 4-31: In the interest of making the report readable to the public, a working level for radon should be defined here and in the definitions.

165 6.2.5 Page 5-2: The second paragraph states a 14 in 1000 increased risk of death to the closest resident as a result of being near the Canonsburg site. Does this risk assume a lifetime exposure? Is the increase each year or over a lifetime? The same questions apply to the Burrell risk data.

166 6.2 5 The technical work done on the Draft EIS casts some doubts about the health effects estimates from the radon progeny. Can the uncertainty for those health effects be estimated?

167 6 2 5 Page 5-2, Section 5.2.1: It should be pointed out that the risk for the closest individual from the radon released is for a 32.5 year period while the normal expectation of dying of lung cancer is for a 71 year period. The reviewers appreciate the fact that DOE was consistent in the statistical approach used, it's just that EPA reviewers prefer the other approach. Thus, the risk at Canonsburg for the status quo is due to slightly more than a doubling dose of radon, i.e., life time risk for lung cancer at that point is slightly more than twice the "normal expectation."

168 6.2 5 Page 5-5: The proposed EPA standard is misinterpreted. It is not a standard for man-rems to a lumped population; it is a standard for indoor radiation levels for buildings constructed from or near tailings materials. Table 5-5 needs further work.

169 6 2.5 Page 5-43, Section 5.18.1, last paragraph: The estimate that the workers will increase their risk of cancer 0.3 to 0.6% may be a factor of 10 too high. From Tables 5-4 and 5-5 the risk would be increased 0.0004 to 0.0008 or 0.04 tp 0.08%. Should this be corrected?

170 6 2.5 Page F.3-3, Section F.3.2, Methods of Impact Assessment: The Draft EIS uses MILDOS to estimate radiological doses. MILDOS and its related programs are not state of the art, depending on ICRP-2, 1959 (International Committee on Radiological Protection) and other old data bases. The programs give dose estimates considerably lower than a more up-to-date code like INREM (a computer code for calculating internal radiation dose equivalent) for some cases.

A better estimate could have been made using AIRDOS (conversion of air concentration to dose radionuclides) or AIRDOS-EPA with INREM II (computer implementation of recent models for estimating the dose equivalent to organs of man from an ingested or or inhaled radionuclide) or ICRP-30 models and data base. As elsewhere stated, this would lend support to the remedial action.

Page F.3-4, last paragraph: The risk coefficients are wrong: they should be $100/10^6$ (100 per million).

171 6.2.5 1. The lung cancer risk coefficient $100/10^6$ PWLM (person working level months) ($20/10^6$Prem) is taken from Evans et al (1981) with a conversion factor of 5 rem/WLM perhaps from BEIR III (biological effects of ionizing radiation-1980). One of the co-authors, J.H. Harley, of the paper by Evans, et al, has pointed out this is at least a factor of 2 lower than what he thought was agreed upon (Stratton Hearings 1982). It is about a factor of 4 lower than a reasonable estimate, and further supports the decision to do the remedial work.

171 6 2 5 2. The "all-cancer-death" risk, $120/10^6$ Prem is taken from B. Cohen, 1981. Cohen derived his numbers from the linear quadratic estimates in BEIR III. The BEIR III estimate was force fit to an α_2/α_1 coefficient derived from the analysis of gamma and neutron risk coefficients for leukemia in the Hiroshima-Nagasaki data (BEIR III, pp. 185-188). Since it subsequently was shown there was no appreciable neutron exposure in Japan, the BEIR III estimate is wrong since it is force fit to nonexistant coefficients. A more reasonable risk estimate based on BEIR I and UNSCEAR 1972 (United Nations Scientific Committee on the Effects of Atomic Radiation) is $200/10^6$ Prem.

172 6.2 5 Page F. 2-3: The statement that "calculated doses are within 20 percent of the doses likely to be received by the general public and remedial-action workers at each site under each alternative," is unduly optimistic. The estimates presented appear reasonable but the accuracy estimate is not carefully developed. On the whole, it appears that the impacts on health due to radon gas have been somewhat underestimated. This will strengthen the conclusion that a remedial action is needed at this site.

It is important to re-emphasize that many of these comments reflect the continually changing computer codes as information is documented and any further time spent in conforming to new codes would probably not be appropriate. The above comments are made for purposes of future action at this or other sites, and so that EPA is on record at recognizing this situation. However, the following general radiation comment should be addressed in the Final EIS.

173 6 2 4 Page 5-1, Item 4· Is there any theory as to why the 1977 surveys are so different from the more recent studies? Will further sampling be done to verify the recent data? (See comment below under groundwater, referring to page 4-23 and the disparity between 1977 data and current information.)

Groundwater

Even though this topic is intricately connected with the previous discussion on radiation effects, it is sufficiently important to be considered separately. The following comments on groundwater point out problems with conflicting data which we understand will be resolved during the Final EIS process through additional technical evaluation.

174 6.2.4 Are the radionuclides in the groundwater suspended or dissolved and what fraction of each? This may make a difference in the type of water treatment needed. Our review failed to note an assessment of the total quantity of radioactivity in the groundwater at the Canonsburg site.

175 6.2 9 Page 1-23: What is the potential at the Hanover site for leaching of contaminants (alternative No. 4, short term impact)? (See Comment No. 1 miscellaneous, this letter.)

176 6.2.9 On 3-18 (Section 3.2.1) no mention is made of groundwater impacts associated with the remedial methods described for decontamination or stabilization. These may be substantial and deserve attention. The same comments apply to the last paragraph, page 3-21.

177 6.2.9 On Page 4-21, paragraph 2, it is stated that not all of the 1979 wells were used in the 1982 studies because some wells had been plugged and vandalized. There is no mention of how the wells were plugged or if the vandalized wells were subsequently plugged. This is important, since these wells could serve as conduits for contaminants to the deeper aquifer. Also, the description of this page does not clear up the issue of any effects or lack of effects from contaminated material. The hydrogeological study appears to be incomplete and will need to be resolved by additional evaluations as design proceeds. On the other hand, as the design proceeds, it will become clear that the remedial action should reduce radionuclide contamination of groundwaters if done properly.

178 6.2.9 Paragraph 2 on page 4-22 mentions the socioeconomic survey of the area within one mile of the site. It states that none of the respondents to the survey reported that the groundwater was used for drinking purposes. Based on Appendix G, pages G-2 thru 5, only 10% of the residents of the Village of Strabane were asked this question specifically. Since there are wells in this area, perhaps further investigations should be conducted, unless the responses constitute a statistically acceptable basis for conclusions.

179 6.2.9 An effort should be made to identify background levels for both radioactive and non-radioactive constituents. For example, on page 4-22 the reason for concentration of selenium significantly exceeding the Primary Drinking Water Standards at the Canonsburg site was speculated as either associated with site activities or due to selenium's natural occurrence as a trace constituent in coal. We believe that to assess the current and potential impacts, a cleaner picture of the background water quality is necessary, and recommend that a sufficient number of upgradient monitoring points be established. It is our understanding that the reporting procedures mentioned in the second paragraph of the cover letter will cover this issue.

180 6.2.7 On page 4-23, paragraph 2, a discussion on the difference between the permeability of the fill and the bedrock is presented. However, this discussion does not include a value for the permeability of the bedrock. Even though the fill at the Burrell site has a much higher permeability than that of the alluvium and the bedrock, this is not conclusive proof that no recharge is occurring. The difference in head between the two units will ultimately control whether any recharge can occur. Permeabilities will influence the amount of recharge. Appendix D.2 should provide data on the head differences between the various units.

173 6.2.4 The variation between the contamination levels reported for 1977 studies and those reported in this document should receive further explanation. Is it possible, for example, that leaching has taken place at the Burell site to the extent that leachate contamination in the future will be negligible? If so, would this argue against further remedial action at that site?

181 6.2.9 On page 4-24, 4th paragraph the results of analyses for priority pollutants for three contaminants are shown at values above detection limits. Two of the three, butyl benzyl phthalate and methylene chloride are often found as contaminants of the sampling and analytical protocols since they can be found in sampling and analytical equipment (as a plasticizer in plastic tubing) or laboratories (as a cleaning solvent). This should be noted in the Final EIS, unless quality control blanks were evaluated and can be used as a basis for substantiating the values given. Any quality control information that substantiates the presence of these two contaminants in the groundwater should be reported.

182 6.2.7 In Appendix C, page C.2-2, there is an inconsistency with respect to the material directly overlying the bedrock. It is described as grey to brown silt and sand, and brown sandy silt and clay in the same location. This discrepancy should be clarified. Precise soils information plays an important role in such a remedial action, but such clarifications should not interfer with the orderly progress of design.

183 6.2.4 It appears the study has overlooked the area to the south of the Canonsburg site (beyond the railroad tracks). Since it is known that contamination exists and has moved off-site, then this area might be studied further. However, this may be a vicinity property. If so, should anything be said regarding any radioactive contamination remedial activities? In addition, long-term monitoring should be preceeded by development of background information off-site. This seems to be in need of attention, but can be done as design and operation phases progress.

184 6.2.9 Some very assured statements are made regarding the groundwater flow directions. Neither Chapter 4 nor Appendix D.2 sufficiently describes how the conclusions were derived. Page A.1-17 bears out this suspicion of insufficient data.

185 6.2.9 Table D.2-11 shows elevated sulfate levels. This may indicate the presence of pyritic minerals which can cause acidic groundwater seeps if surface disturbance allows such materials to be exposed to oxidation. Low pH water may carry implications for the mobilization of radionuclides. Are any other contaminants present in the groundwater as result of activities at this site?

186 6.2.9 Appendix D describes some constraints to the groundwater investigations. These constraints appear to have required the investigators to arrive at their conclusions using assumptions rather than hard data. In addition, the limited sampling information is inadequate to arrive at definite conclusions. A clear example is found on the first page of Appendix D. The second paragraph states that "...the slug tests were not considered reliable. Therefore, other measurements...had to be used...", but these are apparently not described in the Appendix. The Final EIS should describe how design progress has cleaned up this deficiency.

187 6.2.9 If, on the other hand, the groundwater information is correct, especially for the Burrell site, then additional analysis might be considered. These are discussed below under the Alternatives section of this review.

188 6.2.9 Finally, the document describes an area that was once a swamp, but has since been used as a repository for waste. This area may serve as either groundwater recharge or floodplain, or both. It could also have been supplied by a spring or seep which should be investigated before the area is reclaimed. The area could carry implications for the floodplain as well as for groundwater.

Air Pollution

Along with the obvious air pollution implications related to radon and other airborne radionuclides, many other questions have been raised with regard to air pollution. Reviewers have cited several places where further work appears to be necessary, or where different control techniques from those proposed are appropriate. These comments will not affect the outcome of the project, but mitigative measures suggested here should be included in the Final EIS.

189 6.2.6 Also on 1-22, air impacts are given in grams per cubic meter. Was it intended to be micrograms per cubic meter?

190 6.2.6 On page 3-19, last paragraph the text refers to the 60 microgram per cubic meter secondary air quality standard. This is not a standard but merely a guideline to meet the 150 ug/m^3 24-hour standard. It is not necessary to meet the 60 ug/m^3 guideline level.

191 6.2.6 On page 4-2, a statement is made that the Southwest Pennsylvania AQCR (Air Quality Control Region) is in attainment for all pollutants but ozone. This is not true. The AQCR has non-attainment for SO_2 and TSP, though the Canonsburg area itself is most likely in attainment.

192 6.2.6 Page 4-11: Again, there is no annual secondary standard to TSP.

193 6.2.6 Page 5-10: Water spray is not effective for control of TSP from unpaved roads. A petroleum-based agglomerating agent or some other equally appropriate agent would be more appropriate. One such agent is marketed under the brand name Coherex, though EPA does not specifically endorse it.

194 6.2.6 Page 5-11: The NO_x calculations predicting standards violations are dubious, since the standard would be violated at every major construction project and in every city if this were the case. This may be a problem with the way the ISC (Industrial Source Complex) model has been applied - probably the initial sigma "z" is too small. Also, note that the hydrocarbon standard will be withdrawn shortly by EPA. This issue should be resolved because No_2 violations were predicted for the NAAQS. EPA does not believe this will happen. A predicted violation of this standard would make the remedial action less attractive and could even precipitate legal action to stop the project if allowed to stand.

195 6.2.6 Page 5-12: Again there is no annual secondary TSP standard.

196 6.2.6 Page 5-44: Again, NO_x calculations look suspicious. The air modeling documentation is not sufficient to determine what was done.

197 6.2.6 Page B.2-2: The AP-42 emission factors (1977) should be checked for currency since many recent changes have been made.

198 6.2.6 Page B.2-10: Water spray can be counter-productive if vehicles are not washed before entering streets to prevent mud track-out. Stabilizing agents should be applied monthly, not quarterly.

199 6.2.6 Page B.2-13: A 95% reduction in TSP emissions is unreasonable for the control measures proposed. 80 or 90% is more likely for a good control program. A poorly handled water spray program can actually enhance the problem through mud track-out onto streets.

200 6.2.6 Page B.2-12: The fact that the ISC model was used is not sufficient detail. The model has many options controllable by the modeler. A detailed description of the input parameters is needed to properly evaluate the modeling.

201 6.2.6 Page B.2-16: There is no systematic relationship between TSP and settled dust. Note that ISC has an option that would allow settled dust to be calculated, but the calculation should be done for a rooftop location since this is where dustfall is routinely measured.

Alternatives

Several questions have been raised over the alternative selected. The questions range from anticipated groundwater problems through questionable encapsulation design. Our review comments center on the alternative selected. It will be necessary to do some additional analyses and perhaps optimize the alternatives. However, this will not detract from the overall need for the remedial action.

202 6.2.2 EPA experts in hazardous waste isolation have raised questions regarding the optimistic expectations of the clay capsule. The rigors of wetting and drying compounded by freezing and thawing (if capsules are placed within the frost zone) may ultimately reduce the integrity of the encapsulating material. In light of this, DOE should at least carry out a worst-case analysis and if that has already been done describe the scenario in the Final EIS or an additional document in accord with the continuing reporting system discussed elsewhere in this review.

203 6.2.2 It appears that the encapsulating modules will be buried where they will be constantly in contact with the water table. On Page 3-9, last paragraph, while the groundwater level in Area C is high, so also is the water table in Areas A and B. Page D.2-1, fourth paragraph states that a groundwater high exists in Area A. This is supported by Figures D.2-2 through D.2-7 which show that the piezometric surface contours are generally within about 10 feet of the surface in Areas A and B. Hence contaminated materials, including some at levels greater than 100 pCi/g, will be beneath the piezometric surface. Although some waste will be encapsulated, it is hard to envision an encapsulation cell which would be less than 10 feet deep and

203 6 2 2 therefore above the groundwater although design may be able to handle this appropriately. It appears that the burial site at Canonsburg will be below the water table. Given the fact that clay liners leak, the encapsulated material could eventually become totally saturated. The Final EIS should discuss the design progress in answer to this question.

204 6 2 2 The proposed remedial methods for both the Burrell and the Canonsburg sites have raised questions. As discussed in the review comments on groundwater, the oxidation of pyritic minerals needs to be included in the deliberations. There should be some discussion as to the long term quality of the resulting leachate and its impact on the liner. If the pH of the leachate decreases inside the capsule (Page 4-12 states the pH in Area C, which will form the most part of the cell's contents, is as low as 2.8) and the metals content of the leachate increases, the liner may be ineffectual in preventing leaking, as both low pH and high metals solutions have been shown to cause an increase in permeability. EPA's experience has shown that proper compaction of material as fine as that found at the remedial action site, along with establishing a good vegetative cover, will reduce infiltration water to acceptable levels. In addition, reference should be made to the design measures being made to assure minimal effects of pH on liner integrity.

205 6 2 2 Page 3-12, Section 3.1.3 and Page A.2-17. We question the effectiveness of the design for the Burrell site to maintain the tailings in a nearly dry state. The design may result in a bathtub effect and possibly increase the leaching of the waste, resulting in periodic discharges of contaminated water to the Conemaugh River. The remedial design for the preferred alternative calls for emplacement of a slag-filled trench with a gravel drain at its bottom (Page A.2-17). This trench would be in the middle of the fill in the low-lying swale. This slag and gravel will have a much larger pore size and probably a much higher permeability than the contaminated fill. This will create an interface between the fill and the drain where there will be a large capillary pressure that must be overcome before water can move across the interface. In order for this to occur, the water table in the fill will have to rise, thereby saturating the fill to overcome the capillary pressure in the large pores of the slag drain. A pulse of water would then move into the drain. Because of the high permeability of the drain, this pulse would discharge rapidly, making it impossible to maintain saturated conditions in the drain for more than a short time. This would result in a repeat of the rise in levels in the fill area. Further design might provide a drain that will maintain the water level at the base of the fill with a minimum water level fluctuation. The alternative possibility exists that extensive leaching has already eliminated a major portion of the leachates, as indicated by the low levels of contaminants reported in the Draft EIS.

206 6 2 9 Page 3-14, fourth paragraph This paragraph states that the new cover at the Burrell site would reduce percolation by a factor of four allowing about 8 inches of precipitation per year to penetrate to the contaminated material. It appears that this site has been designed to allow percolation (from precipitation above and groundwater below) to leach contaminants from their matrix into a swale which will carry the mixture to the Conemaugh River where dilution will take place. EPA feels DOE should design against further contamination of surface waters by any unscheduled releases of radionuclides.

207 6 2 2 Furthermore, as discussed on page 3-10 (first paragraph) a liner constructed with native materials is suspect due to the fact that they will very likely contain humic acid and some by-products which could jeopardize the liner's integrity.

208 6 2 2 Page 3-18, Section 3.1.6.3. We agree that disposal in surface structures is an alternative that does not warrent further consideration. However, the Draft EIS presents evidence indicating the contaminated materials and capsules will finally reside in the groundwater. EPA's position is that all contaminated materials, encapsulated and otherwise, should be isolated above the groundwater. This is a design refinement and should be covered as the project proceeds and through optimization of the alternative selected.

209 6 2 2 Mention is made on page 3-10 of the attempts that will be made to control vegetation on the areas above the modules. What will be done to guard against invasion by burrowing animals? What precautions will be carried out to be sure that the vegetation, especially deep rooted vegetation, does not "pipe" radionuclides into above ground plant tissues?

210 6 2 2 Has the design included analyses of the effects of differential settlement on the geotextile? Such information should have been included in both parts of Appendix A.

211 6 2 7 The random fill that exists at Canonsburg and at Burrell (Page 4-13 and Page 4-12) raises questions concerning the stability of the fill under loading. Landsliding and subsidence would seem to be likely risks. Has the ability of this random fill to support vertical or lateral (due to flood waters for example) loads been assessed?

212 6 2 2 Some indication exists the DOE anticipates that future work will be required. On page 3-14, (fourth paragraph) it is stated that further work in re-contouring may be necessary after a period of 50 years. What contingency plans are being considered to cover such an occurrence 50 to 100 years hence? In light of this, some confusion exists with regard to the alternative No. 3 as described starting on page 3-12. Further explanations of how this additional remedial work is to be done will clear this up. While we understand that NRC licensing requires long-term surveillance and monitoring (and EPA agrees with this wholly) EPA prefers designs that do not depend upon continued maintenance. Under the new EPA standards, it will now be necessary to specifically state the expected lifetimes of the remedial action, regardless of the alternative selected. This presumably will differ according to the alternative under consideration.

Floodplains and Surface Runoff

213 6 2 8 Projects of this kind where surface configuration is changed may carry implications for surface runoff water quality. Two major concerns are described here that should be addressed by DOE before design is completed. They are water quality problems that may be expected if pyritic minerals are disturbed and runoff and seeps from those areas where low level wastes are to be buried.

214 629 As discussed elsewhere, acid mine drainage is a very real problem in the area of Pa. where Canonsburg is located. This is a result of exposure of iron and other metal sulfides to air. As this reaction develops, the lowered pH, which results from the oxidation of the compounds, tends to encourage an increase in reaction rates and, in addition, ubiquitous bacteria complicate the problem by specifically using sulfide as an energy source. Once started, this reaction goes on until all metal sulfides are oxidized and under current technology there is no site where this situation prevails that has ever stopped producing acid mine drainage. Occasionally, a flooded deep mine (one or two exist in the anthracite region of Pa.) will slow or even cease producing acid mine drainage for a time, but the potential to resume production is there merely waiting for the mine pool level to go down. As also mentioned elsewhere in these comments, such an acid condition could provide a means for the mobilization of radionuclides.

215 629 Disturbance of such areas followed by stabilization can be expected to eventually have a re-established groundwater system. These almost always are difficult to predict with any precision. If the above condition prevails, i.e., the production of acid mine drainage, then seeps can be expected to develop around the perify of the reclaimed area and these may mobilize many ions that are soluble at low pH's. Current state-of-the-art technology exists to assess this possibility and, as stated in the cover letter, should be incorporated into the Final EIS by reference, as part of the long-term monitoring program.

216 628 Current runoff patterns and seeps probably cannot be used for predicting the picture after the project is completed. Reviewers also noted that very little information is included regarding surface runoff and its quality impacts on the receiving streams. The information that is presented indicates little impact at this time, but as stated above this situation can conceivably change after project completion. The Final EIS should discuss how this is to be done.

217 628 These changes in surface and groundwater configurations may be further complicated by streambed realignment which is always accompanied by floodplain shifts. Since the design is for a period of time of at least several hundred years, an attempt should be made to anticipate any problems that may result from extreme flood events, i.e., the probable maximum flood or storm with the one-in-ten chance of occurring for the 1000 year period. (40 CFR 192) (Reference to pages 5-21, D.1-2, & 3-13, Draft EIS). A worst-case scenario would probably suffice. Again, as stated elsewhere in this letter, relocation of materials out of the floodplain is preferred.

Miscellaneous

218 624 1. On page 4-32 (last paragraph), EPA and NRC standards are different but the EPA standards cover this project. Since the document is intended to be widely distributed to both the scientific community and the public, an explanation should accompany the text so that confusion over the various standards is avoided. The differing purposes of the EPA and NRC standards should be explained.

219 629 2. EPA agrees that the Hanover site is the least desirable because a very clear possibility exists that an acid mine drainage problem may develop. Groundwater quality indicates the possible presence of pyrites which cause acid mine drainage. Reasons stated elsewhere in this review have detailed our concerns regarding this possibility.

220 627 Related to this is confusion over the use of the term, "red dog." On page 4-4 (third paragraph) it is identified as steel-milling slag while on page C.1-8 it is called burned overburden from coal mines. We agree with the latter more than the former, but in any case if steel-milling slag is indeed correct for the text on 4-4, then high pH conditions probably exist. Does high pH carry any implication for mobilization of radionuclides or any other pollutants? On the other hand, if it is residue from burned out coal mining wastes, then the possibility exists that a low pH situation prevails. It is EPA's recommendation that some weathering tests be carried out to determine the quality of groundwater resulting both from infiltration as well as interflows. Such tests are regularly performed in advance of coal mining in the east and procedures can be found in EPA 600/2-78-054 (pp 182ff), entitled Field and Laboratory Methods Applicable to Overburdens and Minesoils, available from the National Technical Information Service under PB 280 495. The results should be published as part of the continuing reporting schedules in accord with the agreements between DOE and cooperating agencies. The tests could be carried out over time as part of a long-term monitoring program.

221 622 3. No mention is made of any sanitary facilities at the Canonsburg site. Was an on-site system used or was it connected with a public system in the area? Does the possibility exist that investigations would turn up useful information for the Final EIS? Continuing environmental assessment may lay this issue to rest and should not be considered serious enough to delay design of the remedial action.

222 624 4. When was George's Pottery built and for how long a period did it operate? Was any of the Vitro uranium or other materials used in the pottery and glazing? These two comments are made merely to assure that a careful attempt has been made to track the fate of radioactive material from the site.

223 625 5. Quantitative estimates of accidental death should be presented rather than the qualitative statements given. It might be appropriate to plug this information into the summary tables. This will not affect the choice of alternatives except to show that the alternatives involving less movement of materials is favored. It may also be worthwhile to investigate this risk to life and health because the risks may be of a similar magnitude as those from the radiation.

224 629 6. Is any information available regarding the condition and final disposition of the 4000 tons of water mentioned in connection with the Burrell site? The possibility exists that it already has all leached away and presents no problem towards blocking design of the remedial action.

7. Presumably, within the lifetime of this facility, coal considered
currently unmineable (for technological and economic reasons) will become
accessible using innovative techniques. DOE should either reserve this coal
225 so that no possible disturbance will ever result, or analyze for any
6 2 7 possible deep contamination resulting from development of these reserves
(see page 4-16). This is not an issue of immediacy and does not warrant
delaying design of the remedial action.

8. On pages 5-20, F.1-6 and 4-33, no mention is made of analysis for
Po-210. We suggest this nuclide be included in all analyses of surface
226 water, groundwater and sediments. In addition, and stream sediment analyses
will be very useful for long-term monitoring. The Final EIS can address
6 2 4 this issue for its worthiness in post operation tasks.

9. Apparently the model used in estimating the radon exhalation rate for
the Canonsburg site was based on the assumption that uniformity exists for
the area. The tailings, to our knowledge at least, are randomly
distributed. Off-site comparisons should have been carried out so that
227 closer precision for the estimates can be realized than is described in the
6 2 5 document. However, this may be associated more with epidemiology than with
the intent of the Draft EIS. For this reason and for the reason that the
results of such a test probably would not materially change the project
outcome, EPA has placed this in a low priority category. It is not
considered a deficiency of major consequence.

10. The contaminated material is randomly scattered throughout the area
inasmuch as it has been employed for various uses. The assumption of a
228 single radom exhalation rate for the Canonsburg site may underestimate the
6 2 5 health effects and would argue in favor of the remedial action.

All questions regarding these technical comments should be directed to Mr.
R.S. Davis, EPA, Region III, (215) 597-4388.

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
PHILADELPHIA REGIONAL OFFICE
CURTIS BUILDING, SIXTH AND WALNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

REGION III

IN REPLY REFER TO:

1983

Mr. Richard H. Campbell, Manager
Uranium Mill Tailings Remedial Action Project
U.S. Department of Energy
Albuquerque Operations Office
5301 Central Avenue N.E., Suite 1700
Albuquerque, New Mexico 87108

Dear Mr. Campbell:

We have completed our review of the DEIS of Remedial Actions at the former Vitro Rare Metals Plant site in Canonsburg, Pa. with special attention to those nonradiological impacts which fall within the purview of HUD interest and expertise. It is our opinion that the housing and community impacts of each alternative have been well studied with appropriate mitigations recommended, where necessary. The selected alternative number three appears to be the least disruptive to the affected communities.

Thank you for the opportunity to comment.

Sincerely,

Thomas J. Gola
Regional Administrator, 3S

AREA OFFICES
Baltimore, Maryland - Philadelphia, Pennsylvania - Pittsburgh, Pennsylvania - Richmond, Virginia - Washington, D.C.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
Post Office Box 2063
Harrisburg, Pennsylvania 17120
February 4, 1983

Office of the Special Deputy

Richard H. Campbell, Project Manager
Uranium Mill Tailings Remedial Action Project
U.S. Department of Energy
Albuquerque Operations Office
5301 Central Avenue NE, Suite 1700
Albuquerque, NM 87108

Dear Mr. Campbell:

We have reviewed the Draft Environmental Impact Statement for Remedial Actions at the Former Vitro Rare Metals Plant Site, Canonsburg, Pennsylvania. We would like to offer the following comments:

1. The Draft EIS does not discuss the impact of the project on public water supplies in the vicinity of sites.

2. The public health impact of the alternatives analyzed will be minimal. The "no action" alternative would not be satisfactory.

3. There are several inconsistencies in the information reviewing water quality impacts.

These points are explained in detail in the attached comments submitted by Commonwealth Agencies.

Thank you for the opportunity to review this Draft EIS.

Sincerely,

Mary T Webber

MARY T. WEBBER
Special Deputy Secretary

Attachment

STAFF COMMENTS:
COMMONWEALTH AGENCIES
DEIS REMEDIAL ACTIONS AT THE FORMER
VITRO RARE METALS PLANT SITE, CANONSBURG.

We have the following comments to make on the Draft Environmental Impact Statement. These comments cover three general topics: 1. discussion of project impact on public water supplies, 2. public health impacts of the alternatives, and 3. errors in information reviewing water quality impacts.

PUBLIC WATER SUPPLIES

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6 2 8

We do not find any discussion concerning the impacts of the public water suppliers in the vicinity of these sites. We strongly feel they should be thoroughly discussed in the Draft EIS. We have attached three maps to these comments showing the sources and/or service areas of those public water supplies within a 3-mile radius of the two sites.

The following is a list of public water supplies within three miles of the sites.

A. Canonsburg Site

1. Western Pennsylvania Water Company - Washington District
62 East Wheeling Street
Washington, Pennsylvania 15301

B. Burrell Township Site

1. Blairsville Borough Water Authority
244 South Stewart Street
Blairsville, Pennsylvania 15717

2. Lower Indiana County Municipal Authority
P. O. Box 444
Blacklick, Pennsylvania 15716

3. Central Pennsylvania Water Supply Company
P. O. Box 367
10th and Chestnut Streets
New Florence, Pennsylvania 15944

C. Hanover Township Site

1. Smith Township Municipal Authority
P. O. Box 387
Burgettstown, Pennsylvania 15021

PUBLIC HEALTH IMPACTS

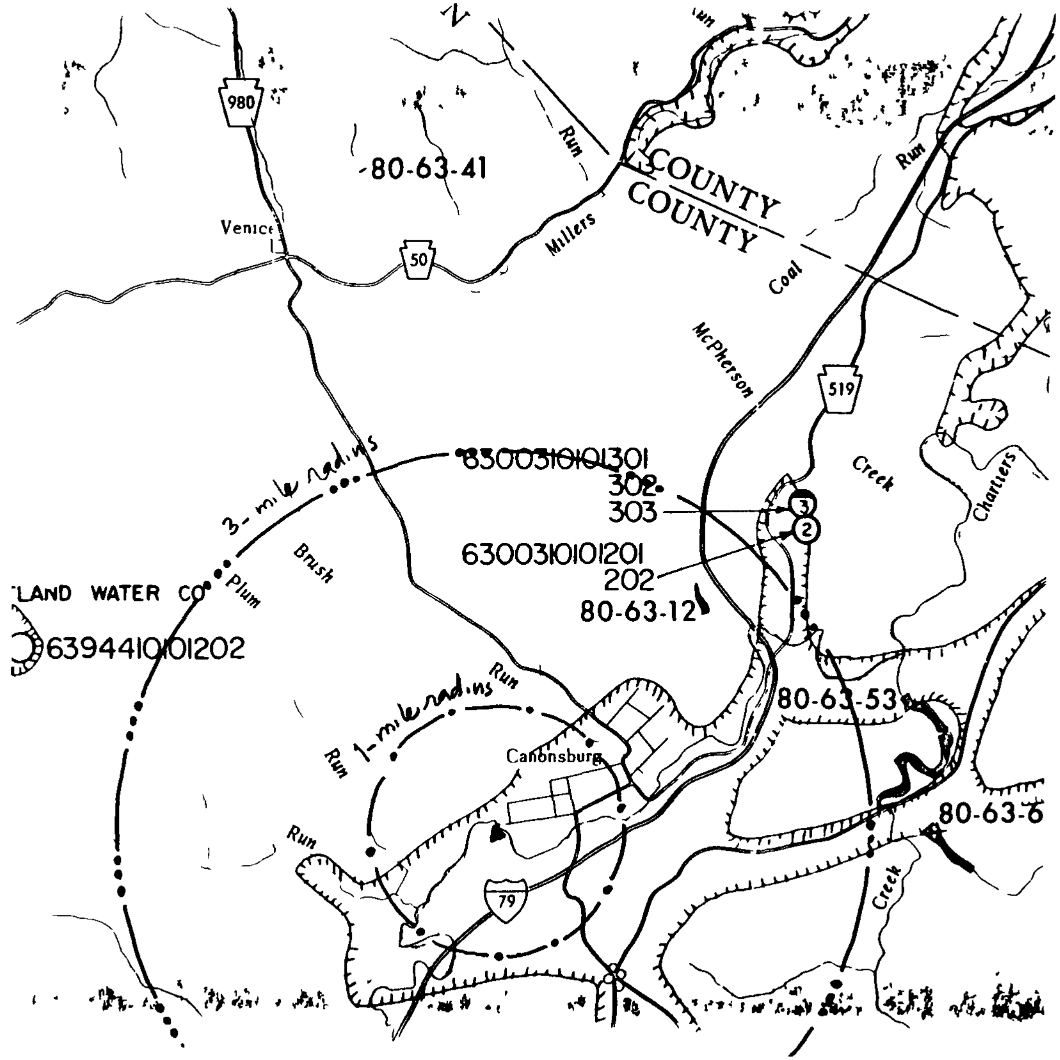
It seems apparent that alternative 1 (no action) would not be satisfactory from a public health point of view but that some remedial action must be done (alternatives 2 through 5). Consequences to the health of the general population appear to be minimal after any of the remedial actions, particularly in relation to radiation cancers. That is the end point of the alternatives 2 through 5 is basically equivalent. There is a small difference in low level radiation at the different sites depending on which alternative would be used, but again, the overall health end point is not much different. The health effects of alternatives 2 through 5 during remedial action indicate a similar risk as if nothing were done (alternative 1). In other words, all alternatives 2 through 5 are, again, basically equivalent regarding the level of risk to the general population.

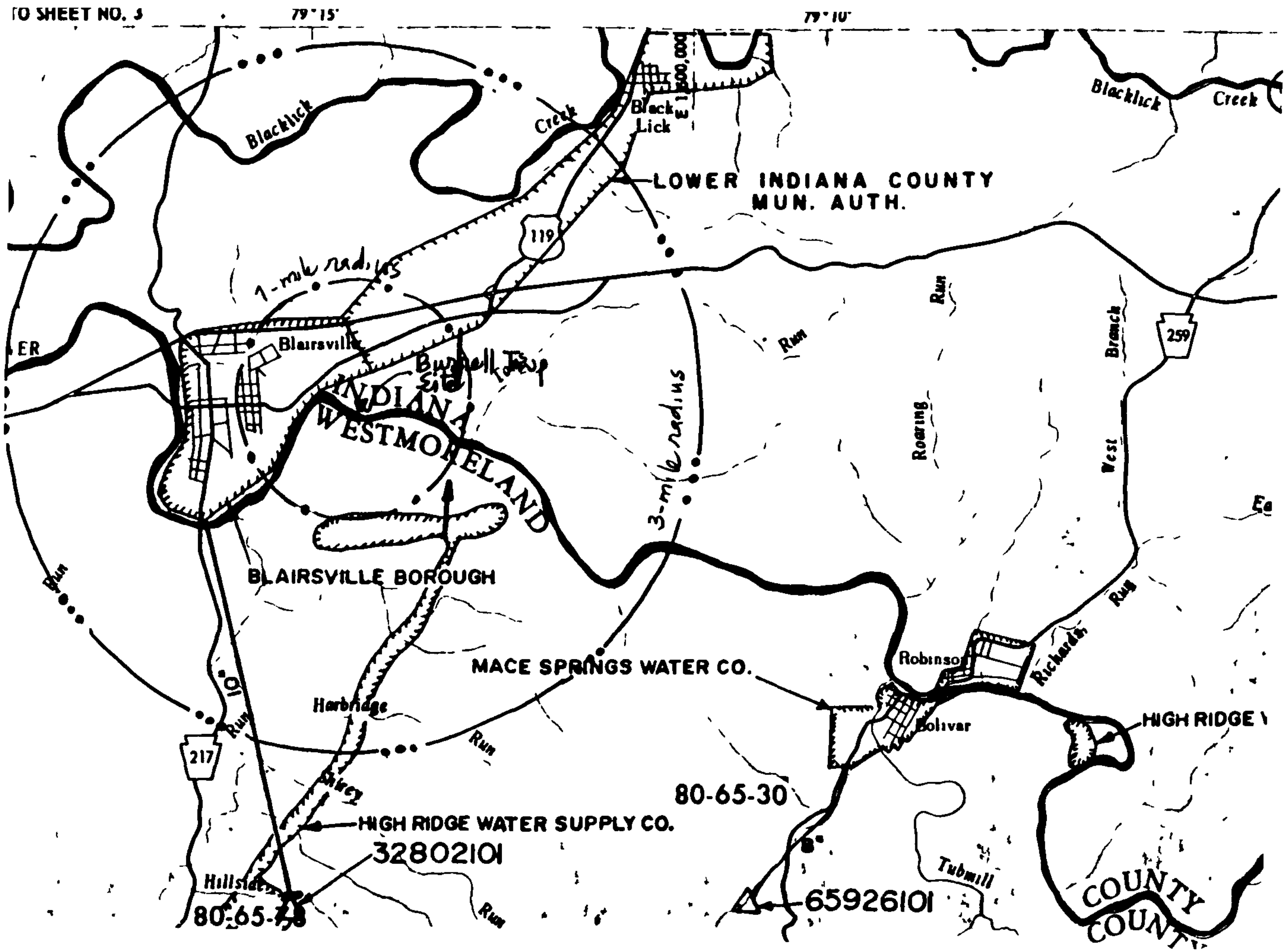
WATER QUALITY IMPACTS

The last paragraph on Page 4-17 states that the sulphate and iron concentrations
are a result of operating mines in the drainage basin. Except for the discharge of
acid mine drainage from abandoned operations, all discharges within the basin are
230 operating under Department of Environmental Resources permit, which have
6 2 8 effluent limits established to protect water quality. A major abandoned mine
discharge to the Chartiers Creek, just above Carnegie, causes the water quality
degradation as noted in table D1-3.

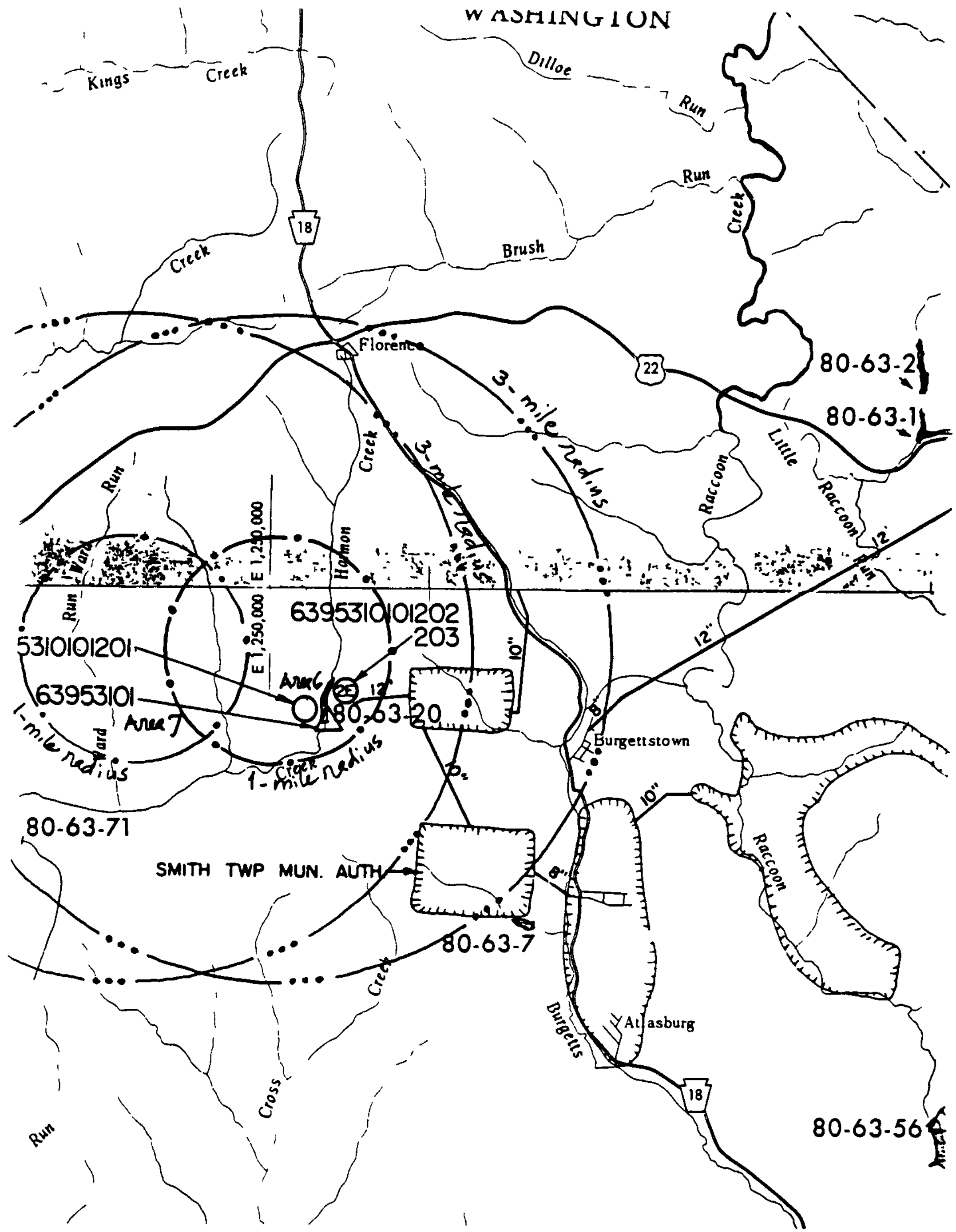
The water quality criteria as listed in table D1-3 is in error. The Department of
Environmental Resources regulations do not list a sulphate criteria for Chartiers
Creek and a total disolved solids (TDS) criteria is not designated in the
concentration limits as shown but rather expressed as 50 miliosmoles
231 per kilogram. In addition, the fecal coliform data is from 1978 and is not
6 2 8 considered to be valid at this time. Both the Washington-East Washington and
Canonsburg Sewage Treatment Plants have been expanded and upgraded and we do
not feel the fecal coliform limits as expressed are indicative of water quality
today.

Please be advised that when the project is undertaken, the proper State permits to
232 control erosion and sedimentation will be required. Also, permits will be required
6 2 8 in accordance with the Dams Encroachment Act and/or the Flood Plain
Management Act.





TO SHEET NO. 3
79°15'
79°10'
Blacklick
Creek
Black Lick
Blacklick Creek
LOWER INDIANA COUNTY MUN. AUTH.
119
1-mile radius
Blairsville
Burrell Twp Site
INDIANA
WESTMORELAND
3-mile radius
Run
Roaring
Branch
West
259
BLAIRSVILLE BOROUGH
MACE SPRINGS WATER CO.
Robinson
Bolivar
Richards
Run
HIGH RIDGE
Harbridge
217
80-65-30
HIGH RIDGE WATER SUPPLY CO.
32802101
Hillside
Tubmill
65926101
COUNTY


WASHINGTON
Kings Creek
Dilloe Run
Run
Creek
Brush
Creek
18
Florence
22
80-63-2
80-63-1
Little Raccoon Run
Raccoon
3-mile radius
3-mile radius
Creek
Run
Harmon
E 1,250,000
Ward Run
639531010101202
203
5310101201
63953101
Area 6
Area 7
80-63-20
12"
10"
12"
8"
Burgettstown
1-mile radius
1-mile radius
Ward Creek
80-63-71
SMITH TWP MUN. AUTH
80-63-7
10"
8"
Raccoon
Atlasburg
Burgetts
Creek
Cross
Run
18
80-63-56

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Abbreviations and Acronyms

ADT	Average daily traffic
AEC	U.S. Atomic Energy Commission
ALARA	As low as reasonably achievable
AQCR	Air Quality Control Region
ASTM	American Society of Testing and Materials
BAT	Best available technology
BEIR	Advisory Committee on the Biological Effects of Ionizing Radiation of the National Academy of Sciences (also their report)
Bendix	Bendix Field Engineering Corporation, Grand Junction, Colorado
BOD	Biological oxygen demand
CDM	Climatological dispersion model
CFR	Code of Federal Regulations
CO	Carbon monoxide
COD	Chemical oxygen demand
COE	U.S. Army Corps of Engineers
dBA	Decibels on the A scale; a logarithmically based unit of sound intensity
DOE	U.S. Department of Energy
dpm	Disintegrations per minute
EA	Environmental assessment
EGR	External gamma radiation
EIS	Environmental impact statement
EPA	U.S. Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FR	Federal Register
FUSRAP	Formerly Utilized MED/AEC Sites Remedial Action Program
g	Grams; a unit of weight = 0.035 ounce
HC	Hydrocarbon
ICRP	International Commission on Radiological Protection
ISC	Industrial Source Complex model
kWh	Kilowatt hours
l	Liter; a unit of volume = 1.057 quarts
LC_{50}	Concentration at which 50 percent of the organisms are killed in 96 hours
LR	Pennsylvania state traffic (legislative) route
m	Meter; a unit of length = 3.28 feet; also milli, a prefix meaning one-thousandth (10^{-3})
MED	U.S. Army Corps of Engineers, Manhattan Engineering District
MeV	Million electron volts

mg	Milligrams; a thousandth of a gram
mgd	Million gallons per day
MILDOS	A computer code used to calculate both the spread of radon and particulates in the atmosphere and the consequent radiation doses
MPC	Maximum permissible concentration
MPN	Most probable number
mr/hr	Milliroentgens per hour
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act of 1969 (PL 91-190)
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
O_3	Ozone
ORNL	Oak Ridge National Laboratory, Oak Ridge, Tennessee
ORO	Oak Ridge, Tennessee office of the DOE
ORP	Oxidation-reduction potential; the same as redox potential or Eh
p	Pico, a prefix meaning one-trillionth (10^{-12})
PA DER	Pennsylvania Department of Environmental Resources
Pb	Lead
pCi/g	Picocuries per gram
pCi/l	Picocuries per liter
PE	Thornwaite Precipitation-Evaporation Index
pH	A logarithmic scale of hydrogen-ion concentration, and hence, an indication of acidity or alkalinity: pH = 7 is neutral; pH less than 7 is acidic; pH greater than 7 is alkaline
PMP	Probable maximum precipitation
Prem	Person-rem
PWLM	Person working level month
RA	Remedial action
Ra-226	Radium-226
RAC	Remedial-action contractor
RACP	Remedial-Action Concept Paper
RDC	Radon-daughter concentration
Rn-222	Radon-222
ROD	Record of Decision
RQD_{25}	Rock quality data -- index of all rock fragments above 0.25 foot in length
RQD_{50}	Rock quality data -- index of all rock fragments above 0.50 foot in length
Sandia	Sandia National Laboratories, Albuquerque, New Mexico
SIC	Standard Industrial Classification
SMSA	Standard Metropolitan Statistical Area
SO_2	Sulfur dioxide
SR	Pennsylvania state traffic route
SU	Standard unit; used in this report to indicate a pH change of one

TOC	Total organic carbon
TSP	Total suspended particulates
TSS	Total suspended solids
U-234	Uranium-234
U-235	Uranium-235
U-238	Uranium-238
U_3O_8	Uranium oxide; also called yellow cake
UMTRAP	Uranium Mill Tailings Remedial Action Project
UMTRCA	Uranium Mill Tailings Radiation Control Act of 1978 (PL 95-604)
UNSCEAR	United Nations Scientific Committee on the Effects of Atomic Radiation
USATHAMA	U.S. Army Toxic and Hazardous Materials Agency
USGS	U.S. Geological Survey
Vitro	Vitro Manufacturing Company, Canonsburg, Pennsylvania
Weston	Roy F. Weston, Inc., West Chester, Pennsylvania
WL	Working level (a measure of radon-daughter-product concentration)
WLM	Working-level month (exposure to 1 WL for 170 hours)
WWTP	Waste-water treatment plant
$\bar{X}$	Mean (average) value of the variable
μ	Micro; a prefix meaning one-millionth (10^{-6})

Glossary

absorbed dose, radiological	Radiation energy absorbed per unit mass, usually given in units of rads.
acid mine drainage	Water that has come in contact with iron disulfide in rock strata and coal seams in the presence of oxygen. This causes the formation of sulfuric acid and ferrous sulfate and lowers the pH of the water.
Act 511 of 1965	"The Local Tax Enabling Act of Pennsylvania," i.e., the authority under which municipalities levy a number of taxes other than real estate and occupation taxes that were previously levied under Act 481 of 1947. These taxes may include per capita, earned income, trailer, mechanical devices, and mercantile taxes.
alluvium	Sediment deposited by a flowing river.
alpha particle	A positively charged particle emitted from certain radionuclides. It is composed of two protons and two neutrons, and is identical to the helium nucleus.
anticline	A fold in the underground rock structure that is convex upward. Its core contains the stratigraphically older rocks.
aquifer	A subsurface formation containing sufficiently saturated permeable material to yield significant quantities of water.
aquitard	A confining bed that retards but does not prevent the flow of water to or from an aquifer.
atom	A unit of matter; the smallest unit of an element consisting of a dense, central, positively charged nucleus surrounded by a system of electrons, equal in number to the number of nuclear protons and characteristically remaining undivided in chemical reactions except for limited removal, transfer, or exchange of certain electrons.
A-weighted sound levels	A method of measuring sound intensity that simulates an individual's sound perception
background radiation	Radiation arising from radioactive material other than that under consideration. Background radiation due to cosmic rays and natural radioactivity is always present, and there is always background radiation due to the presence of radioactive substances in building materials, etc.

beta particle	Charged particle emitted from the nucleus of an atom, with mass and charge equal to those of an electron.
borough	A political subdivision of a county with a defined boundary over which a municipal administration has been established to provide local government functions and facilities. In Pennsylvania, a borough is a minor civil division within a county with similar administrative and political functions as a city or a township.
colluvium	Rock fragments, sand, and soil that accumulate on steep slopes or at the foot of hills.
confined aquifer	An aquifer bounded above and below by relatively impermeable beds.
contamination	In this report, the presence of radioactive material in undesirable concentrations.
daughter product(s)	A nuclide resulting from radioactive disintegration of a radionuclide, formed either directly or as a result of successive transformations in a radioactive series; it may be either radioactive or stable.
decay, radioactive	Disintegration of the nucleus of an unstable nuclide by spontaneous emission of charged particles, photons, or both.
decibel	A unit expressing relative sound levels.
decontamination	The reduction of radioactive contamination from an area to a predetermined level set by a standards-setting body such as the EPA by removing the contaminated material.
disintegrations per minute or second	The number of radioactive decay events occurring per minute or second.
disposal	The planned safe permanent placement of radioactive waste.
dose	A general term denoting the quantity of radiation or energy absorbed; for special purposes, it must be qualified; if unqualified, it refers to absorbed dose.
dose, absorbed	The amount of energy imparted to matter by ionizing radiation per unit mass of irradiated material at the point of interest; given in units of rads.
dose commitment	The cumulative dose equivalent that results and will result from exposure to radioactive materials over a discrete time period; given in units of rems.

dose equivalent	The quantity that expresses all kinds of radiation on a common scale for calculating the effective absorbed dose; defined as the product of the absorbed dose in rads and modifying factors, especially the qualifying factor; given in terms of rems. Often abbreviated "dose."
electron	A negatively charged particle found either free or surrounding the nucleus of an atom.
equipotential lines	Lines of equal pressure within an aquifer.
excess lifetime cancer deaths	The number of cancer deaths occurring in the lifetime of a particular population that is in excess of the number normally expected.
exposure	The presence of radiation that may deposit energy in an individual; given in units of roentgens.
external dose	The absorbed dose or dose commitment that is due to a radioactive source external to the individual as opposed to radiation emitted by inhaled or ingested sources.
fault	A surface or zone of rock fracture along which there has been movement.
fecal coliforms	Bacteria indicative of human waste.
flood plain	Lowland or relatively flat areas that are subject to a 1 percent or greater probability of flooding in any given year (i.e., a 100 year or more common flood).
flux, radon	The emission of radon gas from the earth or other material, usually measured in units of picocuries per square meter per second.
gamma dose	Radiation dose caused by gamma radiation.
gamma logging (or logs)	A technique for determining gamma radiation levels at various depths in a bore hole.
gamma ray or radiation	High energy electromagnetic radiation emitted from some radionuclides. The energy levels are specific for different radionuclides.
gamma spectral analysis (gamma spectroscopy)	An analytical technique for identifying radionuclides based on their different gamma energy levels.

geotextile	A manmade fabric used for physical stabilization, such as erosion or embankment control.
ground water	Water below the land surface, generally in a zone of saturation.
half life	The time it takes for 50 percent of the quantity of a radionuclide to decay into its daughters.
in situ	In the natural or original position.
internal dose	The absorbed dose or dose commitment resulting from inhaled or ingested radioactivity.
isotopes	Nuclides having the same number of protons in their nuclei, but differing in the number of neutrons: the chemical properties of isotopes of a particular element are almost identical.
legislative route	A state-maintained roadway serving less than an arterial capacity.
licensing	In this report, the process by which the NRC will, after the remedial actions are completed, approve the final disposition and controls over a disposal site. It will include a finding that the site does not and will not constitute a danger to the public health and safety.
lineament	Any line on the ground or on an aerial photograph, that is structurally controlled.
made land	A miscellaneous land type where the soil has been covered, moved, or graded by man.
man-rem	Unit of population exposure obtained by summing individual dose-equivalent values for all people in the population. Thus, the number of man-rems attributed to 1 person exposed to 100 rems is equal to that attributed to 100 people each exposed to 1 rem.
micro	A prefix meaning one millionth (x 1/1,000,000 or 10^{-6}).
milli	A prefix meaning one thousandth (x 1/1000 or 10^{-3}).
Modified Mercalli (scale)	A standard scale for the evaluation of the local intensity of earthquakes based on observed phenomena such as the resulting level of damage. Not to be confused with magnitude, such as measured by the Richter scale, which is a measure of the comparative strength of earthquakes at their sources.
municipality	General term for a city, town, borough, village, or other district incorporated for self-government.

neutron	An electrically neutral particle found in or emitted from the nucleus of an atom.
nucleus	The positively charged center of an atom.
nuclide	A kind of atom characterized by the constitution of its nucleus. It is specified by the number of protons and the number of neutrons in the nucleus.
passerine	Birds in the order Passeriformes, which includes perching birds and all song birds.
permeability	The ease with which liquids or gases penetrate or pass through a layer of soil. Technically, it is the volume of fluid that will flow through a unit area under a unit hydraulic gradient, measured in centimeters per second or equivalent units.
permissible dose	That dose of ionizing radiation that is considered acceptable by standards-setting bodies such as the EPA. Also, the dose of radiation that may be received by an individual within a specified period with the expectation of no substantially harmful result.
person-rem	Same as man-rem.
pico	A prefix meaning one trillionth (x 1/1,000,000,000,000 or 10^{-12}).
picocurie	A unit of radioactivity defined as 0.037 disintegrations per second.
piezometric surface	The potentiometric surface of an aquifer. This represents the pressure exerted on a confined aquifer, or the water table in an unconfined aquifer.
population dose (exposure)	The sum of individual radiation doses received by all of those exposed to the source of interest.
priority pollutant	One of 65 toxic substances officially recognized by the EPA and declared toxic under Section 307(a) of the Clean Water Act of 1977 by the U.S. Congress. The EPA has promulgated guidelines for the analytical methods to be used for testing for these pollutants.
probable maximum precipitation (PMP)	Maximum precipitation that could occur from the most severe combination of meteorological conditions that are reasonably possible in a region.
proton	An electrically positive elementary particle found in the nucleus of an atom. Also, the nucleus of a hydrogen atom.

quality factor (QF)	The principal modifying factor by which absorbed doses are multiplied to obtain dose equivalents for radiation-protection purposes and thus express the effectiveness of absorbed doses on a common scale for all kinds of ionizing radiation. The quality factor depends on the type and the energy of the radiation being considered.
rad	A unit of measure for the absorbed dose of radiation. It is equivalent to 100 ergs per gram of material.
radioactively contaminated material	Waste that includes residual radioactive material and any other material that has become radioactively contaminated with radiation from this residual radioactive material.
radioactivity (radioactive decay)	The property of some nuclides of spontaneously emitting particles or gamma radiation or of spontaneous fission.
radioisotope	A radioactive isotope of an element with which it shares almost identical chemical properties.
radionuclide	A radioactive nuclide.
radium-226	A radioactive daughter product of uranium-238. Radium is present in all uranium-bearing ores; it has a half life of 1620 years.
radon-222	The gaseous radioactive daughter product of radium-226; it has a half life of 3.8 days.
radon-daughter product	One of several short-lived radioactive daughter products of radon-222. All are solids.
red dog	A reddish-brown slag produced by steel mills.
rem	A unit of dose equivalent equal to the absorbed dose in rads times quality factor times any other necessary modifying factor. It represents the quantity of radiation that is equivalent in biological damage to 1 rad of x-rays.
residual-radioactive material	Waste in the form of tailings from processing ores for the extraction of uranium and other valuable constituents in the ores and other waste relating to such processing, including any residual stock of unprocessed ores or low-grade materials.
riparian	Pertaining to a river bank.
roentgen	A unit of measure of ionizing radiation in air; 1 roentgen in air is approximately equal to 1 rad and 1 rem in tissue.

sands	In this report, relatively coarse-grained waste products of uranium-ore processing.
second-class township	A classification based on the ranking of a municipality (i.e., township) based on population size. A second-class township is any township not classified as a first-class township; a first-class township contains a minimum population density of 300 persons per square mile.
slimes	In this report, fine-grained waste materials from uranium-ore processing that are mixed with small amounts of water.
soil infiltration rate	The rate at which water enters the soil surface and moves vertically.
soil percolation rate	The rate at which water moves through soil in all directions.
source term	The rate at which radionuclides are released from a radioactively contaminated area.
specific conductance	A measure of the electrical conductivity of a solution, expressed in mhos per centimeter. It is an indicator of the presence of free ions (cations and anions) in the solution.
stabilization	The reduction of radioactive contamination in an area to a predetermined level by a standards-setting board such as the EPA, by encapsulating or covering the contaminated material.
state route	A Pennsylvania traffic route. It is a state-maintained arterial road.
syncline	A fold in the rock structure that is concave upward.
tailings, uranium-mill	The wastes remaining after most of the uranium has been extracted from uranium ore.
thorium-230	A radioactive-daughter product of uranium-238; it has a half life of 80,000 years and is the parent of radium-226.
transmissivity, hydraulic	A measure of the ability of an aquifer to transmit water equal to the product of the permeability and the thickness of the aquifer, expressed in gallons per day per foot of drawdown.
unconfined aquifer	An aquifer that is not confined by impermeable beds. The upper surface is called the water table.

uranium-238	A naturally occurring radioisotope with a half life of 4.5 billion years; it is the parent of uranium-234, thorium-230, radium-226, radon-222, and others.
vicinity property	A property in the vicinity of the Canon Industrial Park that is determined by the DOE, in consultation with the NRC, to be contaminated with residual radioactive material derived from the Canon Industrial Park, and which is determined by the DOE to require remedial action.
water table	The level from which water can be drawn from a well.
working level (WL)	A measure of radon-daughter-product concentrations. Technically, it is any combination of short-lived radon decay products in 1 liter of air that will result in the ultimate emission of alpha particles with a total energy of 130,000 MeV.
working-level month (WLM)	Exposure to a worker resulting from inhalation of air with a concentration of 1 WL of radon daughters for 170 working hours. Continuous exposure of a member of the general public to 1 WL for one year results in approximately 27 WLM of exposure after allowing for lighter breathing rates during nonworking hours; 1 WLM is approximately equal to 5 rem.

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[a]No longer with Weston.

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Federal Agencies

Corps of Engineers
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    Robert W. Schmitt
Department of the Interior
    Headquarters, Washington, D.C.
    Fish and Wildlife Service, Charles J. Kulp
Environmental Protection Agency
    Headquarters, Washington, D.C. (5)
    Region III (5)
    Stanley Lichtman
    Henry D. May
    John Giedt
    David L. Duncan
    Marvin Rubin
    Robert S. Davis
Housing and Urban Development
    Headquarters, Washington, D.C.
Nuclear Regulatory Commission
    W. A. Nixon (7)
Office of Management and Budget
    Richard Brozen

Elected Officials

U.S. House of Representatives
    Alan B. Mollohan
    Austin J. Murphy
    John P. Murtha
U.S. Senate
    Robert C. Byrd
    John Heinz
    Jennings Randolph
    Arlen Specter
Pennsylvania Governor
    Richard L. Thornburgh
Pennsylvania House of Representatives
    David W. Sweet
    Victor Lescovitz
Pennsylvania Senate
    James E. Ross
    J. Barry Stout
Indiana County Commission
    William R. McMillen
Washington County Commission
    Frank Mascara
City of Weirton
    Donald T. Mentzer
Burrell Township Supervisors

Canonsburg Borough
    Jack Passante
Chartiers Township Supervisors
Hanover Township Supervisors
Houston Borough
    H. Polinski
North Strabane Township Supervisors
    George Elish

State Agencies

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    James G. Yusko
    Terry Fabian
    Donald J. McDonald
    Douglas L. Lesher
    Peter T. Slack
    Robert L. Orwan
Pennsylvania Department of Transportation
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Arizona Radiation Regulatory Agency
    Charles F. Tedford
Colorado Department of Health
    A. J. Hazle
Idaho Department of Health and Welfare
    Robert Funderburg
Navajo Environmental Protection Commission
    Harold Tso
New Mexico Department of Health and Environment
    Al Topp
North Dakota Department of Health
    Dana K. Mount
Oregon Department of Energy
    Don Godard
Texas Department of Health
    Edgar D. Bailey
Utah Bureau of Radiation and Occupational Health
    Larry Anderson
Wyoming Department of Environmental Quality
    Walt Ackerman

Organizations

Concerned Citizens of Southwestern Pennsylvania
    George Lucchino
Environmental Action, Inc.
Environmental Defense Fund
Friends of the Earth
National Audubon Society

National Wildlife Federation
Natural Resources Defense Council, Inc.
New Mexico Mining Association
Pennsylvania Public Interest Coalition
    Julie Stewart
Sierra Club (3 locations)
Southwest Research and Information Center
    Paul Robinson
U. C. A. R. E.
    Agnes Engel

Libraries

Burgettstown Community Library
    Burgettstown, Pennsylvania
Burrell Township Library
    Black Lick, Pennsylvania
Canonsburg Library
    Canonsburg, Pennsylvania
Chartiers-Houston Community Library
    Houston, Pennsylvania
Mary H. Weir Public Library
    Weirton, West Virginia
U.S. Department of Energy
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10-28-83 JS(1) UC-70A

DOE/EIS-0096-F

I-11692

DOE/EIS--0096-F-Vol.2-App.

DE84 001443

Final Environmental Impact Statement

Remedial Actions at the Former Vitro Rare Metals Plant Site,

Canonsburg,
Washington County,
Pennsylvania

United States Department of Energy

July 1983

Volume II
Appendices

DISCLAIMER

Appendix A

ENGINEERING APPENDICES

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Appendix A.1

SUMMARY OF CONCEPTUAL DESIGN FOR STABILIZATION OF RADIOACTIVELY CONTAMINATED MATERIALS, CANONSBURG, PENNSYLVANIA

SUMMARY OF CONCEPTUAL DESIGN FOR STABILIZATION OF RADIOACTIVELY CONTAMINATED MATERIALS, CANONSBURG, PENNSYLVANIA

U.S. DEPARTMENT OF ENERGY

URANIUM MILL TAILINGS REMEDIAL ACTION PROJECT OFFICE

ALBUQUERQUE OPERATIONS OFFICE

ALBUQUERQUE, NEW MEXICO 87108

July 1983

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1 INTRODUCTION

1.1 PURPOSE

This report provides a summary of the conceptual design and other information necessary to understand the proposed remedial action at the expanded Canonsburg, Pennsylvania site. This design constitutes the current approach to stabilizing the radioactively contaminated materials in place in a manner that would fully protect the public health and environment. This summary is intended to provide sufficient detail for the reader to understand the proposed remedial action and the anticipated environmental impacts.

The site conceptual design has been developed using available data. In some cases, elements of the design have not been developed fully and will be made final during the detailed design process. Additional details and supporting analyses can be found in the remedial action plan (U.S. DOE, 1983).

1.2 DESIGN OBJECTIVES

The purpose of the remedial action is to dispose of the radioactively contaminated materials in a manner that complies with the EPA standards (40 CFR 192) to prevent future health risks. Consistent with these EPA standards (40 CFR 192), and to meet other objectives, the following major design objectives have been established:

1. Reduce the average radon flux from the radioactively contaminated materials to levels less than 20 picocuries per square meter per second.

2. Design controls that would be effective for up to 1000 years with minimum maintenance and a minimum design life of 200 years.

3. Prevent inadvertent human intrusion.

4. Ensure that existing or anticipated beneficial uses of ground and surface water would not be adversely affected.

5. Reduce radioactive contaminant levels on areas released for unrestricted use and areas without additional erosion protection to levels that would not exceed 5 picocuries of radium per gram of soil above background in the top 15 centimeters of soil, and would not exceed 15 picocuries of radium per gram of soil above background in any 15-centimeter layer below that depth (EPA, 40 CFR 192).

6. Include the adjacent vicinity properties (former Georges Pottery and the Wilson Avenue and George Street residential properties) north of the ConRail right-of-way in the expanded Canonsburg site and provide for the disposal of other vicinity property material at the expanded Canonsburg site. Decontaminate the adjacent ConRail right-of-way (a vicinity property) for release for unrestricted use.

7. Protect against releases of radioactively contaminated materials from the expanded Canonsburg site during construction.

8. Provide flood protection, runoff and sediment control, and waste-water treatment.

9. Reconstruct and reopen Strabane Avenue after the remedial action is completed.

10. Minimize the areas that would be disturbed during construction to minimize exposure of the public and the remedial-action workers to radioactively contaminated materials.

1.3 MAJOR ELEMENTS OF THE DESIGN

The principal feature of the concept design is the consolidation of the more radioactively contaminated materials (Figure A.1-1) into a lined encapsulation cell (Figures A.1-2, A.1-3, and A.1-4) on the expanded Canonsburg site to control radon exhalation and to protect the ground water. The remaining radioactively contaminated materials on the expanded Canonsburg site, but not placed in the encapsulation cell, would be stabilized in place using cover systems. The design would require the following major construction activities:

1. Preparation of the expanded Canonsburg site, including construction of a flood control berm and construction of a waste-water sedimentation basin to protect against release of contaminants from the expanded Canonsburg site during construction.

2. Construction of drainage control measures to direct all generated waste- and storm-water runoff to the sedimentation basin during construction activities.

3. Removal and relocation of onsite surface and subsurface utilities to areas that could be serviced without disturbing those parts of the expanded Canonsburg site containing radioactively contaminated materials.

4. Excavation and handling of radioactively contaminated materials during relocation and encapsulation.

5. Dewatering of soils within Area C to facilitate excavation of radioactively contaminated materials from this area.

6. Installation and operation of a waste-water treatment facility to protect against contamination of surface waters during construction.

7. Construction of the encapsulation cell liner for protection of ground water.

8. Emplacement of radioactively contaminated materials into the encapsulation cell to control radon exhalation and protect ground water.

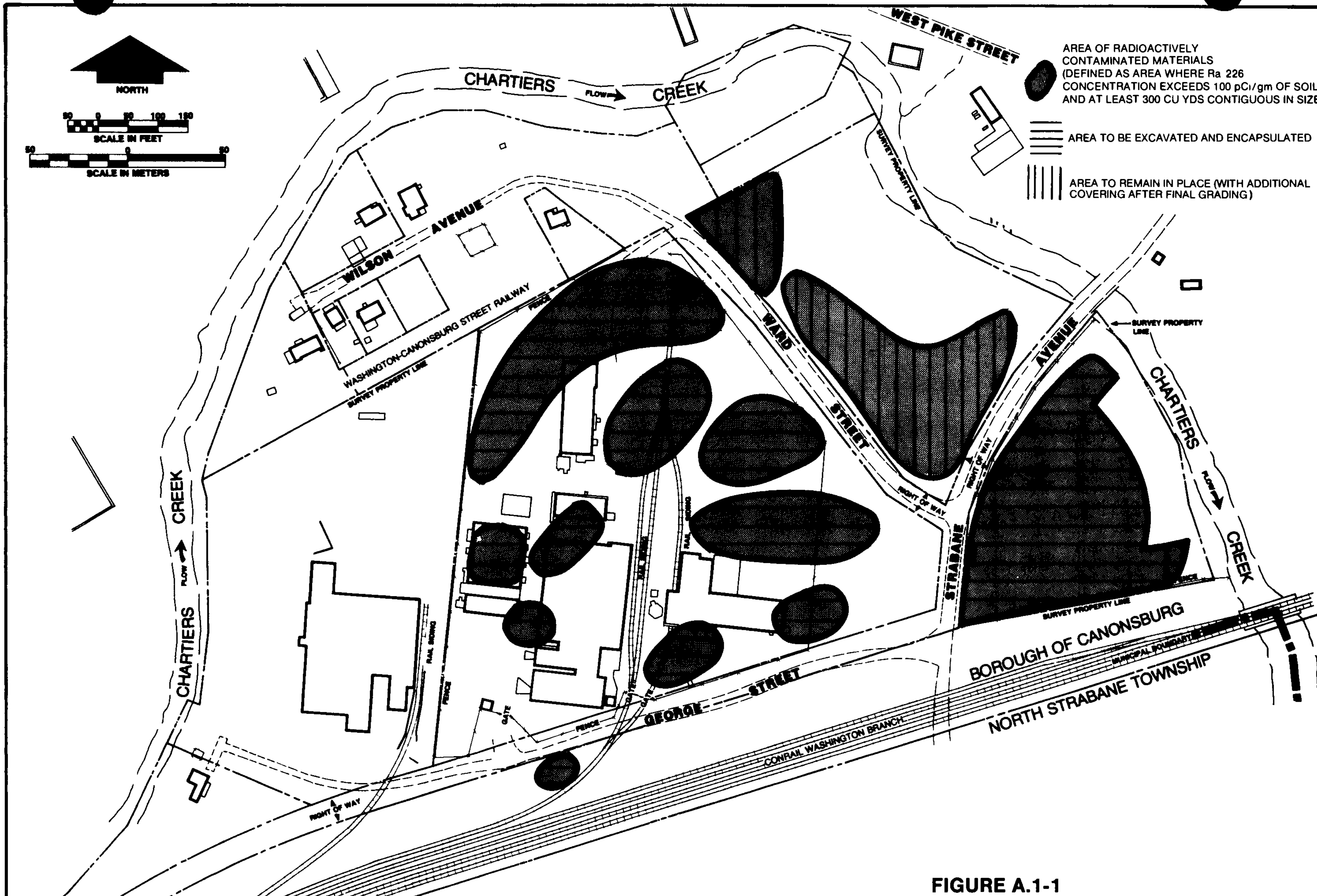

FIGURE A.1-1
AREAS OF RADIOACTIVELY CONTAMINATED MATERIALS
EXPANDED CANONSBURG SITE

NOTE THIS MAP IS BASED ON A SURVEY AND TOPOGRAPHY BY KURCH HOUSLEY & ASSOC PITTSBURGH PA DATED MARCH 1983 AND ON MAPS OF THE CHARTIERS CREEK BASIN PA BY THE US ARMY CORPS OF ENGINEERS PITTSBURGH PA DATED 6/3/73

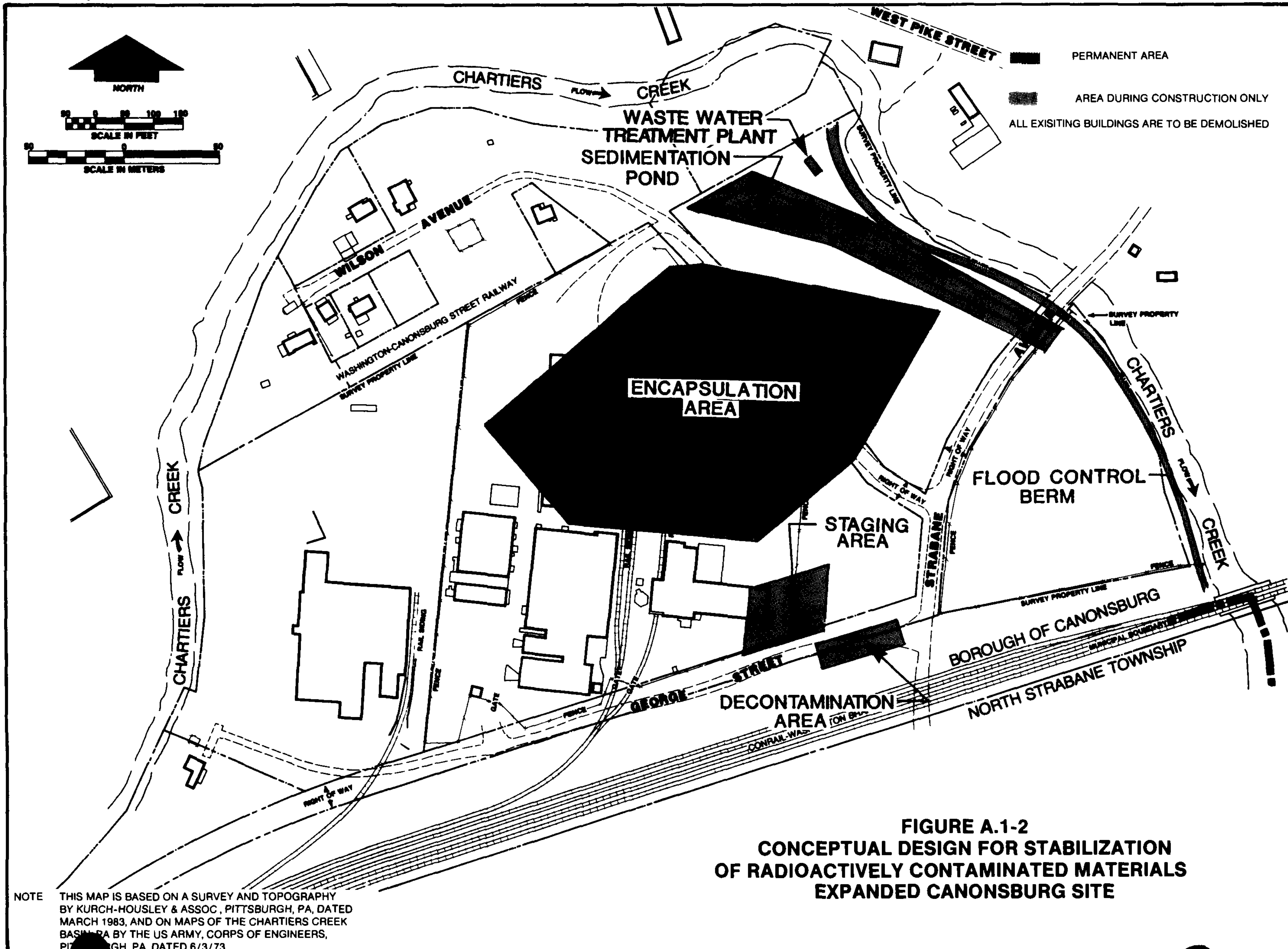

FIGURE A.1-2
CONCEPTUAL DESIGN FOR STABILIZATION OF RADIOACTIVELY CONTAMINATED MATERIALS EXPANDED CANONSBURG SITE

NOTE THIS MAP IS BASED ON A SURVEY AND TOPOGRAPHY BY KURCH-HOUSLEY & ASSOC., PITTSBURGH, PA, DATED MARCH 1983, AND ON MAPS OF THE CHARTIERS CREEK BASIN, PA BY THE US ARMY, CORPS OF ENGINEERS, PITTSBURGH, PA, DATED 6/3/73,

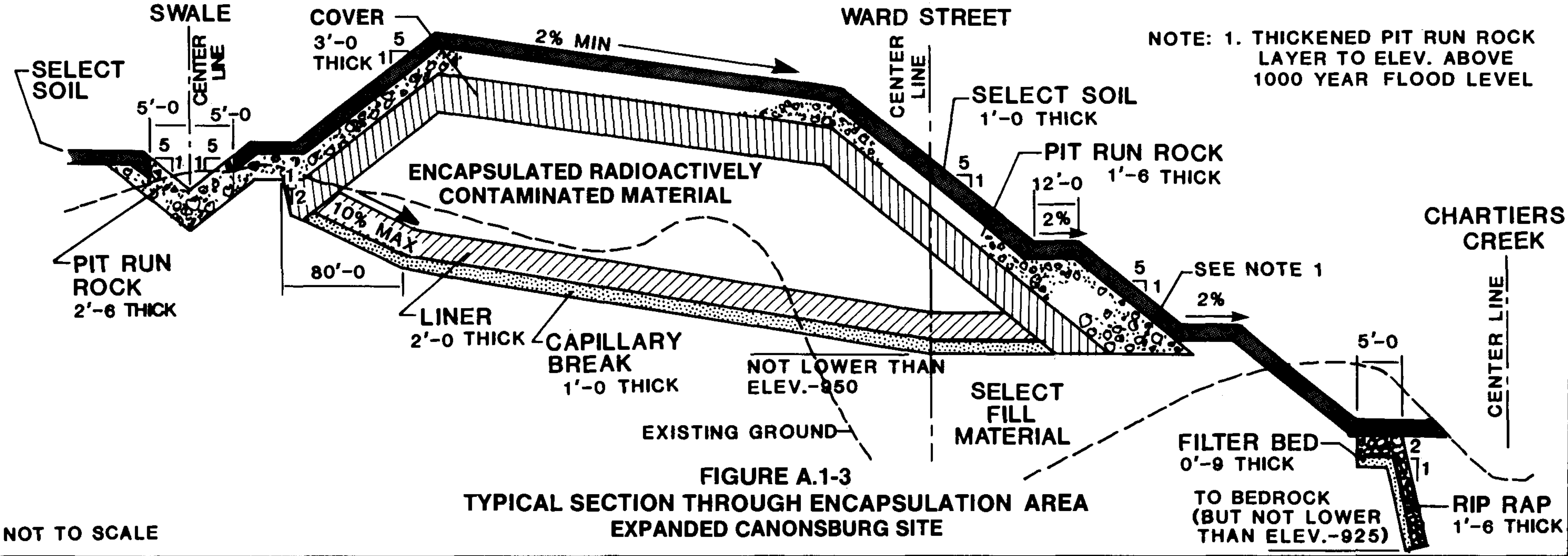

FIGURE A.1-3
TYPICAL SECTION THROUGH ENCAPSULATION AREA
EXPANDED CANONSBURG SITE

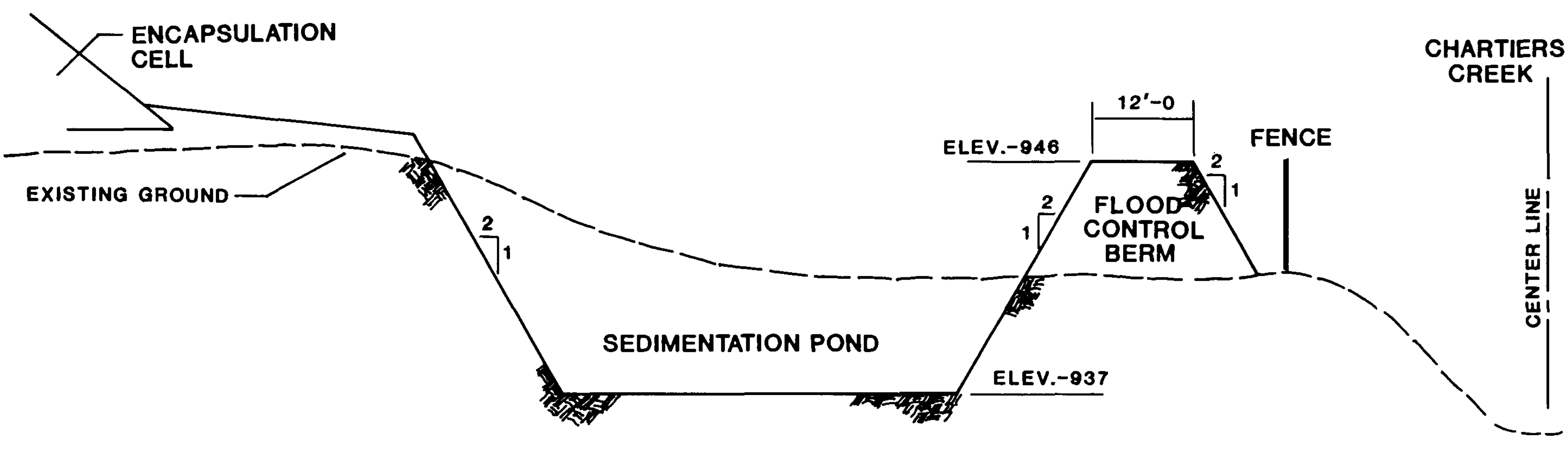

FIGURE A.1-4
TYPICAL SECTION THROUGH SEDIMENTATION POND
AND FLOOD CONTROL BERM –EXPANDED CANONSBURG SITE

NOT TO SCALE

9. Decontamination (as necessary), demolition, and disposal of all buildings and railroad spur lines on the expanded Canonsburg site (including the former Georges Pottery property and the residential areas on Wilson Avenue and George Street).

10. Construction of the final cover system over the encapsulation cell to inhibit water infiltration and radon exhalation.

11. Emplacement of soil cover over the remainder of the expanded Canonsburg site (with the exception of the George Street and Wilson Avenue residential areas) with final grading to provide suitable drainage control.

12. Emplacement of topsoil and erosion protection on the encapsulation cell and the remainder of the expanded Canonsburg site.

13. Revegetation of all disturbed areas to mitigate erosion.

14. Installation of temporary and permanent fencing to discourage human intrusion.

15. Reconstruction of Strabane Avenue.

1.4 PROPOSED FINAL CONDITION

The completed encapsulation cell will encompass about 6 acres in Areas A and B. The encapsulation cell will be constructed with a clayey soil liner on the bottom and a low permeability cover over the top. The top of the embankment will be about 20 feet above the elevation of the existing grades with a maximum slope of 1 vertical to 5 horizontal side slopes. The residential areas that are part of the expanded Canonsburg site would require little remedial action except for building demolition. Disturbed areas would be covered with clean soil and revegetated. A small amount of final grading could extend into this area. The buildings in Area A and the former Georges Pottery property would be demolished leaving their foundations in place if there is no interference with construction activities and there is no major radioactive contamination beneath the foundations. The construction of the encapsulation cell would produce an excess of excavated material. The building rubble would be mixed with some of this excess material and placed in Area C. The remainder of the excess excavated material would be spread over the area west of the encapsulation cell (comprising portions of Area A and the former Georges Pottery property).

After completion of the encapsulation cell, the remainder of the expanded Canonsburg site (excluding the George Street and Wilson Avenue residential areas) would be covered with 1 to 3 feet of clean fill and select soil, contoured for drainage, and revegetated. Any surface radioactive contamination on the residences would have been removed and included with other radioactively contaminated materials on the expanded Canonsburg site. Strabane Avenue would be decontaminated and repaved. Chain link fences with warning signs would enclose the expanded Canonsburg site (including Area C) while leaving access to Strabane Avenue available to the public.

2 CONCEPTUAL DESIGN

2.1 GENERAL

2.1.1 Layout

Figure A.1-2 illustrates the expanded Canonsburg site development plan. The encapsulation cell has been sized to contain approximately 85,000 cubic yards of radioactively contaminated materials. The remainder of the expanded Canonsburg site would be graded to allow for excess excavated material and additional clean soil cover, and to provide adequate expanded Canonsburg site drainage.

The encapsulation cell has been located to minimize construction conflicts with demolition activity and with the removal of radioactively contaminated materials. The location would also allow for sequencing construction activities with minimum rehandling of radioactively contaminated materials. Due to emplacement of compacted fill, the bottom of the liner of the cell would be above the 100-year flood level. The slope would be protected to above the 1000-year flood level.

The proposed remedial action construction staging area would be located to have minimum impact on demolition activity and to be centrally located for the encapsulation cell construction activities. This area would also have easy access from the intersection of George Street and Strabane Avenue and is adjacent to existing utilities.

2.1.2 Design criteria

2.1.2.1 Excavation criteria for radon control

The excavation rationale considered the potential for increased levels of radium-226 from decay of thorium-230. Thorium-230 exists on the expanded Canonsburg site in concentrations greater than those found in natural uranium- and radium-bearing ores since radium-226 and thorium-230 were extracted during the recovery operations. Based on decay rates, the increase in radium-226 after 1000 years will result in an activity of approximately 30 percent of the original thorium-230 activity.

Significant quantities of radioactively contaminated materials would be excavated and placed in the encapsulation cell (Figure A.1-1). Areas to be excavated would be delineated using a survey grid. The survey grid (50 feet x 50 feet) would minimize the likelihood that a contiguous volume of soil greater than 300 cubic yards and contaminated with greater than 100 picocuries of radium-226 per gram of soil projected for 1000 years would remain undetected and unexcavated. Smaller contiguous volumes of greater than 15 cubic yards that could have an average concentration of greater than 100 picocuries of radium-226 per gram of soil throughout the design life would be excavated and encapsulated if they were detected as a result of the grid survey or the excavation activities.

After the major portion of the radioactively contaminated materials has been encapsulated, a cover would be placed over the radioactively contaminated materials. The cover would consist of soil compacted at or close to optimum moisture content that would reduce the diffusion of radon and decrease the penetration of water.

To control radon emissions from radioactively contaminated materials having lower level concentrations that would not be encapsulated and to provide long-term stability, the remainder of the expanded Canonsburg site, except for uncontaminated areas, would be covered with a minimum of 2 feet of compacted soil. This is calculated to reduce the current and future radon emission rates to well below the EPA standard (40 CFR 192) and to provide an adequate allowance for erosion to ensure the longevity of the treatment. Additionally, concrete slabs would be left in place and lower-level vicinity property radioactively contaminated materials would be placed on top of the disposal site prior to the placement of the final 2 feet of cover material.

The use of a minimum of 2 feet of additional cover for radon control also considered the increase of radium-226 from the decay of thorium-230. The average radium-226 activity over the nonencapsulated area considering thorium-230 decay is expected to be less than 100 picocuries per gram of soil during the design life of the expanded Canonsburg site.

Radon emissions were calculated using the RAECO model (Rogers et al., 1981) to predict emission rates from the radioactively contaminated materials before and after remedial action. Data on the distribution of radium in the radioactively contaminated materials, the quantities of radioactively contaminated materials to be encapsulated, and the properties of the liner and cover materials would be collected before selecting the final cover and liner thickness.

2.1.2.2 Excavation criteria for water quality protection

After completion of the remedial action, migration through ground water would be the principal exposure pathway. Because of this exposure pathway, excavation criteria were considered that would limit radionuclide concentrations in water to acceptable levels.

Analyses of ground water indicated that uranium and radium-226 are the most radiotoxic or toxic contaminants at the expanded Canonsburg site. Soil and ground-water samples were further evaluated to determine a level of residual radioactive contamination in soil that would maintain onsite ground water at a level that would have a negligible impact on offsite ground and surface waters.

As a first step in the ground-water analysis, average concentrations of radium-226 and uranium in soil and ground water were compared to derive a soil excavation criterion in terms of residual radium-226 concentrations. Empirical and theoretical estimates of ground-water leach rates, contaminant migration rates, and contaminant concentrations of less than 100 picocuries of radium-226 per gram of soil (not encapsulated) would result in levels of less than 5 picocuries of radium-226 per liter, and 10 picocuries of total uranium per liter in Chartiers Creek during the design life of the expanded Canonsburg site. Excavation criteria that would limit the unencapsulated radium-226 concentration, including grow-in from thorium-230 over the long term to 100 picocuries of radium-226 per gram, would therefore limit potential water contamination to below the EPA National Primary Interim Drinking Water standards (40 CFR 141).

It should also be noted that radionuclides other than uranium and radium-226 may affect ground-water quality. In the event that the grid survey reveals high levels of other radionuclides, other excavation criteria would be selected to provide an equivalent degree of protection.

2.1.3 Long-term stability

The remedial action has been designed so the disposal site would withstand the forces of nature for a long period of time (more than 200 years). Several types of natural erosive damage have been investigated and protective systems identified. The results of these investigations are discussed in the subsections that follow.

2.1.3.1 Wind erosion

Due to the ease of establishing a self-perpetuating vegetative cover on the expanded Canonsburg site, wind erosion is not anticipated to have a significant effect on the long-term stability of the expanded Canonsburg site. In the unlikely event that wind erosion would occur, design features incorporated for protection against other erosive forces would ensure long-term stability.

2.1.3.2 Water erosion

To reduce the potential for water erosion, embankment slopes would be limited to a maximum of 1 vertical to 5 horizontal (Figures A.1-3 and A.1-4). The remainder of the expanded Canonsburg site would be gently sloped with two drainage swales located on the north and south sides of the encapsulation cell. The drainage swales would be lined with pit run rock to prevent erosion. Except for those swale areas covered with rock, the encapsulation cell and the remainder of the expanded Canonsburg site would be revegetated for additional erosion protection.

Severe rainfall events have the potential to develop rills and gullies on the steeper (20 percent) side slopes of the embankment. These events could erode away some or all of the topsoil in small, undefinable areas. One such potential rainfall event is commonly referred to as a probable maximum precipitation (PMP). A PMP is defined as the maximum precipitation that could occur from the most severe combination of meteorological conditions that are reasonably possible in a region.

To protect against an unlikely PMP occurring on the expanded Canonsburg site, the encapsulation cell would have a 1.5-foot thick layer of rock as part of the cover system. The rock sizes are designed to remain intact during and following a PMP even if the topsoil is eroded away. Other areas of the expanded Canonsburg site with gentler slopes would not require this added protection.

2.1.3.3 Flood protection

The expanded Canonsburg site is adjacent to Chartiers Creek and is therefore subject to certain flood conditions. Flow conditions and flood levels have been calculated for three flood events: a 100-year flood, a 1000-year flood, and a probable maximum flood (PMF). The results of these calculations are contained in the remedial action plan. A PMF is the flood in Chartiers Creek adjacent to the expanded Canonsburg site that could result from a PMP on the drainage basin upstream from the expanded Canonsburg site.

The bottom of the encapsulation cell would be placed above the 100-year flood plain. This would require some fill with compacted soil in certain areas of lower elevation. The location of the cell would be such that even during a 1000-year flood, the cell would not be subjected to erosive water velocities. However, the cell would have additional rock protection to above the 1000-year flood level. Flood velocities associated with a PMF may erode some topsoil but would not affect the integrity of the encapsulation cell. The rock size selected to protect against PMP-initiated gully erosion would also protect against PMF damage.

2.1.3.4 Geomorphology (stream meander)

The expanded Canonsburg site is located on alluvial fill along Chartiers Creek and therefore has a slight possibility of being subject to stream meander. Based on drill logs and visual inspection, the creek bank adjacent to the expanded Canonsburg site along the western, northwestern, and northern boundaries of the expanded Canonsburg site consists of bedrock and is not likely to erode and allow the creek to encroach on the expanded Canonsburg site in the foreseeable future. Along the northeastern and eastern sides of the expanded Canonsburg site, the stream bank consists of alluvial fill and is subject to a slight potential encroachment into the expanded Canonsburg site

(U.S. DOE, 1983). Those areas of the expanded Canonsburg site subject to stream encroachment would be protected with a rock structure. This rock structure is designed to preclude lateral stream migration that could expose the radioactively contaminated materials (Figure A.1-3).

2.1.4 Ground-water protection

Encapsulation of most (± 90 percent) of the radioactive contamination in an engineered cell above the ground-water level in Area A would reduce the potential for leaching and contaminant migration. The encapsulation cell would be designed with a relatively impermeable cover and liner that would reduce infiltration of precipitation, retard water flow through the encapsulation cell, and a liner that would retard contaminant migration.

The demolition and abandonment of the existing structures would eliminate the storm sewer recharge to the ground water in Area A and the former Georges Pottery property. Covering the ground surface with a sloping clayey cover would reduce the amount of infiltration from precipitation events. Ground-water modeling indicates that these actions would result in lowering the water levels beneath Area A and the former Georges Pottery property to about 952 feet elevation and beneath Area B to about 942 feet elevation. Since the expanded Canonsburg site ground water is also recharged off the expanded Canonsburg site, ground water would continue to flow beneath the expanded Canonsburg site, but the water levels in Areas A and B and the former Georges Pottery property would be reestablished at a lower elevation. Ground-water levels in Area C would not be significantly affected by the remedial action.

Removal of most of the radioactively contaminated materials below the ground-water level in Area C would greatly reduce the existing source for water-soluble radioactive constituents. The small quantity of radionuclides already in the ground-water system between the radioactively contaminated portion of Area C and Chartiers Creek would continue to move toward the creek. The calculated concentration of uranium that would continue to migrate to the creek is estimated to be less than 0.006 milligram per liter.

Some radioactively contaminated materials would remain in place in all areas of the expanded Canonsburg site; however, lowering the ground-water levels described previously would reduce leaching and contaminant migration toward Chartiers Creek. Water-soluble constituents already in the ground water of other areas of the expanded Canonsburg site would continue to migrate toward the creek. Concentrations of radionuclides as they discharge into the creek would be reduced to levels below detection by standard laboratory techniques.

Since the major portion ($\pm$ 90 percent) of the radioactive contamination would be placed in the encapsulation cell, water infiltration into and through the encapsulation cell could be a potential source of future ground-water contamination. Accordingly, the encapsulation cell would be designed to greatly reduce the quantity of water that can infiltrate through the radioactively contaminated materials and into the ground water.

2.2 SITE PREPARATION

2.2.1 Clearing

A significant quantity of vegetation including grasses, shrubs, and small to large trees presently grow on the expanded Canonsburg site. Trees and other vegetation on nonradioactively contaminated areas that do not interfere with construction would remain on the expanded Canonsburg site. Grasses, weeds, shrubs, and trees on radioactively contaminated areas, and radioactively contaminated organic building materials would be shredded, chipped, or otherwise reduced in size and buried on the expanded Canonsburg site outside the encapsulation area. Organic materials would not comprise more than 5 percent by volume per lift in areas with buried radioactively contaminated materials.

2.2.2 Flood-control berm

A flood-control berm would be designed, located, and maintained to protect the expanded Canonsburg site during construction activities from the 100-year flood of Chartiers Creek (Figure A.1-4). As portions of Areas B and C lie within this flood boundary, the berm would be located adjacent to Chartiers Creek and extend from the northeast corner of Area B (abutting the Canonsburg Street Railway berm) to the southeast boundary of Area C.

After the area where the berm is to placed has been decontaminated, fill suitable for final cover material would be used to construct the berm. The final design of the berm would be dependent on additional radiological surveys.

2.2.3 Storm drainage

All construction activities would be conducted in such a way as to prevent accelerated erosion and sedimentation. Within Areas A, B, C, and the former Georges Pottery property, areas disturbed by construction activities would be graded so that runoff would drain to one or more sedimentation basins. Channels would limit runoff velocity by being grassed or lined with erosion resistant material.

During remedial action, all drainage within Areas A, B, and C would be effectively blocked by the flood-control berm. The drainage within Areas A and B would flow eastward around the northern and southern sides of the encapsulation cell construction area to the sedimentation basin. During initial expanded Canonsburg site construction the low areas on Ward Street and along Strabane Avenue would be filled in to ensure drainage to the basin along the south side of the cell. Due to the geometry of the encapsulation cell, storm runoff waters would collect in the excavated portion during construction. These waters could be trenched or pumped out of the encapsulation cell area and into the sedimentation basin.

Drainage within the former Georges Pottery area flows primarily westward. Prior to earthwork activity, this area would be encircled on three sides (north, west, and south) with a berm and a ditch to direct flows towards the sedimentation basin. Within Area C, drainage would be trapped by dewatering trenches and the excavation process. A berm would be necessary along Strabane Avenue to ensure that drainage along the southern side of the encapsulation cell construction would flow to the basin and not into Area C. Some ditching adjacent to the flood berm within Area C would be necessary to direct drainage across Strabane Avenue to the basin. All waste water generated from runoff and dewatering in Area C would be pumped into this ditch for gravity flow to the sedimentation basin.

Demolition and reclamation activities in the onsite residential area would be conducted independently of other expanded Canonsburg site activities and in such a manner as to minimize localized erosion and sediment production. Control measures that could be employed include vegetation, filters, fabric fences, and channels.

Runoff from land outside the affected areas would be diverted away from the expanded Canonsburg site. Diversions could be by means of ditches or berms.

2.2.4 Sedimentation basin

A sedimentation basin would be the primary means to collect radioactively contaminated waste water prior to treatment. Waste waters would result from the following:

1. Decontamination activities including equipment washing, building washing, and truck washdown.

2. Initial dewatering and maintenance pumping of Area C.

3. Runoff from Areas A, B, C and the former Georges Pottery property.

Because of the limited working area and the numerous construction activities, it would be very difficult to separate clean runoff from contaminated runoff. Therefore, all runoff from Areas A, B, and C and the former Georges Pottery property would be diverted to the sedimentation basin and collected for treatment.

The sedimentation basin would have the capacity to retain 7000 cubic feet per acre for affected areas, plus expected decontamination and dewatering streams. In addition, the sedimentation basin would be designed with sufficient freeboard and a spillway system to allow discharge to Chartiers Creek of effluent quantities from storm events greater than the design capacity. The spillway system would be designed so that any flow would enter Chartiers Creek at a location where the creek flood-water elevation is far enough below the spillway elevation to allow for free drainage.

The proposed location of the sedimentation basin would be the narrow strip of land between the encapsulation cell and the flood control berm within Area B. The bottom of the sedimentation basin could be excavated 2 to 3 feet lower than the existing grade to allow free drainage around the encapsulation cell into both ends of the basin. A level area contiguous with the top of the flood control berm could be filled in at the northeast corner of Area B, for location of a water treatment facility.

The Area C excavation would be conducted to retain rainfall runoff as necessary. Area C water would then be pumped to the sedimentation basin for treatment.

2.2.5 Waste-water treatment

Depending on the effectiveness of the sediment basin in removing contaminants, a secondary means of removing contaminants could be required. This secondary treatment could involve a combination of pH adjustment, metals precipitation, ion exchange, and multimedia filtration. The selection and design of the secondary treatment system can be determined only with additional data on the water-quality characteristics of the expected waste streams and the requirements of the NPDES discharge limitations (40 CFR 124). At the completion of construction, residues removed by the treatment plant and the sedimentation basin would be buried on the expanded Canonsburg site.

2.2.6 Dust control

Dust generated by excavation, earth movement, vehicle use, stockpiling, and similar activities must be controlled and minimized.

Special emphasis would be placed on controlling dust that originated from building decontamination and temporary stockpiling or mixing of radioactively contaminated materials.

It is anticipated that water with a water-based surfactant sprayed under high pressure (from trucks and hoses) would be adequate to control dust. Hoses would be available for each excavation area.

The sources for dust suppression water would include impounded runoff and/or potable water. Recycled water would be used as much as practicable.

To reduce excessive fugitive dust generated by vehicular traffic, a paved exit and entrance road from the site would be supplied for a minimum length of 150 feet. These driveways would be used to remove any radioactively contaminated materials that adhere to the wheels or undercarriage of the vehicles. Driveways would drain to a conveyance, which in turn would drain to the sedimentation basin. This paved area would be kept clean. The head of the driveways would be equipped with a wash area supplied with a hose.

The need for spraying the roads and pile areas would be determined on a day-by-day basis. The frequency of spraying would increase as combinations of low soil moisture and high wind speed conditions were encountered.

2.3 DEMOLITION

Numerous buildings presently located on the expanded Canonsburg sites would be demolished and the rubble added to other materials on the expanded Canonsburg site. The buildings would be decontaminated (if necessary) and/or a contamination fixing agent (i.e., paint) would be applied to the extent necessary to minimize the spread of radioactive contamination during demolition, and demolished. Demolition rubble would be placed in the excavation created in Area C. Organic and other biodegradable rubble would be buried on the expanded Canonsburg site outside the encapsulation area. Building foundation materials that did not interfere with expanded Canonsburg site construction activities would be left in place and covered.

2.4 ENCAPSULATION CELL

The encapsulation cell is designed to contain approximately 85,000 cubic yards of radioactively contaminated material and would be placed in Areas A and B well above the projected post-remedial action ground-water levels. It is estimated that about 62,000 cubic yards of radioactively contaminated materials would be excavated from all areas of the expanded Canonsburg site and placed in the encapsulation cell. This quantity is estimated to contain $\pm$ 90 percent of the radioactive contamination on the expanded Canonsburg site. The excess design capacity is to allow for overexcavation and revisions in the radioactively contaminated materials estimate. The encapsulation cell would be covered with a multilayer cover as described below. The remainder of the expanded Canonsburg site (except the residential areas) would be covered with a minimum of 2 feet of clean soil (U.S. DOE, 1983). The major features of the encapsulation cell design consist of the following, from top to bottom.

1. A 1-foot thick layer of select (top)soil with vegetation.
2. A 1-1/2-foot thick layer of pit run rock.
3. A 3-foot thick compacted earthen cover.
4. The encapsulated radioactively contaminated material.
5. A 2-foot thick compacted earthen liner.
6. A 1-foot thick layer of coarse sand.

2.4.1 Select soil layer

The top 1-foot soil layer would be a base for shallow-rooted vegetation.

2.4.2 Pit run rock layer

The 1-1/2-foot thick pit run rock layer would serve several design functions. It would serve as a backup barrier against erosion, as a barrier against plant root penetration, as a barrier against burrowing animal penetration, and as a device to channel the water percolating through the topsoil layer away from the cover. The water would drain into the swales or other engineered drain areas at the low points around the toe of the encapsulation cell.

2.4.3 Encapsulation cell cover

The encapsulated cell cover is designed to inhibit the infiltration of surface water and to retard the release of radon. The cover would consist of a 1-foot layer of bentonite, modified clayey soil, and an additional 2 feet of compacted clayey materials.

2.4.4 Encapsulation cell liner

The 2-foot thick liner would be constructed of locally available borrow materials and would be placed over the capillary break. The liner is designed to be more permeable than the cover and would thus reduce the potential for accumulation of water within the encapsulation cell and also would act to retard radioactively contaminated materials migration.

2.4.5 Capillary break

The coarse sand is designed as a capillary break to preclude upward water migration into the encapsulation cell. The capillary break would consist of a 1-foot layer of coarse sand placed on undisturbed or recompacted onsite materials.

2.5 WATER BALANCE

Water infiltration into and through the encapsulated radioactively contaminated materials and into the ground water is a potential source of ground-water contamination.

Although the liner and capillary break are designed to reduce ground-water contamination, the primary barrier against ground-water contamination would be the encapsulation cell cover. A multilayer cover system would be placed over the encapsulation cell to inhibit water infiltration and radon exhalation. As discussed previously, 3 feet of compacted earthen cover would be required for radon attenuation. This 3-foot-thick radon barrier, in conjunction with the rock erosion barrier and the 1-foot layer of selected soil, is calculated to reduce the net annual infiltration through the cover system to 1.2 inches per year. This is about 3 percent of the average annual rainfall in the Canonsburg area.

2.6 RADON AND WATER INFILTRATION BARRIER

The radon barrier (and the water infiltration barrier) would be constructed of locally available borrow material and bentonite. Radon emissions before and after the remedial action were calculated using the RAECO model (Rogers et al., 1981). Data on the distribution of radium in the radioactively contaminated materials, the quantities of radioactively contaminated materials to be encapsulated, and the properties of the cover materials have been used to develop the estimate of cover thickness. The cover thickness necessary to reduce the radon exhalation rate from the encapsulated radioactively contaminated materials to less than 20 picocuries per square meter per second (EPA, 40 CFR 192) is calculated to be about 2.4 feet. The remainder of the covered expanded Canonsburg site would require a minimum of 6 inches of cover to reduce the radon flux to below 20 picocuries per square meter per second (EPA, 40 CFR 192).

Radon emissions after the completed remedial action, including the erosion barrier and vegetation support layer, are calculated to be about 5 picocuries per square meter per second from the encapsulation cell, and about 9 picocuries per square meter per second for the remainder of the expanded Canonsburg site. The average post-remedial-action radon emission rate for the covered expanded Canonsburg site is calculated to be about 8 picocuries per square meter per second.

2.7 RADIOACTIVELY CONTAMINATED MATERIALS EXCAVATION

Excavation in Area C would require a dewatering scheme. Most of the radioactive contamination at the expanded Canonsburg site lies within Area C and extends to depths of as much as 18 feet. The ground water in this area is quite close to the surface. The remedial-action plan proposes that a drain trench system be constructed within the portion of Area C to be excavated. Pumping of ground water to the sedimentation basin would be required at only one point. Because of uncertainties in the characteristics of the deeper radioactively contaminated materials, excavation by dragline could be required. No major problems are expected in Area A, where a number of smaller volumes of radioactively contaminated materials that are above the ground-water table would be excavated.

2.8 RADIOACTIVELY CONTAMINATED MATERIALS ENCAPSULATION

Even with dewatering, Area C radioactively contaminated materials could be found to have high moisture contents. It is proposed that radioactively contaminated materials be physically mixed with the relatively dry radioactively contaminated materials excavated from Area A and possibly some soil stabilizers. This mixing should take place within the encapsulation cell itself and should result in a compactable material near optimum moisture content. The radioactively contaminated materials would be spread in 12-inch maximum loose lifts and compacted to a dry density of 90 percent of Standard Proctor compaction level.

Some of the radioactively contaminated materials from Area C are acidic in nature. Waste conditioning to neutralize these radioactively contaminated materials could be necessary to prevent damage to the soil liner.

2.9 SURFACE STABILIZATION

Side slopes of the encapsulation cell would be no greater than 1 vertical to 5 horizontal. To promote drainage the top of the encapsulation cell would have a minimum slope of 2 percent. To ensure that the encapsulation cell would withstand erosion during the 200- to 1000-year design life, and to present a natural appearance, the cover for the encapsulation cell and the remainder of the expanded Canonsburg site would be graded and the corners of the expanded Canonsburg site would be rounded to avoid sharp breaks in grade.

In the extremely unlikely event that the top 1-foot thick layer of soil that would support the vegetation would be eroded away, the encapsulation cell would be covered with a 1.5-foot thick layer of pit run rock that would provide additional erosion protection. The drainage swales north and south of the encapsulation cell as they near Chartiers Creek would also be lined with pit run rock. The encapsulation cell and the remainder of the expanded Canonsburg site would be revegetated.

2.10 EXISTING UTILITIES

The final objective of remedial action concerning utilities would be to disconnect and remove, or abandon and leave in place, all utilities within the expanded Canonsburg site. Main utility lines following Strabane Avenue could remain in place.

The water utility has a main running along Strabane Avenue that could remain active and in place. Two lines branch off this main and proceed up George Street and up Ward Street to the residential area along Wilson Avenue. The Ward Street branch would be abandoned; the George Street branch is a subsidiary feeder to the Village of Strabane and would be either relocated or abandoned.

The gas utility has a main line running along Strabane Avenue. At one point this line diverts from Strabane Avenue into Area C. This section of line would be relocated to follow along the boundary of Strabane Avenue. A branch line ties into this gas main at the George Street intersection, loops around the expanded Canonsburg site, and ties into another main located across Chartiers Creek from Area B. This branch would be disconnected at the two tie-in points and left in place.

The main overhead power lines that run along Strabane Avenue would remain active and in place. One of these, however, diverts slightly from Strabane Avenue across the southeastern tip of Area B enroute to the substation across Chartiers Creek. Another branch line runs from the substation across Area B and ties into a branch running up George Street. Both of these branch lines would be disconnected and removed. A final power line runs from the substation along the Washington-Canonsburg Street Railway right-of-way, extends to a location across Chartiers Creek to the west, and returns across the creek to a terminal near the residence at the end of George Street. This line could be left in service if it services the area across the creek; otherwise, it would be disconnected and removed.

If radioactively contaminated materials that must be excavated are found along and beneath Strabane Avenue, care would be taken during construction not to disrupt the main utility lines running along this road. Temporary utility routing may be required during the remedial action.

A sewer line running along the Washington-Canonsburg Street Railway right-of-way ending near the former Georges Pottery property has been identified. This line is assumed to be used by only the residences along Wilson Avenue. Because of its closeness to the north side of the encapsulation cell it would be removed.

2.11 REVEGETATION

All areas of the 30-acre expanded Canonsburg site disturbed by remedial action, except those to receive riprap, would be prepared and seeded with native grasses.

2.12 FENCING

After remedial action is complete, permanent fencing would be placed around the entire expanded Canonsburg site. Strabane Avenue would be fenced along both sides. The fence would be 6-foot high chain link topped with three strands of barbed wire, and would be secured with a locked gate.

Appendix A.2

SUMMARY OF CONCEPTUAL DESIGN FOR STABILIZATION OF RADIOACTIVELY CONTAMINATED MATERIALS, BURRELL TOWNSHIP, PENNSYLVANIA

SUMMARY OF CONCEPTUAL DESIGN FOR STABILIZATION OF RADIOACTIVELY CONTAMINATED MATERIALS BURRELL TOWNSHIP, PENNSYLVANIA

U.S. DEPARTMENT OF ENERGY

URANIUM MILL TAILINGS REMEDIAL ACTION PROJECT OFFICE

ALBUQUERQUE OPERATIONS OFFICE

ALBUQUERQUE, NEW MEXICO 87108

July 1983

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1 INTRODUCTION

1.1 PURPOSE

This report provides a summary of the conceptual design and other information necessary to understand the proposed remedial action at the Burrell Township, Pennsylvania site.

This summary is intended to provide sufficient detail for the reader to understand the proposed remedial action and the anticipated environmental impact. In some cases, planning assumptions have been necessary; these will be finalized during the detailed design process. Location, topography, and the extent of the radioactive contamination are shown on Figures A.2-1, A.2-2, and A.2-3, respectively.

1.2 DESIGN OBJECTIVES

The purpose of the remedial action is to stabilize the radioactively contaminated materials at the Burrell Township site in a manner that complies with the EPA standards (40 CFR 192) to prevent future health risks. Consistent with these EPA standards (40 CFR 192), and to meet other objectives, the following major design objectives have been established:

1. Reduce the average radon flux from the radioactively contaminated materials to levels less than 20 picocuries per square meter per second.

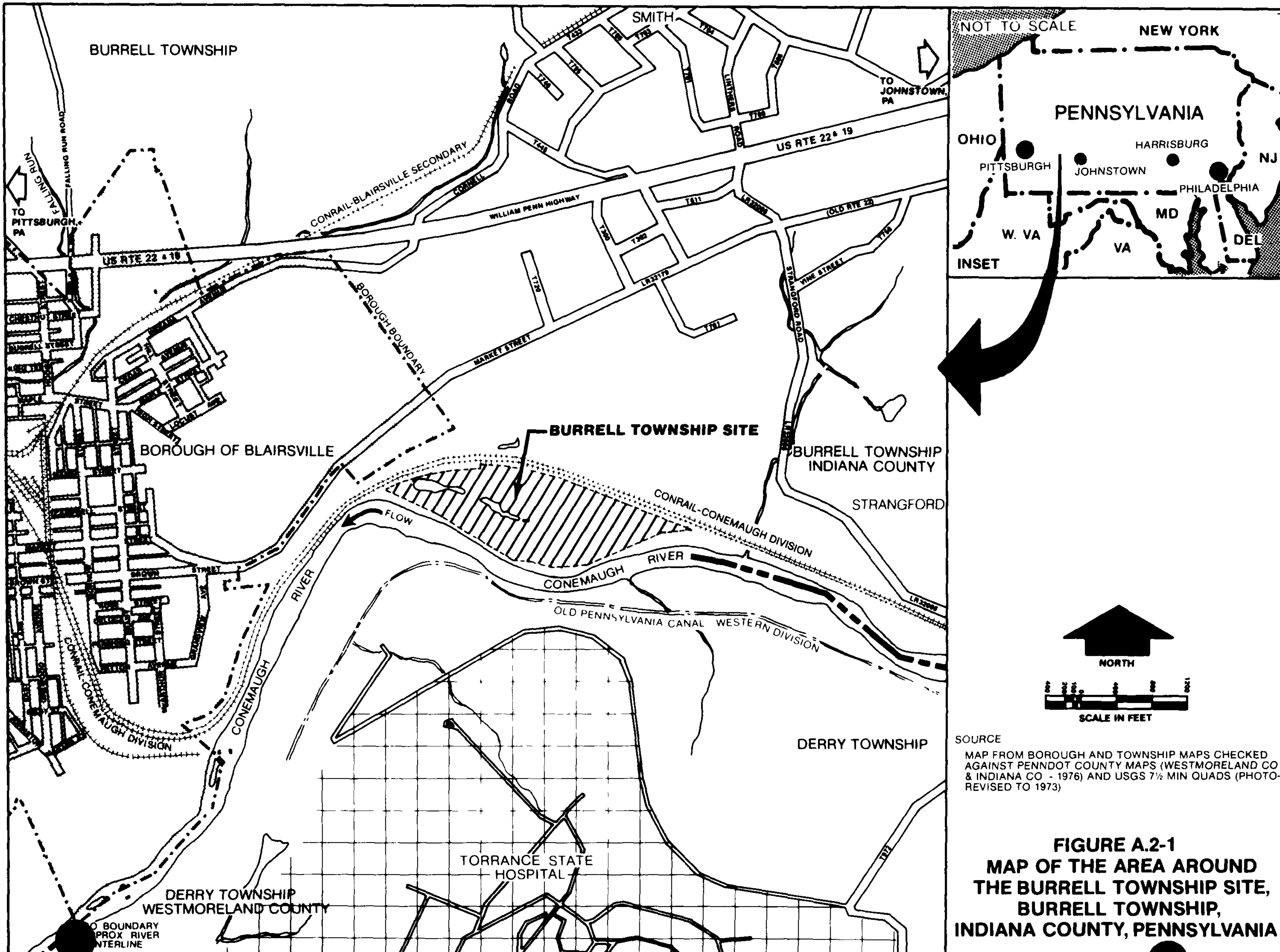
2. Design controls to be effective for up to 1000 years with minimum maintenance and a minimum design life of 200 years.

3. Discourage future excavation at the Burrell site.

4. Ensure that existing or anticipated beneficial uses of ground and surface water would not be adversely affected.

5. Reduce radioactive contaminant levels on areas released for unrestricted use to levels that do not exceed 5 picocuries of radium per gram of soil above background in the top 15 centimeters of soil, and do not exceed 15 picocuries of radium per gram of soil above background in any 15-centimeter layer below that depth (EPA, 40 CFR 192).

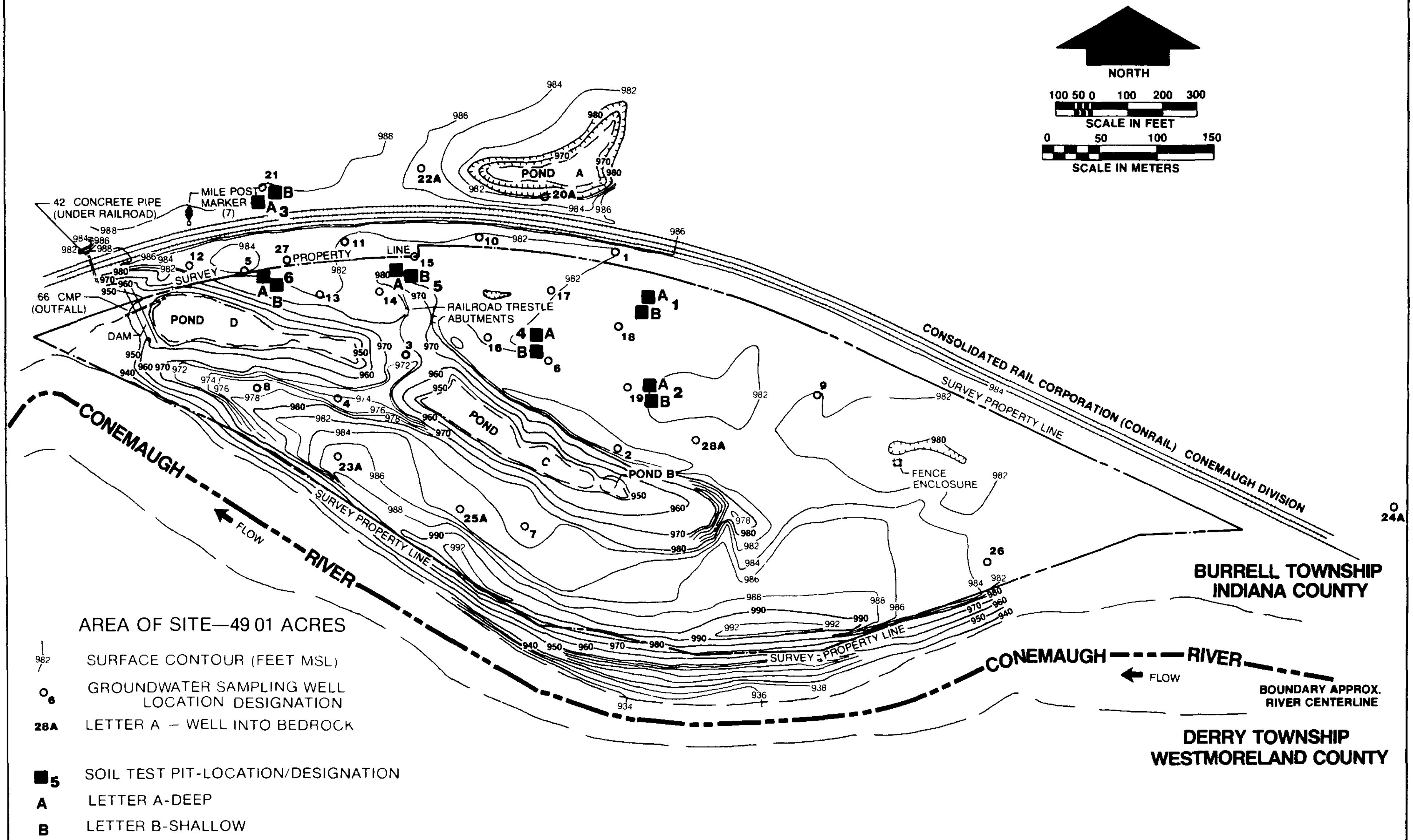
6. Radioactively decontaminate the adjacent ConRail right-of-way.



SOURCE

MAP FROM BOROUGH AND TOWNSHIP MAPS CHECKED AGAINST PENNDOT COUNTY MAPS (WESTMORELAND CO & INDIANA CO - 1976) AND USGS 7½ MIN QUADS (PHOTO-REVISED TO 1973)

FIGURE A.2-1
MAP OF THE AREA AROUND THE BURRELL TOWNSHIP SITE, BURRELL TOWNSHIP, INDIANA COUNTY, PENNSYLVANIA



NOTE
1. PROPERTY LINE DATA FROM PLAN OF PROPERTY FOR UNION CARBIDE CORP BY RICHARD G BACH & ASSOC ZELIENOPLE PA-DATED 11/16/77
2. TOPOGRAPHICAL DETAIL FROM MAP TEST HOLE LOCATIONS FOR ROY F WESTON INC BY KURCH-HOUSLEY & ASSOC PITTSBURGH PA-DATED 11/6/81 REV 3/2/82
3. ALL ELEVATIONS ARE TO USGS DATUM BLAIRSVILLE PA AND ARE SHOWN IN FT/MSL ELEVATION CHECK RUN BY KURCH-HOUSLEY PITTSBURGH PA-DATED 6/11/82

FIGURE A.2-2
TOPOGRAPHIC MAP—EXISTING CONDITIONS
BURRELL TOWNSHIP SITE

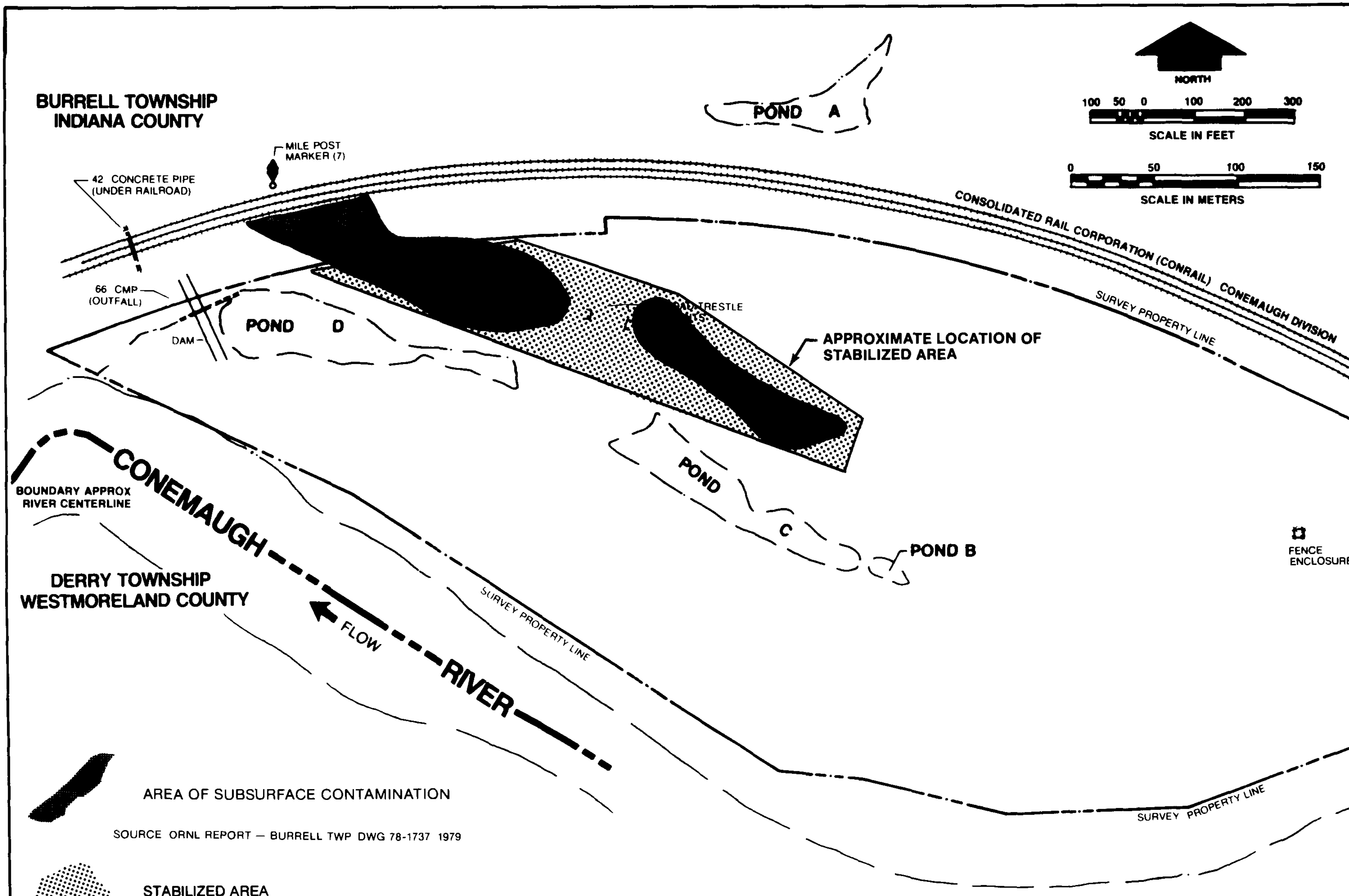


FIGURE A.2-3
AREAS OF SUBSURFACE CONTAMINATION—1977
BURRELL TOWNSHIP SITE

NOTE 1 PROPERTY LINE DATA FROM PLAN OF PROPERTY FOR UNION CARBIDE CORP. BY RICHARD G BACH & ASSOC., NOPLE, PA-DATED 11/16/77

7. Minimize releases of radioactive contamination from the Burrell site during construction.

8. Provide for erosion control during construction.

9. Minimize the areas that would be disturbed during contruction and minimize the exposure of the remedial-action workers and the public to radioactively contaminated materials.

1.3 MAJOR ELEMENTS OF THE DESIGN

The principal feature of the design concept is capping the surface of the Burrell site to control radon exhalation, inhibit water infiltration, and prevent erosion. This design would require the following major construction activities:

1. Preparation of the Burrell site, including construction of temporary roads, a railroad crossing, and erosion control facilities to protect against release of radioactively contaminated materials from the Burrell site during construction.

2. Construction of the cover system over the radioactively contaminated area to inhibit water infiltration and radon exhalation.

3. Emplacement of topsoil and erosion system on the Burrell site.

4. Seeding all disturbed areas to mitigate erosion.

1.4 PROPOSED FINAL CONDITION

The completed stabilized area would encompass about 4 acres in the northwest portion of the Burrell site. Cover material would be brought from elsewhere on the Burrell site or from the immediate area to form a low permeability cover. The surface would be graded to maximize runoff and vegetated to discourage erosion.

While the Burrell site has been designated a vicinity property, it is the DOE's intent to redesignate the Burrell site as a disposal site, and acquire and maintain title to the radioactively contaminated portion of the Burrell site. Chain-link fences with warning signs would enclose that portion of the Burrell site containing the buried radioactively contaminated materials.

2 CONCEPTUAL DESIGN

2.1 GENERAL

It is estimated that the radioactively contaminated area at the Burrell site is limited to approximately 4 acres and that its stabilization could be accomplished by covering the radioactively contaminated area with 3 feet of locally available soil, a rock or riprap layer on embankment slopes, and a final soil layer for vegetation. Additional onsite monitoring in 1984 would confirm the area involved and provide the data required for the final design of the site cover. The remainder of the Burrell site (once designated) would be graded and vegetated to allow for adequate drainage.

Radioactively contaminated materials on the adjacent ConRail right-of-way would be excavated and moved to the area of the Burrell site that is to be covered.

A soil cover would be placed over the radioactively contaminated materials. The cover would consist of soil compacted at optimum moisture content to reduce diffusion of radon and to minimize the infiltration of precipitation. The cover would be designed to reduce radon exhalation rates to less than 20 picocuries per square meter per second (EPA, 40 CFR 192).

Because of the climatic conditions at the Burrell site and the ease of establishing and maintaining vegetative cover on the Burrell site, wind erosion is not expected to have any significant effect on the long-term stability of the Burrell site. To reduce the potential for water erosion, slopes would be limited to a maximum of 1 vertical to 5 horizontal. Rock covers or riprap would be used where required to control erosion. The remainder of the Burrell site would be gently sloped with drainage swales to the onsite ponds and the Conemaugh River. The existing onsite ponds would be drained by removing the dam and the soil between ponds C and D (see Figures A.2-2 and A.2-3).

Stabilization of the radioactively contaminated materials above the ground-water level would reduce the potential for leaching and radioactive contaminant migration. The Burrell site would be designed with a low permeability cover that would reduce infiltration of precipitation, retard water flow through the Burrell site, and attenuate radioactively contaminated materials. Covering the ground surface with a sloping clayey cover would reduce the amount of infiltration from precipitation.

Radioactively contaminated materials would remain in place; however, lowering the ground-water levels by limiting infiltration would reduce leaching and radioactive contaminant migration toward the Conemaugh River. Water-soluble radioactively contaminated materials already in the ground water would continue to migrate toward the Conemaugh River. The rate of water flow and radioactively contaminated water migration is estimated to be minimal.

Concentrations of radionuclides as they discharge into the Conemaugh River would be diluted to well below the levels discussed in the EPA's hazardous waste management system guidelines (47 FR 32274; July 26, 1982) and in the relevant state (25 PA Code 93) and Federal (40 CFR 141) water quality criteria.

2.2 SITE PREPARATION

A significant quantity of vegetation including grasses, shrubs, and small trees presently grows on the Burrell site. Trees and other vegetation from nonradioactively contaminated areas that would not interfere with construction would remain intact on the Burrell site. Grasses, weeds, shrubs, and trees from radioactively contaminated areas would be reduced in size and buried on the Burrell site; organic materials would comprise no more than 5 to 10 percent by volume per lift. Vegetation from nonradioactively contaminated areas that interferes with remedial-action construction, could be cut and removed from the Burrell site or handled in the same manner as radioactively contaminated organic material.

2.3 FLOOD CONTROL

The 1972 storm resulting from Hurricane Agnes is considered a 1000-year storm. The Conemaugh River level at the Burrell site attained an elevation of 969.45 feet during this storm. The finished Burrell site would be above this level. The only anticipated remedial action below this level would be the removal of the onsite pond dams to allow drainage. All borrow and Burrell site work would be above this elevation.

2.4 EROSION CONTROL

Erosion during construction would be controlled through contouring and erosion control fences. All construction activities would be conducted in such a way as to prevent accelerated erosion and sedimentation. Channels of conveyance would limit runoff velocity by being planted with grass or lined with erosion-resistant material.

Runoff from land outside the affected areas would be diverted away from the Burrell site. Diversions could be by means of ditches or berms.

2.5 DUST CONTROL

Dust generated by excavation, earth movement, vehicle use, stockpiling, and similar activities would be controlled and minimized. It is anticipated that water with a water-based surfactant sprayed under high pressure (from trucks and hoses) would be adequate to control dust.

The sources for dust suppression water would include impounded runoff and/or potable water. Recycled water would be used as much as practicable. Conemaugh River water could be used, if practical.

The need for spraying the roads and pile areas would be determined on a day-by-day basis. The frequency of spraying would increase as combinations of low soil moisture and high wind speed conditions were encountered.

2.6 COVER

A cover system would be designed and constructed over the radioactively contaminated area to inhibit water infiltration and radon exhalation. The compacted earthern cover would reduce water infiltration to less than 10 percent of the annual precipitation at the Burrell site. Preliminary estimates indicate that a 3-foot soil cover would reduce the average radon flux from the radioactively contaminated materials to levels well below the 20 picocuries per square meter per second standard (EPA, 40 CFR 192). The cover system would be constructed of locally available borrow material amended as necessary with sodium bentonite to reduce permeability to less than 1.0×10^{-7} centimeters per second.

The final cover thickness would be determined by the characteristics of borrow materials, additional onsite monitoring, and the results of water-balance calculations.

2.7 SURFACE STABILIZATION

The side slopes of the stabilized area would be no greater than 1 vertical to 5 horizontal. To promote drainage the top would have a minimum slope of 2 percent. Portions of the Burrell site subject to erosive water velocities would be protected with rock. To ensure that the cover would withstand water erosion during the 200- to 1000-year design life, the cover for the stabilized area and the remainder of the Burrell site would be graded and corners would be rounded to avoid sharp breaks in grade. Areas of the Burrell site disturbed during construction would be revegetated.

2.8 EXISTING UTILITIES

There are no known utilities on the Burrell site.

2.9 REVEGETATION

All areas of the Burrell site disturbed by remedial action would be prepared and seeded with native grasses.

2.10 FENCING

After all remedial action is complete, permanent fencing would be placed around the Burrell site. The fence would be 6-foot high chain link topped with three strands of barbed wire, and would be secured with a locked gate.

Appendix A.3

ENERGY AND OTHER RESOURCES CALCULATIONS

The values given in the tables in this appendix are estimates of the amounts of energy and materials necessary for the entire project.

Table A.3-1. Electrical power use by alternative (kilowatt hours)

Alternative	Base	Contingency (25%)	Total
Alternative 2			
Canonsburg site			
Storage trailers (2)	112,000		
Shower/lockerroom trailer	30,250		
Hot water	3,000		
Waste-water treatment plant	7,800		
Yard lighting	24,650		
Subtotal	177,700	44,300	222,000
Burrell site			
Storage trailer	45,300		
Shower/lockerroom trailer	42,300		
Hot water	2,500		
Waste-water treatment plant	2,600		
Yard lighting	20,300		
Subtotal	113,000	27,000	140,000
Total	290,700	71,300	362,000
Alternative 3			
Canonsburg site	177,700	44,300	222,000
Burrell site			
Storage trailer	5,100		
Hot water	800		
Yard lighting	900		
Subtotal	6,800	1,700	8,500
Total	184,500	46,000	230,500

Table A.3-1. Electrical power use by alternative (kilowatt hours) (continued)

Alternative	Base	Contingency (25%)	Total
<u>Alternative 4</u>			
Canonsburg site			
Storage trailers (2)	112,000		
Shower/lockerroom trailer	60,500		
Hot water	3,600		
Waste-water treatment plant	12,000		
Yard lighting	27,000		
Subtotal	215,100	54,900	270,000
Burrell site	113,000	27,000	140,000
Hanover site			
Storage trailers(s)	115,000		
Shower/lockerroom trailer	64,500		
Hot water	3,900		
Waste-water treatment plant	10,900		
Yard lighting	28,000		
Subtotal	222,300	57,700	280,000
Total	550,400	139,600	690,000
<u>Alternative 5</u>			
Canonsburg site	215,100	54,900	270,000
Burrell site	6,800	1,700	8,500
Hanover site	222,300	57,700	280,000
Total	444,200	114,300	558,500

Table A.3-2. Fuel use by alternative (gallons)

Alternative	Base		Utilization factor	Total
<u>Alternative 2</u>				
Diesel fuel				
Canonsburg site	250,668	x	0.80	200,000
Burrell site	108,605	x	0.80	87,000
Subtotal				287,000
Gasoline				
Canonsburg site	40,300	x	0.80	32,000
Burrell site	48,680	x	0.80	40,000
Subtotal				72,000
Total				359,000
<u>Alternative 3</u>				
Diesel fuel				
Canonsburg site	228,468	x	0.85	195,000
Burrell site	90,232	x	0.85	77,000
Subtotal				272,000
Gasoline				
Canonsburg site	39,160	x	0.85	33,000
Burrell site	6,120	x	0.85	5,000
Subtotal				38,000
Total				310,000

Table A.3-2. Fuel use by alternative (gallons) (continued)

Alternative	Base		Utilization factor	Total
Alternative 4				
Diesel fuel				
Canonsburg site	663,430	x	0.90	600,000
Burrell site	108,605	x	0.80	87,000
Hanover site	607,317	x	0.80	485,000
Subtotal				1,172,000
Gasoline				
Canonsburg site	48,400	x	0.80	40,000
Burrell site	48,400	x	0.80	40,000
Hanover site	21,840	x	0.80	18,000
Subtotal				98,000
Total				1,270,000
Alternative 5				
Diesel fuel				
Canonsburg site	663,430	x	0.90	600,000
Burrell site	90,232	x	0.85	77,000
Hanover site	431,795	x	0.85	367,000
Subtotal				1,044,000
Gasoline				
Canonsburg site	48,400	x	0.80	40,000
Burrell site	6,120	x	0.85	5,000
Hanover site	20,080	x	0.80	16,000
Subtotal				61,000
Total				1,105,000

Table A.3-3. Concrete use by alternative (cubic yards)

Alternative	Waste-water treatment plants	Pads for truck wash	Stabilization of filter sludge	Total
Alternative 2				
Canonsburg site	70	190	4,850	5,000
Burrell site	70	190	1,000	1,260
Total	140	380	5,850	6,260
Alternative 3				
Canonsburg site	70	190	5,000	5,260
Total	70	190	5,000	5,260
Alternative 4				
Canonsburg site	70	190	7,500	7,760
Burrell site	70	190	1,000	1,260
Hanover site	70	190	4,250	4,510
Total	210	570	12,750	13,530
Alternative 5				
Canonsburg site	70	190	7,500	7,760
Hanover site	70	190	3,250	3,510
Total	140	380	10,750	11,270

Table A.3-4. Water use by alternative (gallons)

Alternative	Dust control	Truck cleaning	Steam cleaning	Total
Alternative 2				
Canonsburg site	150,000	1,320,000	650,000	2,120,000
Burrell site	125,000	60,000	---	185,000
Total	275,000	1,380,000	650,000	2,305,000
Alternative 3				
Canonsburg site	150,000	1,320,000	650,000	2,120,000
Burrell site	125,000	---	---	125,000
Total	275,000	1,320,000	650,000	2,245,000
Alternative 4				
Canonsburg site	1,000,000	3,700,000	650,000	5,350,000
Burrell site	125,000	60,000	---	185,000
Hanover site	1,600,000	2,400,000	---	4,000,000
Total	2,725,000	6,160,000	650,000	9,535,000
Alternative 5				
Canonsburg site	1,000,000	3,700,000	650,000	5,350,000
Burrell site	125,000	---	---	125,000
Hanover site	1,600,000	2,400,000	---	4,000,000
Total	2,725,000	6,100,000	650,000	9,475,000

Appendix A.4

ORDER-OF-MAGNITUDE COST ESTIMATES FOR PERFORMING REMEDIAL ACTION AT THE ALTERNATIVE SITES

Table A.4-1. Summary of cost estimates

Item	Site: Canonsburg	Site: Burrell	Total
Alternative 2			
General site preparation	$ 465,000[a]	$ 670,000[b]	---
Contaminated soil excavation	275,000[a]	1,816,000[b]	---
Building decontamination and demolition	925,000[a]	---	---
Waste-water treatment plant	510,000[a]	380,000[b]	---
Encapsulation	2,417,000[a]	2,320,000[b]	---
Fill importation	1,004,000[a]	1,010,000[b]	---
Standby equipment and crew[c]	500,000[a]	500,000[b]	
Subtotal	$6,096,000	$6,696,000	$12,792,000
Contingency (15 percent)[d]			$ 1,919,000
Monitoring and radiation management (15 percent)			1,919,000
Engineering and construction management (15 percent)			1,919,000
Legal, administration, and site acquisition			3,156,000
Total[e,f]			$21,705,000
Alternative 3			
General site preparation	$ 465,000[a]	$ 349,000[g]	---
Contaminated soil excavation	275,000[a]	---	---
Building decontamination and demolition	925,000[a]	---	---
Waste-water treatment plant	510,000[a]	---	---
Encapsulation	2,417,000[a]	---	---
Fill importation	1,004,000[a]	---	---
Standby equipment and crew[c]	500,000[a]	---	---
Landfill surface stabilization -- contaminated area	---	597,000[g]	---
Subtotal	$6,096,000	$ 946,000	$ 7,042,000
Contingency (15 percent)[d]			$ 1,056,000
Monitoring and radiation management (15 percent)			1,056,000
Engineering and construction management (15 percent)			1,056,000
Legal, administration, and site acquisition			3,156,000
Total[e,f]			$13,366,000

Table A.4-1. Summary of cost estimates (continued)

Item	Site: Canonsburg	Site: Burrell	Total
Alternative 4			
General site preparation	$ 465,000[h]	$ 670,000[b]	---
Contaminated soil excavation	4,610,000[h]	1,816,000[b]	---
Building decontamination and and demolition	925,000[h]	---	---
Waste-water treatment plant	510,000[h]	380,000[b]	---
Encapsulation	8,500,000[h]	2,320,000[b]	---
Fill importation	1,500,000[h]	1,010,000[b]	---
Standby equipment and crew[c]	1,000,000[h]	500,000[b]	---
Disposal site preparation	1,000,000[h]	500,000[b]	---
Disposal site waste-water treatment plant	380,000[h]	---	---
Subtotal	$18,890,000	$7,196,000	$26,086,000
Contingency (15 percent)[d]			$ 3,193,000
Monitoring and radiation management (15 percent)			3,193,000
Engineering and construction management (15 percent)			3,193,000
Legal, administration, and site acquisition			3,300,000
Total[e,f]			$38,965,000
Alternative 5			
General site preparation	$ 465,000[h]	$ 349,000[g]	---
Contaminated soil excavation	4,610,000[h]	---	---
Building decontamination and demolition	925,000[h]	---	---
Waste-water treatment plant	510,000[h]	---	---
Encapsulation	8,500,000[h]	---	---
Fill importation	1,500,000[h]	---	---
Standby equipment and crew[c]	1,000,000[h]	---	---
Landfill surface stabilization -- contaminated area	---	597,000[g]	---
Pond rehabilitation	---	1,134,000[g]	---
Disposal site preparation	1,000,000[h]	---	---
Disposal site waste-water treatment plant	380,000[h]	---	---
Subtotal	$18,890,000	$ 946,000	$19,836,000
Contingency (15 percent)[d]			$ 2,975,000
Monitoring and radiation management (15 percent)			2,975,000
Engineering and construction management (15 percent)			2,975,000
Legal, administration, and site acquisition			2,730,000
Total[e,f]			$31,491,000

[a]See Table A.4-2.

[b]See Table A.4-3.

[c]Cost of idle time for inspections, construction quality control, monitoring, and inclement weather.

[d]Based on Engineering News Record Cost Index 3560.

[e]An ion-exchange barrier may be considered a means of controlling the migration of radionuclides in or into the ground water. The approximate cost of $500,000 is not included in the total.

[f]Total does not include the cost of transporting the degradable organics (i.e., wood products) to a controlled low-level waste landfill (Richland, Washington, or Beatty, Nevada).

[g]See Table A.4-4.

[h]See Table A.4-5.

Table A.4-2. Order-of-magnitude cost estimate for the expanded Canonsburg site -- Alternatives 2 and 3

Item	Approximate cost
General site preparation	
Flood-control berm (2,400 feet)	$ 240,000
Fencing (7,000 feet)	100,000
Remove railroad embankment and track (1,900 feet)	40,000
Vehicle decontamination	30,000
Worker facility	30,000
Demobilization and cleanup	25,000
Subtotal	$ 465,000
Contaminated soil excavation (23,985 cubic yards)	
Dewater Area C	60,000
Excavation and material handling	215,000
Subtotal	$ 275,000
Building decontamination and demolition	
Building decontamination	200,000
Salvageable-steel decontamination (4,700 tons)	30,000
Building demolition	575,000
Demolition-debris handling (18,000 cubic yards)	120,000
Subtotal	$ 925,000
Waste-water treatment plant -- Subtotal	$ 510,000
Encapsulation area (6 acres)	
Liner at $200,000 per acre	$1,200,000
Material filling at $4 per cubic yard	182,000
Multilayer cover with vegetation	1,035,000
Subtotal	$2,417,000
Fill importation (24 acres)	
Minimum of 2-foot cover with vegetation -- Subtotal	$1,004,000
Standby equipment and crew (100 days at $5000 per day) -- Subtotal	$ 500,000
Total	$6,096,000

Table A.4-3. Order-of-magnitude cost estimate for the Burrell site -- Alternatives 2 and 4

Item		Approximate cost
General site preparation -- Subtotal		$ 670,000
Contaminated soil excavation		
Excavation (80,000 cubic yards at $10 per cubic yard)		800,000
Staging and loading (80,000 cubic yards at $4 per cubic yard)		320,000
Material hauling (80,000 cubic yards x $8.70 per cubic yard for 70 miles)		696,000
Subtotal		$1,816,000
Waste-water treatment plant		
Burrell		380,000
Subtotal		$ 380,000
Encapsulation area (5 acres)		
Liner at $200,000 per acre		1,000,000
Material filling at $4 per cubic yard		320,000
Multilayer cover		1,000,000
Subtotal		$2,320,000
Earth work soil importation and backfilling (16,000 cubic yards at $10 per cubic yard)		160,000
Backfilling adjacent ponds		850,000
Subtotal		$1,010,000
Preparation of new disposal[a] site -- Subtotal		$ 500,000
Standby equipment and crew (100 days at $5,000 per day) -- Subtotal		$ 500,000
Total	Alternative 2	$6,696,000
	Alternative 4	$7,196,000

[a]For Alternative 4 only.

Table A.4-4. Order-of-magnitude cost estimate for the Burrell site -- Alternatives 3 and 5

Item	Approximate cost
General site preparation	
Lightly grade 8 acres and add fill	$ 40,000
Apply topsoil on 10 acres and seed	80,000
Construct sedimentation basin and drainage	34,000
Construct access roads and install fencing	150,000
Worker facilities	20,000
Demobilize and clean up	25,000
Subtotal	$ 349,000
Landfill surface stabilization -- contaminated area	
Construct earth fill for surface slope	180,000
Install earth cover	337,000
Apply topsoil and seed	80,000
Subtotal	$ 597,000
Total	$ 946,000

Table A.4-5. Order-of-magnitude cost estimate for the Canonsburg site -- Alternatives 4 and 5

Item	Approximate cost
General site preparation	
Canonsburg (see Table A.4-2)	
Subtotal	$ 465,000
Contaminated soil excavation	
Areas A, B, and C (250,000 cubic yards at $10 per cubic yard)	2,500,000
Dewater Area C	60,000
Excavation (250,000 cubic yards at $4 per cubic yard)	1,000,000
Material hauling (250,000 cubic yards x $4.20 per cubic yard for 20 miles)	1,050,000
Subtotal	$ 4,610,000
Building decontamination and demolition (see Table A.4-2)	
Subtotal	$ 925,000
Waste-water treatment plant	
Canonsburg	510,000
Disposal site	380,000
Subtotal	$ 890,000
Preparation of a new disposal site	
Subtotal	$ 1,000,000
Encapsulation area at the Hanover site (15 acres)	
Liner at $250,100 per acre	3,000,000
Material filling at $10 per cubic yard	2,500,000
Multilayer cover at $200,000 per acre	3,000,000
Subtotal	$ 8,500,000
Soil importation and backfilling (150,000 cubic yards at $10 per cubic yard) -- Subtotal	$ 1,500,000
Standby equipment and crew (200 days at $5,000 per day)	
Subtotal	$ 1,000,000
Total	$18,890,000

Table A.4-6. Unit costs, including material, labor, and equipment

Item	Cost
Fill -- select	$ 7.65 per cubic yard
Fill -- placement	2.75 per cubic yard
Borrow and haul	5.10 per cubic yard
Clay fill -- borrow	11.17 per cubic yard
-- place	3.00 per cubic yard
Bentonite	543.00 per ton
Fill and compact (general site)	3.90 per cubic yard
Sand fill	7.15 per cubic yard
Gravel fill	6.90 per cubic yard
Clean fill	5.00 per cubic yard
Topsoil	9.40 per cubic yard
Vegetation	0.60 per square yard
Grading -- rough	2.10 per cubic yard
-- finish	0.60 per square yard
Riprap	18.25 per square yard
Basin excavation	3.10 per cubic yard
2 inches asphalt	4.50 per square yard
Concrete -- pads, etc.	275.00 per cubic yard
Fencing -- 8-foot chain link	12.00 per linear foot
-- gates	51.70 per linear foot
-- posts	131.00 each
Grating	22.50 per square foot
Dewatering	3100.00 each

Appendix A.5

ESTIMATES OF SOIL LOSSES

The following calculations indicate the amounts of soil that are expected to be removed from the sites through erosion and runoff during the various phases of the project.

Table A.5-1. Estimates of current soil loss off the sites

Symbol	Description	Site: Canonsburg	Burrell	Hanover	Basis
R	Rainfall and runoff erosivity index	150	140	150	Local conditions
K	Soil-erodibility factor	0.25	0.25	0.33	--[a]
L_s	Topographic factor	0.34	1.9	2.35	--[b]
C	Cover	0.44	0.043	0.090	--[c]
P	Supporting practices	1.0	1.0	1.0	--[d]
A	Annual soil loss (tons per acre per year)	5.61	2.86	10.47	--[e]
Ac	Acreage	30	49	50	--
SDR	Sediment delivery ratio	0.50	0.46	0.46	--[f]
T	Total annual soil loss from site (tons per year)[g]	84.15	64.46	240.81	--[g]

[a]50 percent silt at the Canonsburg and Burrell sites, 55 percent at the Hanover site. 20 percent sand at all sites. 2 percent organic material at the Canonsburg and Burrell sites, 1 percent at the Hanover site.

[b]Slopes of length 600 feet, 800 feet, and 800 feet; 2-, 6-, 7-percent grade, at the Canonsburg, Burrell, and Hanover sites, respectively.

[c]Assumes: Canonsburg site -- An average based on a mixture of lawn, gravel, scrub vegetation and dredged material.
Burrell site -- 80 percent cover of low-growing vegetation; no appreciable canopy.
Hanover site -- 80 percent cover of low-growing vegetation; no appreciable canopy.

[d]Not applicable -- applies only to intensive farming practices.

[e]Using the Universal Soil Loss Equation (U.S. EPA, 1975):

$$A = R \times K \times L_s \times C \times P.$$

[f]SDR (sediment delivery ratio) -- Obtained from SCS National Engineering Handbook, Section 3, "Sedimentation," Chapter 6, "Sediment Sources, Yields, Delivery Ratios," Figure 6-2.

[g]$T = R \times K \times L_s \times C \times P \times$ total acreage $\times$ SDR.

Table A.5-2. Estimates of soil loss off the sites during construction

Symbol	Description	Site			Basis
		Canonsburg	Burrell	Hanover	
R	Rainfall and runoff erosivity index	150	140	150	Local conditions
K	Soil-erodibility factor	0.25	0.25	0.33	--[a]
L_s	Topographic factor	0.34	1.9	2.35	--[b]
C	Cover	1.0	1.0	1.0	--[c]
P	Supporting practices	1.0	1.0	1.0	--[d]
A	Annual soil loss (tons per acre per year)	12.75	66.5	116	--[e]
Ac	Acreage	30	49	50	--
SDR	Sediment delivery ratio	0.50	0.46	0.46	--[f]
T	Total annual soil loss from site (tons per year)[g]	191.25	1498.91	2668.00	--[g]

[a]50 percent silt at the Canonsburg and Burrell sites, 55 percent at the Hanover site. 20 percent sand at all sites. 2 percent organic material at the Canonsburg and Burrell sites, 1 percent at the Hanover site.

[b]Slopes of length 600 feet, 800 feet, and 800 feet; 2-, 6-, 7-percent grade, at the Canonsburg, Burrell, and Hanover sites, respectively.

[c]Assumes no ground cover.

[d]Not applicable -- applies only to intensive farming practices.

[e]Using the Universal Soil Loss Equation (U.S. EPA, 1975):

$$A = R \times K \times L_s \times C \times P.$$

[f]SDR (sediment delivery ratio) -- Obtained from SCS National Engineering Handbook, Section 3, "Sedimentation," Chapter 6, "Sediment Sources, Yields, Delivery Ratios," Figure 6-2.

[g]$T = R \times K \times L_s \times C \times P \times$ total acreage $\times$ SDR.

Table A.5-3. Estimates of soil loss off the sites after remedial action

Symbol	Description	Site: Canonsburg	Burrell	Hanover	Basis
R	Rainfall and runoff erosivity index	150	140	150	Local conditions
K	Soil-erodibility factor	0.25	0.25	0.33	--[a]
L_s	Topographic factor	0.34	1.9	2.35	--[b]
C	Cover factor	0.003	0.003	0.003	--[c]
P	Supporting practices	1.0	1.0	1.0	--[d]
A	Annual soil loss (tons per acre per year)	0.038	0.199	0.349	--[e]
Ac	Acreage	30	49	50	--
SDR	Sediment delivery ratio	0.50	0.46	0.46	--[f]
T	Total annual soil loss from site (tons per year)	0.57	4.48	8.03	--[g]

[a]50 percent silt at the Canonsburg and Burrell sites, 55 percent at the Hanover site. 20 percent sand at all sites. 2 percent organic material at the Canonsburg and Burrell sites, 1 percent at the Hanover site.

[b]Slopes of length 250 feet, 800 feet, and 800 feet; 2-, 6-, 7-percent grade, at the Canonsburg, Burrell, and Hanover sites, respectively.

[c]Assumes 95 to 100 percent ground cover with herbaceous plants and decaying duff or litter at least 2 inches deep.

[d]Not applicable -- applies only to intensive farming practices.

[e]Using the Universal Soil Loss Equation (U.S. EPA, 1975):

$$A = R \times K \times L_s \times C \times P$$

[f]SDR (sediment delivery ratio) -- Obtained from SCS National Engineering Handbook, Section 3, "Sedimentation," Chapter 6, "Sediment Sources, Yields, Delivery Ratios," Figure 6-2.

[g]$T = R \times K \times L_s \times C \times P \times$ total acreage $\times$ SDR.

Table A.5-4. Estimates of soil loss for 1000 years[a]

	Site	
Canonsburg	Burrell	Hanover
0.12 inch	0.56 inch	0.98 inch

[a]Based on the following:

$$1{,}000\text{-yr soil loss (in.)} = \frac{\text{Total annual soil loss after remedial action}\left(\frac{\text{tons}}{\text{yr}}\right) \times 2{,}000\left(\frac{\text{lbs}}{\text{ton}}\right) \times 1{,}000\ \text{yrs} \times 12\left(\frac{\text{in.}}{\text{ft}}\right)}{\text{Area (acres)} \times 43{,}560\left(\frac{\text{sq ft}}{\text{acre}}\right) \times 90\left(\frac{\text{lbs}}{\text{cu ft}}\right)}$$

Appendix A.6

BORROW PITS

Appendix A.6

BORROW PITS

Local contractors in the Canonsburg Borough and Hanover Township areas have borrow pits with the necessary quantities of soil for rehabilitation of either site. The approximate locations and distances to several sites are shown in Table A.6-1. At the present time there are no known active borrow pits in the area near the Burrell site.

It should be pointed out that between now and the actual initiation of cleanup activities these borrow pits may become unavailable, or possibly new, closer pits would be developed. It has been our experience that once a project is slated for startup many contractors and landowners would have the quantity and type of fill required. Prior to beginning any construction activities, all necessary soil testing would be completed to ensure receiving suitable clean soil.

Table A.6-1. Borrow pit locations

Site	Location	Distance to site (miles) Canonsburg	Hanover
Houston	Pike Street	2	10
Houston	Route 519	2	10
Hickory, PA	Route 50	10	10
Bavington	Route 22	17	10
M&M site	Route 18	24	3

Source: Batty, 1982; Orient, 1982.

REFERENCES FOR APPENDIX A

Batty, F., 1982. Batty Excavating, Washington, Pennsylvania, Telephone conversation with Dr. M. V. Mellinger, Roy F. Weston, Inc., West Chester, Pennsylvania on September 10, 1982.

Orient, D., 1982. M&M Equipment Company, Florence, Pennsylvania, Telephone conversation with Dr. M. V. Mellinger, Roy F. Weston, Inc., West Chester, Pennsylvania on September 8, 1982.

Rogers, V. C., G. M. Sandquist, and K. K. Nielson, 1981. Radon Attenuation Effectiveness and Cost Optimization of Composite Covers for Uranium Mill Tailings, RAECO (Rogers and Associates Engineering Corporation), Salt Lake City, Utah.

U.S. DOE (Department of Energy), Uranium Mill Tailings Remedial Action Project Office, Albuquerque Operations Office, 1983. Remedial Action Plan of the Inactive Uranium Mill Tailings Site at Canonsburg, Pennsylvania, UMTRA-DOE/ AL , Albuquerque, New Mexico.

U.S. EPA (Environmental Protection Agency), 1975. Control of Water Pollution from Cropland, Volume I, EP-600/2-75-026a.

Appendix B

METEOROLOGICAL AND AIR QUALITY INFORMATION

Appendix B.1

METEOROLOGICAL MONITORING PROGRAMS

Appendix B.1

METEOROLOGICAL MONITORING PROGRAMS

The meteorological monitoring system employed at the Canonsburg site is the Climatronics Electronic Weather Station (EWS). The electronic weather station is composed of six individual meteorological sensors and a recording device. It continually monitors and records specific meteorological parameters. By using alternating and direct current operation the electronic weather station can operate unattended for as long as 31 days using 115-volts alternating current line power or two standard 6-volt lantern batteries. The recorder and batteries are solid state, and are housed in a weatherproof fiberglass enclosure. The sensors may be located as far as 1000 feet from the recorder without a loss of accuracy.

The meteorological parameters monitored at the Canonsburg site are wind speed, wind direction, relative humidity, temperature, integrated solar radiation, and precipitation. Wind speed is sensed by a photochopper using a solid-state light source. Wind direction is sensed by a precision potentiometer with 540-degrees output (eliminating the problem of crossover). The relative humidity sensor enables full range measurement (0 to 100 percent) between $-30^{o}C$ and $+50^{o}C$. The temperature sensor utilizes a precision thermistor with $0.5^{o}C$ accuracy. Solar radiation is measured by a photovoltaic sensor. Precipitation is measured by a tipping rain and snow gauge with 0.01-inch resolution. The specifications for the individual sensors and for the recorder are contained in Table B.1-1.

The recorder prints through the impinging action of its two styluses driven by the chopper bar against the pressure-sensitive chart paper. Its presentation is a series of dots appearing as a continuous line. The recorder contains a multiplexer that allows the six meteorological parameters to be recorded on the chart paper simultaneously. The recorder operates by swinging each stylus to three separate zones on each half of the chart paper.

Recording on the chord of the stylus arch by the edge of the chopper bar is possible because the styluses are able to write along their length rather than at their points. This results in chart paper printed with straight lines and rectilinear recordings.

The standard electronic weather station chart operates at 1 inch per hour. Therefore, 24 hours of operation are recorded over 24 inches of chart paper. The entire length of the paper roll is printed with hours (1 to 12) along the left margin and horizontal lines marking each 15 minutes (1/4 inch) interval. The electronic weather station recorder contains an internal timing mark which provides a check of the drive mechanism. All sensors come to rest for 5 minutes every 24 hours, which results in a zero printout on the chart paper.

Table B.1-1. Specifications of the Climatronics Electronic Weather Station

Sensor	Accuracy	Range	Distance or time constant	Threshold	Damping ratio
Sensor specifications (metric)					
Wind speed	0.011 m/sec or 1.5 percent	0 to 50 m/sec	2.4 m	0.33 m/sec	
Wind direction	±1.5 percent	0 to 360° mechanical 0 to 540° electronic	2.4 m	0.33 m/sec	0.4 to 0.6
Relative humidity	±2 percent 0 to 100 percent	0 to 100 percent	10 sec		
Temperature	±0.55°C	-30° to +50°C	10 sec		
Integrated solar radiation	±3 percent	0 to infinity, in 2 Langley steps and 20 Langley cycles			
Precipitation	±1 percent	0 to infinity, in 0.0254-cm and 0.254-cm cycles			

Sensor	Range	Chart resolution
Electronic weather station recorder specifications (metric)		
Wind speed	0 to 25 m/sec 0 to 50 m/sec	0.22 m/sec
Wind direction	0 to 540°C	±5°
Relative humidity	0 to 100 percent	±2 percent
Temperature	-30°C to +20°C 0°C to +50°C	0.55°C
Integrated solar radiation	0 to ∞ Langleys	2 Langleys/division
Precipitation	0 to ∞ cm (0.0254-cm events)	0.0254 cm

Source: Climatronics service manual.

The electronic weather station includes a method for site calibration during use. Each parameter is calibrated against a precision internal reference source. The procedure is accomplished by adjusting specific potentiometers contained on an extender board within the recorder. Calibration of the electronic weather station at the Canonsburg site is performed once a month in conjunction with changing the chart paper rolls and batteries.

The Canonsburg site meteorological monitor was installed in April 1979, and has been operating continuously since then. The sensors are situated at the top of a 33-foot tower on the highest level of Building 10 (Figure 1-3). This configuration represents the optimum location within the site confines, minimizing the effects of site structures on wind conditions.

An identical station was installed at the Burrell site in May 1981. The system was located in the open area in the western portion of the site, with the sensors placed on the top of a 33-foot tower which was cemented into the ground. In an effort to prevent vandalism, a cyclone fence with three strands of barbed wire on top was erected around the unit. Within one month, however, the sensors were shot off the tower and the tower stolen from the site. Because of the expense of the system and the inability to provide complete security, the unit was not replaced.

Just under one-month's data was recovered from the Burrell site unit. Because of their similar settings (within valleys) and relative closeness (50 miles) these data were compared with data recorded at the Canonsburg site during the same time period. This comparison revealed that the Canonsburg site wind data could be applied to the Burrell site if an adjustment was made in wind direction values to reflect the difference in valley orientation. The wind speeds did not require any adjustments.

The Hanover site is similar to the Burrell site in that it is an open, easily-accessible property. Therefore, although site-recorded meteorological data would be desirable, it was ruled out. This site is fairly close to the Pittsburgh International Airport (13 miles) and has a similar topographic setting (i.e., both are located on ridge tops). Thus, the airport data were determined to be applicable to the Hanover site.

The results of the temperature data available to date are given in Table B.1-2, and the wind data are depicted on Figures B.1-1, B.1-2, and B.1-3.

Table B.1-2. Temperatures

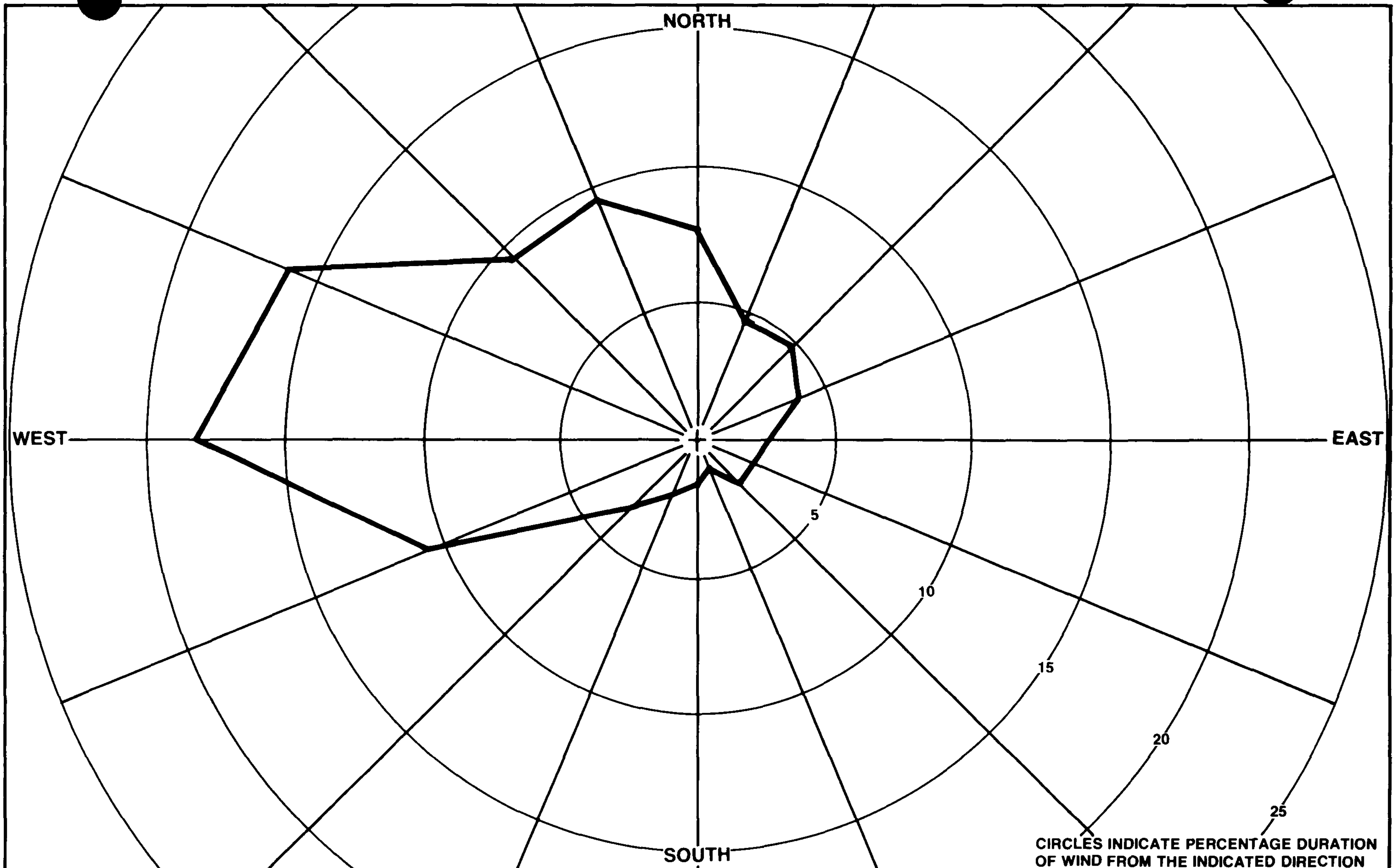
Category	Site: Canonsburg[a]	Site: Burrell[b]	Site: Hanover[c]
	(Temperature, °F)		
Average annual	50	50	50
Maximum[d] winter	63		39
Average winter	28	30	32
Minimum[d] winter	-6		-18
Maximum[d] spring	82		87
Average spring	50	49	51
Minimum[d] spring	30		15
Maximum[d] summer	95		99
Average summer	70	68	73
Minimum[d] summer	36		34
Maximum[d] fall	88		97
Average fall	50	52	52
Minimum[d] fall	10		-1

[a]Based on onsite data collected from 1979 to 1981.

[b]Based on data collected at the Indiana Airport, Indiana, Pennsylvania from 1967 to 1981. Maximum and minimum temperatures are not available for Burrell.

[c]Based on data collected at the Greater Pittsburgh International Airport from 1953 to 1981.

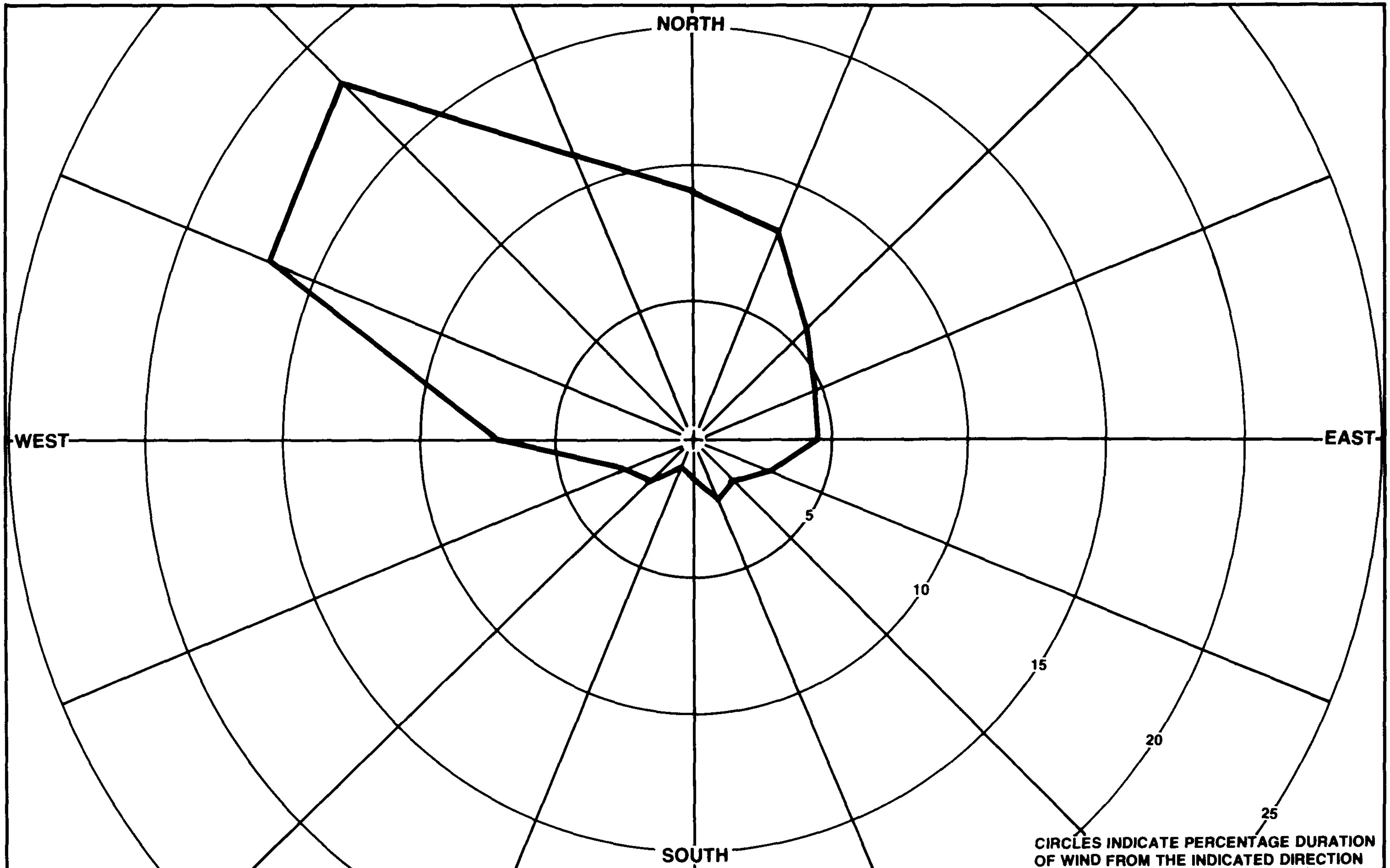
[d]The highest and lowest temperatures recorded during the period of record.



CANONSBURG SITE (FOR THE PERIOD MAY 1979 TO APRIL 1980)

SOURCE: DATA FROM METEOROLOGICAL TOWER-ON SITE
CANONSBURG SITE

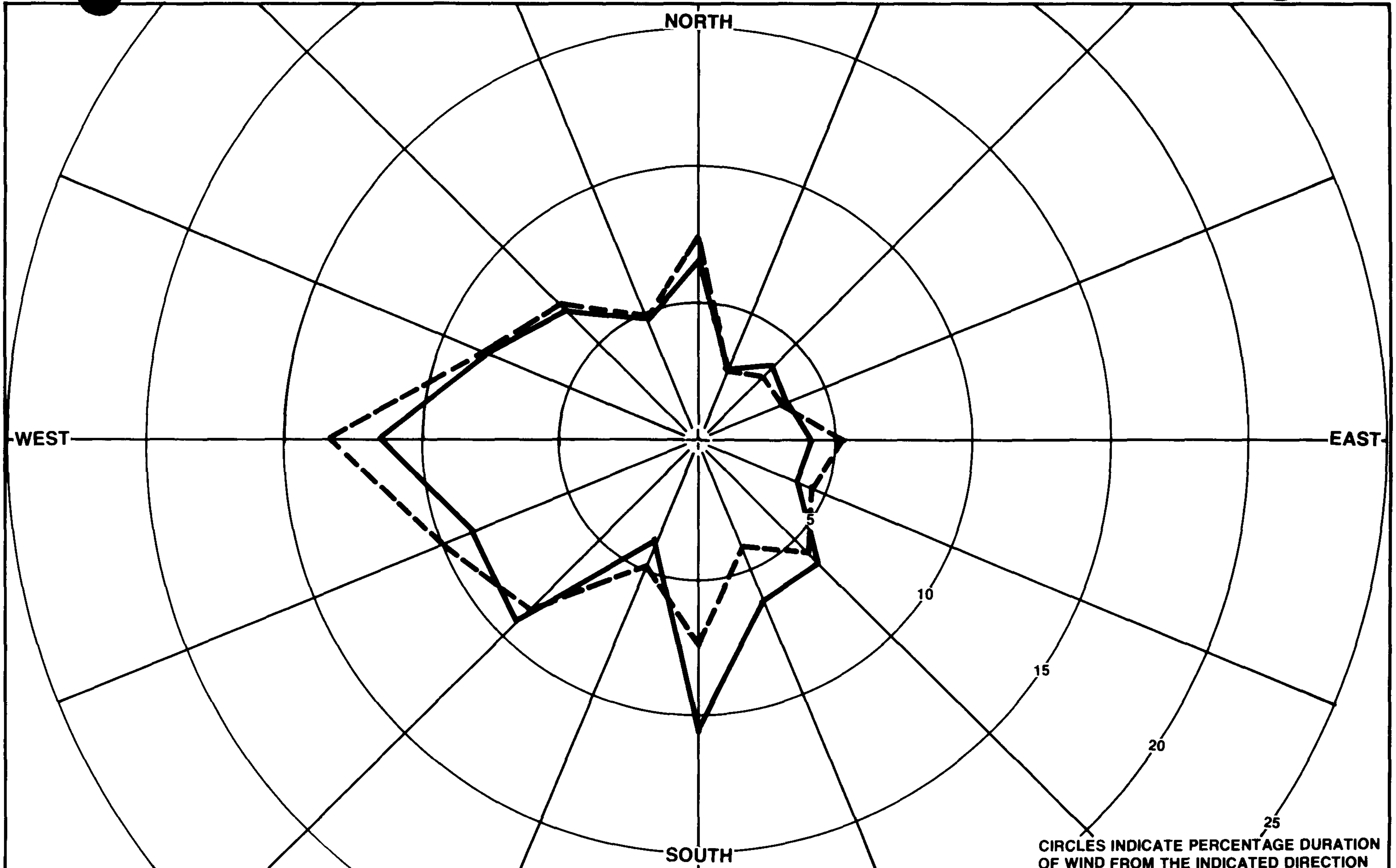
FIGURE B.1-1
ANNUAL AVERAGE WIND FREQUENCY POLYGON FOR THE VICINITY OF THE CANONSBURG SITE



BURRELL TOWNSHIP SITE (FOR THE PERIOD MAY 1979 TO APRIL 1980)

SOURCE: CANONSBURG DATA ADJUSTED FOR TOPOGRAPHY IN THE VICINITY OF THE BURRELL TOWNSHIP SITE

FIGURE B.1-2
ANNUAL AVERAGE WIND FREQUENCY POLYGON FOR THE VICINITY OF THE BURRELL TOWNSHIP SITE



ANNUAL AVERAGE (FOR THE PERIOD MAY 1979 TO APRIL 1980)

10 YEAR ANNUAL AVERAGE (FOR THE PERIOD 1967 TO 1976)

GREATER PITTSBURGH INTERNATIONAL AIRPORT DATA
(APPROX 12 MILES TO N E OF HANOVER TWP SITE)

FIGURE B.1-3
ANNUAL AVERAGE WIND FREQUENCY POLYGON
FOR THE VICINITY OF THE HANOVER TOWNSHIP SITE

Appendix B.2

NONRADIOLOGICAL AIR-QUALITY INFORMATION

Appendix B.2

NONRADIOLOGICAL AIR-QUALITY INFORMATION

B.2.1 Background

The proposed activities for each alternative would result in the emission of criteria pollutants at each of the sites. The following pollutants could potentially be emitted:

1. Total suspended-particulates (TSP).
2. Carbon monoxide (CO).
3. Nitrogen oxides (NO_x).
4. Sulfur dioxide (SO_2).
5. Hydrocarbons (HC). Although the EPA has revoked the primary and secondary NAAQS (40 CFR 50) for hydrocarbons (48 FR 628-629, January 5, 1983), the revoked hydrocarbon standard is still included for completeness.

These pollutants could be emitted in a variety of activities. Gaseous pollutants (CO, NO_x, SO_2, HC), could be generated by construction vehicles on the site, as well as by trucks bringing clay and fill material onto the site and removing radioactively contaminated materials. Total suspended-particulate emissions could be generated by the following:

1. General construction activities: demolition and earth-moving.
2. Truck traffic on unpaved roads.
3. Storage-pile stacking.
4. Wind erosion from storage piles.
5. Exhaust emissions from construction vehicles and trucks.

The emissions from these activities were calculated for each site and alternative based on the following engineering information:

1. Number and type of construction vehicles on the site for each period and alternative.

2. Number of truck-hauling trips per day for each period and alternative.

3. Amount of fill, clay, and demolition material stacked during each period and the size of the piles.

4. Size of the active construction area at each site.

The first step required to determine the ambient air-quality impacts of any of the proposed remedial actions is to determine the emission rate for each criteria pollutant under each of the remedial-action alternatives. Subsequent subsections of this appendix include a description of the methods used to calculate the emission rates. All emission rates were calculated using EPA emission factors such as those contained in the AP-42 publication (U.S. EPA, 1977), which was used to calculate the vehicle-exhaust-emission rates.

The second step in the analysis is to use an air-pollution dispersion model to estimate the offsite ambient air quality impacts of each alternative. The models used for this determination are part of the EPA-approved UNAMAP Version 4 series, and include a climatological area-source screening model, the Climatological Dispersion Model (Busse and Zimmerman, 1977), and the more sophisticated dispersion model, Industrial Source Complex model (both the short- and long-term versions (Bowers et al., 1979)). The modeling assumptions used for calculating both short-term (1-hour, 3-hour, 8-hour, 24-hour) and long-term (annual) ambient air-quality impacts for each alternative and site are described in subsequent subsections of this appendix.

The final step in the analysis involves combining the model predicted incremental concentrations, and the assumed background (25 PA Code 131) concentrations, and comparing the result to national (40 CFR 50) and Commonwealth ambient air-quality standards (Table B.2-1) in order to determine whether any of the remedial-action alternatives will result in significant offsite concentration levels that may exceed the applicable standards.

B.2.2 Vehicle exhaust emission rate calculations

The exhaust emission rate for all criteria pollutants emitted by the construction and hauling vehicles (trucks, bulldozers, scrapers, rollers, etc.) used on the site were computed using AP-42 (U.S. EPA, 1977) emission factors. The emission factors for both heavy-duty diesel and gasoline-powered construction vehicles were used to calculate the emission rates of these pollutants (Table B.2-2). The maximum emission rate was calculated as follows:

$$\text{Emission rate (grams per second)} = \frac{\text{(Vehicle emission factor in grams per hour)} \times \text{(\% used)}}{3600 \ \frac{\text{seconds}}{\text{hour}}}$$

Table B.2-1. Air quality standards

National Ambient Air-Quality Standards (NAAQS) (40 CFR 50)

Pollutants	Averaging times					
	1 hour	3 hours	8 hours	24 hours	1 quarter	1 year
Carbon monoxide (mg/cu m)	40.0		10.0			
Nonmethane hydrocarbons (μg/cu m)		160.	(6:00 a.m. - 9:00 p.m.)			
Nitrogen dioxide (μg/ cu m)						100.
Ozone (μg/cu m)	235.					
Total-suspended particulates ($\mu g/m^3$)				260 150[a]		75[a] 60[b]
Sulfur dioxide (μg/cu m)		1300[a]		365.		80.
Lead ($\mu g/m^3$)					1.5	

Pennsylvania Ambient Air-Quality Standards (25 PA Code 131)

Pollutant	Averaging times			
	1 hour	24 hours	30 days	1 year
Settleable particulates (tons/square mile/month)			43	23
Beryllium ($\mu g/m^3$)			0.01	
Sulfates ($\mu g/m^3$)		30	10	
Fluorides ($\mu g/m^3$) (total soluble as hydrogen fluoride)		5		
Hydrogen sulfide (ppm)	0.1	0.005		

[a]Secondary standards.

[b]Value is a guide to be used in assessing implementation plans for achieving the annual maximum 24-hour standard.

Table B.2-2. AP-42 (U.S. EPA, 1977) emission factors for diesel- and gasoline-powered construction vehicles

		Emission factor (grams per hour (g/hr))					
Vehicle	Fuel	TSP	CO	NO_x	SO_2	HC	Percent used[a]
Wheeled tractor	Diesel	61.5	973	451	40.9	68.4	100
Wheeled dozer	Diesel	75	335	2290	158	104	80
Scraper	Diesel	184	660	2820	210	284	80
Motor grader	Diesel	27.7	97.7	478	39.0	25.2	80
Wheeled loader	Diesel	77.9	251	1090	82.5	86.4	90
Off-highway truck	Diesel	116	610	3460	206	198	80
Roller	Diesel	22.7	83.5	474	30.5	25.2	100
Miscellaneous	Diesel	63.2	188	1030	64.7	72.0	60
Wheeled loader	Gas	13.5	7060	235	10.6	86.4	50
Miscellaneous	Gas	11.7	7720	187	10.6	255	100

[a]Percent used reflects the maximum percentage of the time in an 8-hour work day that the equipment is used on the site.

The emission rate for each vehicle, alternative, and site was calculated for the total time required to perform each remedial action and the total per-period-emission rate for each pollutant for each site and alternative was computed by summing the emissions for each pollutant from all vehicles used in each period for each alternative and site. The annual average emission rate of exhaust pollutants for each site and alternative was calculated by averaging the per-period emission rates (Table B.2-3). The annual emissions were also based on a maximum of 250 days of operation (i.e., no weekend or holiday activities).

The maximum 1-hour, 3-hour, or 8-hour exhaust emission rates were determined by using the maximum emission rate in any period for each site. The maximum 24-hour emission rate was determined by dividing the value in Table B.2-3 by 3. This represents the proportion of the day that the activities are generating emissions (assuming an 8-hour work day) (Table B.2-4).

B.2.3 Construction activity emission-rate calculation

Construction emissions due to demolition and earth-moving activities on the site were calculated using AP-42 (U.S. EPA, 1977) emission factors. The EPA emission factor is based on a silt content of 30 percent in the material being used. Other variables and assumptions being used in calculating the construction activity emission rates are as follows:

1. The quantity of dust generated is proportional to the amount of activity and the area being worked.

2. The emission rate only includes particles less than 100 micrometers.

3. A conservative Thornwaite Precipitation-Evaporation Index (PE) value of 50 (i.e., a semi-arid climate) was used to reflect potential short-term, extended dry periods experienced at all sites. The annual average value of 100 for the area was used for long-term emissions.

Using these conservative assumptions, the maximum per acre emission rate for particulates is 1.2 tons per acre per month of activity, or an average of 0.42 gram per acre per second. The maximum potential-emission rate was scaled on the basis of the level of construction activity for each period. During the most active construction period (based on the number of construction vehicles and trucks working at the site) the emission rate was assumed to be equal to the rates just given. The emission rates for other periods of activity were reduced to reflect the level of activity; i.e.,

$$\text{Emission rate for period (g/area-sec)} = \frac{\text{Vehicles in period}}{\text{Maximum number of vehicles in any period for the site}} \times \text{Maximum emission rate}$$

Table B.2-3. Annual average exhaust emission rate of onsite construction vehicles and trucks for criteria pollutants[a]

Alternative	Site	Emission rate (g/sec)				
		TSP	CO	NO_x	SO_2	HC
2	Canonsburg	0.057	3.60	1.65	0.15	0.057
	Burrell	0.044	2.77	0.91	0.088	0.044
3	Canonsburg	0.057	1.94	1.54	0.14	0.041
	Burrell	0.029	2.83	0.99	0.095	0.029
4	Canonsburg	0.065	3.22	2.02	0.19	0.057
	Burrell	0.044	2.77	0.91	0.088	0.044
	Hanover	0.072	2.08	2.09	0.20	0.084
5	Canonsburg	0.065	3.22	2.02	0.19	0.057
	Burrell	0.029	2.83	0.99	0.095	0.029
	Hanover	0.076	1.80	2.05	0.196	0.088

[a]Annual emission rates based on an 8-hour day, 250-day operating period.

Table B.2-4. Maximum exhaust emission rates of onsite construction vehicles and trucks for criteria pollutants[a]

Alternative	Site	Emission rate (g/sec) TSP	CO	NO_x	SO_2	HC
2	Canonsburg	0.37	19.00	13.70	1.26	0.51
	Burrell	0.37	25.05	9.48	0.88	0.42
3	Canonsburg	0.37	19.34	10.28	0.97	0.28
	Burrell	0.20	17.30	6.48	0.59	0.19
4	Canonsburg	0.45	21.55	13.46	1.29	0.49
	Burrell	0.37	25.05	9.48	0.88	0.42
	Hanover	0.32	19.66	20.16	2.17	1.24
5	Canonsburg	0.45	21.55	13.46	1.29	0.49
	Burrell	0.20	17.30	6.48	0.59	0.19
	Hanover	0.66	19.66	20.16	2.17	1.24

[a]These values were used to calculate the 1-hour, 3-hour, 8-hour, and 24-hour exhaust emission rates. The maximum 24-hour exhaust emission rates can be determined by dividing these values by 3.

B.2.4 Fugitive emissions from roadways

The per-vehicle emission rate for particulates generated by vehicular activity on unpaved roadways was calculated using the approach suggested by Cowherd et al. (1979). Based on empirical data, the roadway emissions can be calculated using the following formula:

$$\text{Emission rate (lbs/vehicle-mile)} = 5.9 \left(\frac{s}{12}\right) \left(\frac{S}{30}\right) \left(\frac{W}{3}\right)^{0.7} \left(\frac{w}{4}\right)^{0.5} \left(\frac{d}{365}\right)$$

Where:

- s = Percent silt content of roadway dust.
- S = Average vehicle speed (mph).
- W = Vehicle weight (tons).
- w = Average number of wheels per vehicle.
- d = Dry days per year (precipitation 0.01 inch).

For each site the values for each of these parameters and the miles of roadway traveled on the site per hour and the per-vehicle-emission rate in grams per second are shown in Table B.2-5. These values were used in conjunction with the number of truck trips per hour at each site for each period and alternative to calculate the gram per second emission rate associated with fugitive-roadway emissions. Thus, the emission rate is given by:

$$\text{Emission rate (g/sec)} = \frac{\text{Emission rate (g/vehicle-mile) x vehicle miles/hour}}{\text{(3600 sec/hr)}}$$

Table B.2-5. Fugitive roadway-emission-parameter values

Silt content of roadway dust	Vehicle speed	Number of wheels/vehicle	Vehicle weight	Dry days
20%	20 mph	16	40 tons	212

	Miles of roadway[a]/hr	Emission rate (g/sec-vehicle)
Canonsburg	0.57	3.36
Burrell	0.57	3.36
Hanover	1.9	11.5

[a]Miles of roadway estimated in engineering design.

B.2.5 Storage-pile-stacking emissions

The emissions associated with stacking fill, clay, and potentially radioactive materials from truck-loading and dumping activities were calculated. The formula (Cowherd et al., 1979) used to make this calculation is as follows:

$$\text{Emission rate (lbs/ton stacked)} = \frac{(0.0018)\ (\frac{S}{5})\ (\frac{U}{5})\ (\frac{H}{10})}{(\frac{M}{2})}$$

Where:

S = Silt content of materials (20 percent, based on information given in Cowherd et al., 1979).
U = Annual average wind speed (miles per hour). (Canonsburg site 4.7, Burrell site 4.7, Hanover site 9.4.)
H = Drop height (10 feet).
M = Moisture content of materials (2 percent).

The emission rates calculated for each site using these values are as follows:

Canonsburg site	3.07 grams per ton stacked
Burrell site	3.07 grams per ton stacked
Hanover site	6.14 grams per ton stacked

Each of these emission rates was multiplied by the number of tons stacked per day for each period divided by the 28,800 seconds in an 8-hour day in order to calculate the maximum per-period emission rate in grams per second.

B.2.6 Wind erosion from storage piles

The emissions associated with wind erosion from storage piles were calculated using the emission-rate formula contained in Cowherd et al. (1979). The formula used to calculate the emission rate is:

$$\text{Emission rate (lbs/ton)} = 0.05\ (\frac{S}{1.5})\ (\frac{d}{235})\ (\frac{f}{15})\ (\frac{D}{90})$$

Where:

S = Silt content of material (20 percent).
d = Number of dry days (precipitation less than or equal to 0.01 inch) (212 days).
f = Percent of time wind speed is greater than 12 miles per hour (Canonsburg site 6.3, Burrell site 6.3, Hanover site 18.8).
D = Duration of material storage (90 days).

The percentages for wind speed greater than 12 miles per hour were obtained from meteorological measurements for 1979-1980. The duration of the 90-day storage cycle is conservative in that it is likely that most materials will be stored less than 90 days. Using this formula and the values just listed, the pound per ton emission rate for each site is as follows:

Canonsburg site	0.25 lb/ton	or	113 g/ton
Burrell site	0.25 lb/ton	or	113 g/ton
Hanover site	0.75 lb/ton	or	340 g/ton

For each period, the amount of material stored (in tons) was multiplied by the emission rate just given, and divided by the total number of seconds in the month to determine the gram per second emission rate for each period.

B.2.7 Mitigative measures for control of fugitive particulates

The fugitive-emission rate for total suspended particulates due to the remedial-action alternatives may cause violations of the total suspended-particulate standards at some sites for some of the alternatives. In order to reduce the emissions, the following mitigative measures were assumed:

1. All roadways for truck-hauling operations will be sprayed with a dust suppressant (e.g., surfactants) monthly in order to reduce fugitive roadway emissions.

2. All storage piles will be sprayed with water or other dust suppressants during dry periods to reduce fugitive wind-blown emissions.

3. Construction areas will be sprayed with water or other dust suppressants during dry periods to reduce fugitive construction emissions.

It is anticipated that these recommended measures can reduce fugitive emissions by 90 percent, based on data referenced in Cowherd et al. (1979). This is slightly above the mid-range of the expected emission reductions (80 to 95 percent). If a higher reduction (i.e., 95 percent) is achieved, the fugitive emissions would be reduced by a factor of 2. If additional total suspended-particulate-emission reductions are required, other mitigative measures, such as those listed in Table B.2-6, could be employed.

Table B.2-6. Example of reasonable precautions for prevention and control of fugitive dust

1. For land clearing, excavating, grading, earthmoving, dredging, or demolition:

   a. Wetting down, including prewatering.
   b. Stabilizing with chemicals.
   c. Applying dust palliatives.
   d. Disturbing less topsoil per unit of time, and reclaiming disturbed areas as quickly as possible.
   e. Restricting the speed of vehicles traversing the area.

2. For constructing, using, altering, or repairing private roads or parking facilities:

   a. Watering, paving, or chemically stabilizing routinely used haul roads.
   b. Restricting the speed of vehicles.
   c. Watering down or chemically stabilizing roadway shoulders.
   d. Enclosing or covering open-bodied trucks.
   e. Switching from moving materials by vehicle to moving them by conveyance systems.
   f. Covering, shielding, or enclosing the area.
   g. Preventing and/or promptly removing dirt and mud deposits on paved roads.
   h. Cleaning paved roads frequently.

3. For exposure of land or materials subject to wind erosion:

   a. Landscaping and replanting exposed areas with native vegetation.
   b. Installing wind screens or equivalent wind-speed reduction devices.
   c. Stabilizing the land with chemicals.
   d. Physically stabilizing the land by covering with a non-erodible material such as gravel.
   e. Enclosing aggregate storage piles.

B.2.8 Total criteria pollutant maximum emission rates

The total criteria-pollutant maximum emission rates were determined by summing the emissions from all sources. The total suspended-particulate-emission rates reflect a 90 percent reduction in fugitive emissions by the recommended mitigative measures.

Table B.2-7 includes the maximum 24-hour emission rate for particulates. The values contained in this table are associated with relatively low wind speeds (i.e., less than 6 meters per second) over an extended dry period (i.e., Thornwaite index≤50). Fugitive emissions from unpaved roadways are the significant source of particulate emissions. During relatively high wind speeds (i.e., greater than 6 meters per second), wind erosion from storage piles becomes a significant source of fugitive emissions. The annual average total suspended-particulate emissions shown in Table B.2-8 reflect the average emission rate during the entire remedial-action program for each site and alternative. On an average annual basis, fugitive emissions from onsite and access roadways represent the primary particulate emission source. As in the short-term period, the fugitive emissions from pile stacking are the least significant source of fugitive particulate emissions.

The values shown in Tables B.2-2, B.2-3 and B.2-4 for gaseous pollutants and in Tables B.2-7 and B.2-8 for total suspended-particulate pollutants were used in the modeling analyses to predict the maximum ambient air-quality impacts attributable to each of the remedial-action alternatives under consideration at each site.

B.2.9 Ambient air-quality impacts

The maximum potential ambient air-quality impacts for each of the pollutants emitted during the proposed remedial actions were calculated using the EPA-approved area-source emissions Industrial Source Complex (ISC) model (Bowers et al., 1979). This model has a volume source option that is the appropriate dispersion modeling tool for this study. The Industrial Source Complex model has been used for a variety of similar source problems and is the EPA-recommended model for such studies.

The 1-hour, 3-hour, 8-hour, and 24-hour ambient concentrations were calculated using the short-term version of the model, while the annual average-ambient concentrations were calculated using the long-term version. The emission rates for criteria pollutants reported previously were used as input to the model.

Table B.2-7. Maximum 24-hour total suspended-particulate-emission rates with mitigation measures used

		Emission rate (g/sec)					
Alter-native	Site	Vehicle exhaust	Construc-tion activities[a]	Wind erosion[a]	Roadway emissions[a]	Pile stacking[a]	Total
2	Canonsburg	0.123	0.211	0.348	0.951	0.001	1.634
	Burrell	0.123	0.102	0.151	0.282	---	0.653
3	Canonsburg	0.123	0.178	0.475	0.551	0.003	1.330
	Burrell	0.066	0.190	0.044	0.282	---	0.582
4	Canonsburg	0.150	0.162	0.577	1.118	---	2.007
	Burrell	0.123	0.102	0.151	0.282	---	0.658
	Hanover	0.081	0.072	0.352	3.706	---	4.211
5	Canonsburg	0.150	0.162	0.577	1.118	---	2.007
	Burrell	0.066	0.190	0.044	0.282	---	0.582
	Hanover	0.220	0.102	0.274	3.870	0.002	4.468

[a]Assumes mitigation measures that reduce emissions by 90 percent.

Table B.2-8. Annual average total suspended-particulate emission rates with mitigation measures used

Alter-native	Site	Emission rate (g/sec) Vehicle exhaust	Construction activities[a]	Wind erosion[a]	Roadway emissions[a]	Pile stacking[a]	Total
2	Canonsburg	0.057	0.081	0.118	0.330	0.002	0.588
	Burrell	0.044	0.055	0.022	0.077	0.001	0.194
3	Canonsburg	0.057	0.062	0.123	0.173	0.002	0.433
	Burrell	0.029	0.082	0.026	0.118	0.004	0.260
4	Canonsburg	0.065	0.081	0.245	0.481	0.006	0.878
	Burrell	0.044	0.055	0.022	0.077	0.001	0.194
	Hanover	0.072	0.037	0.152	1.376	0.003	1.640
5	Canonsburg	0.065	0.081	0.245	0.481	0.006	0.878
	Burrell	0.029	0.082	0.026	0.118	0.004	0.260
	Hanover	0.076	0.034	0.169	1.236	0.005	1.520

[a]Assumes mitigation measures that reduce emissions by 90 percent.

Table B.2-9 identifies the model parameters used in the application of both the long-term and short-term versions of the ISC model (Bowers et al., 1979). The model was run in the rural mode for all sites and alternatives. A dense rectangular grid of receptors spaced at 100 meters out to 1000 meters was used to identify the peak impact areas due to the remedial-action alternatives at each site. The particle settling option was used to calculate the deposition rate for particulates as well as to calculate the ambient particulate concentration. The concentration of gaseous pollutants was determined by removing the particle settling option.

The short-term impacts of the remedial-action program were estimated on the basis of assumed most probable worst-case meteorological conditions. These included the following:

1. Wind direction was constrained to be within a 10-degree sector for 24 hours.

2. Wind speed was assumed to be 2 meters per second.

3. Mixing height was assumed to be 500 meters.

4. Stability was category 5 -- slightly stable.

These relatively low wind-speed conditions will occur on the average approximately 5 percent of the time at both the Canonsburg and Burrell sites, and at a slightly lower frequency of occurrence at the Hanover site. It is important to note that although the particulate emission rate for wind erosion is greater at higher wind-speed conditions, the selected most probable, worst-case, short-term meteorological conditions contribute to higher offsite impacts. This is primarily related to the fact that since predicted air pollutant levels are inversely proportional to wind speed, the short-term TSP concentrations at wind speeds of 6 meters per second would be a factor of 3 less than the concentration for the selected most probable low wind-speed conditions if the emissions were assumed to be equal. This is due to the fact that the total emission rates during low wind-speed conditions are only reduced by about 20 percent (due to a reduction in erosion from piles); hence, the highest offsite concentrations will occur during the low wind-speed conditions used in the analysis.

Using these assumptions and the maximum emission rate for each pollutant, alternative, and site, the maximum potential offsite 3-hour, 8-hour, and 24-hour ambient-pollutant concentrations were predicted (Table B.2-10). It should be emphasized that these concentrations represent the maximum potential short-term ambient concentration for each alternative. It is unlikely that these concentrations would occur for any prolonged period.

Table B.2-9. Model parameters used to calculate offsite impacts

Site	Source type	Source dimensions (meters)	Release height (meters)	y_o (meters)	z_o (meters)
Canonsburg	Volume	285 x 285	5	66	10
Burrell	Volume	270 x 270	5	63	10
Hanover	Volume	200 x 200	5	50	10

<u>ISCST (Bowers et al., 1979) options used at all sites</u>

Calculate (concentration = 1, deposition = 2)	ISW(1) = 1
Receptor grid system (rectangular = 1 or 3, polar = 2 or 4)	ISW(2) = 1
Discrete receptor system (rectangular = 1, polar = 2)	ISW(3) = 1
Terrain elevations are read (yes = 1, no = 0)	ISW(4) = 0
Calculations are written to tape (yes = 1, no = 0)	ISW(5) = 0
List all input data (no = 0, yes = 1, meteorological data also = 2)	ISW(6) = 2
Compute average concentration (or total deposition) with the following time periods:	
Hourly (yes = 1, no = 0)	ISW(7) = 1
2-hour (yes = 1, no = 0)	ISW(8) = 0
3-hour (yes = 1, no = 0)	ISW(9) = 1
4-hour (yes = 1, no = 0)	ISW(10) = 0
6-hour (yes = 1, no = 0)	ISW(11) = 0
8-hour (yes = 1, no = 0)	ISW(12) = 1
12-hour (yes = 1, no = 0)	ISW(13) = 0
24-hour (yes = 1, no = 0)	ISW(14) = 1
Print "n"-day table(s) (yes = 1, no = 0)	ISW(15) = 0
Print the following types of tables whose time periods are specified by ISW(7) through ISW(14):	
Daily tables (yes = 1, no = 0)	ISW(16) = 0
Highest and second highest tables (yes = 1, no = 0)	ISW(17) = 1
Maximum 50 tables (yes = 1, no = 0)	ISW(18) = 1

Table B.2-9. Model parameters used to calculate offsite impacts (continued)

ISCST (Bowers et al., 1979) options used at all sites (continued)

Meteorological data input method (pre-processed = 1, card = 2)	ISW(19) = 2
Rural-urban option (rural = 0, urban mode 1 = 1, urban mode 2 = 2)	ISW(20) = 0
Wind profile exponent values (defaults = 1, user enters = 2, 3)	ISW(21) = 1
Vertical potential temp. gradient values (defaults = 1, user enters = 2, 3)	ISW(22) = 1
Scale emission rates for all sources (no = 0, yes = 0)	ISW(23) = 0
Program calculates final plume rise only (yes = 1, no = 2)	ISW(24) = 2
Program adjusts all stack heights for downwash (yes = 2, no = 1)	ISW(25) = 1
Number of input sources	NSOURC = 1
Number of source groups (= 0, all sources)	NGROUP = 1
Time period interval to be printed (= 0, all intervals)	IPERD = 0
Number of X (range) grid values	NXPNTS = 9
Number of Y (theta) grid values	NYPNTS = 13
Number of discrete receptors	NXWYPT = 0
Number of hours per day in meteorological data	NHOURS = 24
Number of days of meteorological data	NDAYS = 1
Source emission rate units conversion factor	TK = 0.10000 + 007
Entrainment coefficient for unstable atmosphere	BETA1 = 0.600

ISCLT (Bowers et al., 1979) options used at all sites

Number of sources	= 1
Number of X axis grid system points	= 8
Number of Y axis grid system points	= 36
Number of special points	= 0
Number of seasons	= 1
Number of wind-speed classes	= 6
Number of stability classes	= 6
Number of wind-direction classes	= 16
File number of data file used for reports	= 1
The program is run in rural mode	
Concentration (deposition) units conversion factor	= 0.10000000+007
Acceleration of gravity (meters/sec = 2)	= 9.800
Height of measurement of wind speed (meters)	= 10.000
Entrainment parameter for unstable conditions	= 0.600
Entrainment parameter for stable conditions	= 0.600
Correction angle for grid system versus direction data north (degrees)	= 0.000

Table B.2-9. Model parameters used to calculate offsite impacts (continued)

ISCLT (Bowers et al., 1979) options used at all sites (continued)

Decay coefficient		= 0.00000000
Calculate (concentration = 1, deposition = 2)	ISW(1)	= 1 and 2
Receptor grid system (rectangular = 1, polar = 2)	ISW(2)	= 2
Discrete receptor system (rectangular = 1, polar = 2)	ISW(3)	= 2
Terrain elevations are read (yes = 1, no = 0)	ISW(4)	= 0
Calculations are written to take (yes = 1, no = 0)	ISW(5)	= 0
List all input data (3 = print all input data)	ISW(6)	= 3
Print seasonal or annual calculations (2 = annual only)	ISW(7)	= 2
Print concentration (deposition) data from all or one source (1 = one source)	ISW(8)	= 1
Rural/urban option (1 = urban model 1, 2 = urban model 2, 3 = rural)	ISW(9)	= 3
Print maximum 10 concentrations/depositions (yes = 0, no = 1)	ISW(10)	= 0
Not applicable ISW(11) to ISW (18)	ISW(11) - ISW(18)	= 0
Plume rise independent of downwind distance (yes = 0, no = 1)	ISW(17)	= 1
Stack tip downwash is applied (yes = 1, no = 0)	ISW(20)	= 0

Table B.2-10. Maximum predicted ambient air-quality impacts due to remedial action[a]

Alter-native	Site	TSP[b] ($\mu g/m^3$) Annual[c]	TSP[b] ($\mu g/m^3$) 24-hour	SO_2 ($\mu g/m^3$) Annual[c]	SO_2 ($\mu g/m^3$) 3-hour	SO_2 ($\mu g/m^3$) 24-hour	CO (mg/m^3) 1-hour	CO (mg/m^3) 8-hour	NO_x ($\mu g/m^3$) Annual	HC ($\mu g/m^3$) 3-hour	Settleable particulates (tons/sq mi-month)
2	Canonsburg	5.9	53	4.9	124	41	1.90	1.86	54	50	0.33
	Burrell	2.1	24	3.1	92	30	2.68	2.60	32	44	0.11
3	Canonsburg	4.4	43	4.6	96	31	1.93	1.89	50	28	0.24
	Burrell	2.8	22	3.3	62	20	1.85	1.80	35	20	0.15
4	Canonsburg	8.9	65	6.2	127	42	2.16	2.11	66	48	0.50
	Burrell	2.1	24	3.1	92	30	2.68	2.60	32	44	0.11
	Hanover	9.0	147	3.2	215	68	1.97	1.81	33	123	3.15
5	Canonsburg	8.9	65	6.2	127	42	2.16	2.11	66	48	0.50
	Burrell	2.8	22	3.3	62	20	1.85	1.80	35	20	0.15
	Hanover	8.5	156[d]	3.2	215	68	1.97	1.87	33	123	2.86
Background concentration		67[e]	74[e]	47[e]			1.14[f]		20[f]		18[e]
National primary standard (40 CFR 50)		75	260	80		365	40.0	10.0	100	160	
National secondary standard (guideline) (40 CFR 50)		60[g]	150		1,300		40.0	10.0	100		
Pennsylvania standards (25 PA Code 131) (same as National Primary and Secondary Ambient Air Quality Standards 40 CFR 50))											43

[a]Incremental levels must be added to background to determine exceedances of standards.

[b]Assumes reduction of TSP by 90 percent due to mitigation measures.

[c]Assumes an 8-hour per day, 5-day per week, 50-week per year work schedule.

[d]Secondary-standard exceedance.

[e]Measured background; TSP and settleable particulates from 1981 data collected at Washington, Pennsylvania; SO_2 from 1981 data collected at Florence, Pennsylvania.

[f]Estimated background based on suggested rural background concentrations (U.S. EPA, 1978).

[g]Value is a guide to be used in assessing implementation plans for achieving the annual maximum 24-hour standard.

The annual average ambient-pollutant concentration for the peak offsite receptor was predicted using the ISC long-term model (Bowers et al., 1979) in conjunction with the emission rates reported previously, and the 1979 meteorological data for each site. For the Canonsburg site onsite meteorological data were available and used. These data were adjusted for the topographical differences between the Burrell and Canonsburg sites, and the modified data were used as input for the Burrell site analysis. Meteorological data collected at the Pittsburgh airport were used for the Hanover site model. The airport data are directly applicable to the Hanover site because of its proximity to the site (13 miles), and its similar topographic setting. The annual average calculated concentrations and the approximate criteria pollutant National (40 CFR 50) and Commonwealth (25 PA Code 131) Ambient Air Quality Standards for all criteria pollutants are shown in Table B.2-10.

B.2.10 Impacts of settleable-particulate matter

The amount of settleable-particulate matter potentially generated at each site under each remedial-action alternative was calculated using the deposition option of the ISCLT (Bowers et al., 1979) model in conjunction with information on the particle size distribution of soils near each site. The size distribution and settling velocity used in the model is contained in Table B.2-11. Only particles less than 100 μm were included since these are the largest particles likely to be transported off the site. Table B.2-10 includes the maximum potential offsite settleable particulate rate. The predicted impact based on the incremental impact due to the project, plus the background value, is well below the Pennsylvania standard (25 PA Code 131) for all sites and alternatives.

B.2.11 Background concentrations used in analysis

In order to compare the impact of the proposed alternative remedial-action plans to the NAAQS (40 CFR 50), the incremental impact due to the project alternatives was added to the background value measured in the vicinity of the sites. The annual geometric mean value for total suspended particulates measured at the Washington, Pennsylvania site was used for the annual total suspended particulates background. This value was increased by 10 percent (as suggested by EPA (Belanger, 1983)) in order to obtain an arithmetic average value that was used for the 24-hour background value. The average background sulfur dioxide concentration was obtained from monitoring data at the Florence, Pennsylvania site. The background values used for carbon monoxide, and nitrogen oxides were based on rural background values suggested by EPA in their modeling guidelines (EPA, 1978). The background value used for settleable particulates is based on data from the official Commonwealth rural background site located in Perry County. A background hydrocarbon value was not available, however, the predicted hydrocarbon levels are quite low relative to the NAAQS (40 CFR 50) (which has been withdrawn by the EPA (48 FR 628-629, January 5, 1983)) so that it is highly unlikely that a violation of the NAAQS (40 CFR 50) will occur.

Table B.2-11. Particle size information and settling velocities based on survey data for 0-2 foot soil samples in the vicinity of the sites

Particle size range (μm)	Mass fraction[a] (%)	Mass median diameter (μm)	Settling velocity[b] (m/s)
Less than 5	45	2.5	0.0001
5 to 10	17	7	0.002
10 to 50	21	30	0.04
50 to 100	17	75	0.25
	100		

[a]Particles less than 100 μm.

[b]$$V_s = \frac{\rho g r^2}{g u}$$

Where:

ρ = Particle density, 1.5 g/cu cm.

r = Particle radius (cm).

u = Absolute viscosity of air - 1.83 x 10^{-4} gm/cm sec.

g = Acceleration rate of gravity - 980 cm/sec.

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Appendix C

SOILS AND GEOLOGICAL INFORMATION

Appendix C.1

SOILS INVESTIGATIONS

Appendix C.1

SOILS INVESTIGATIONS

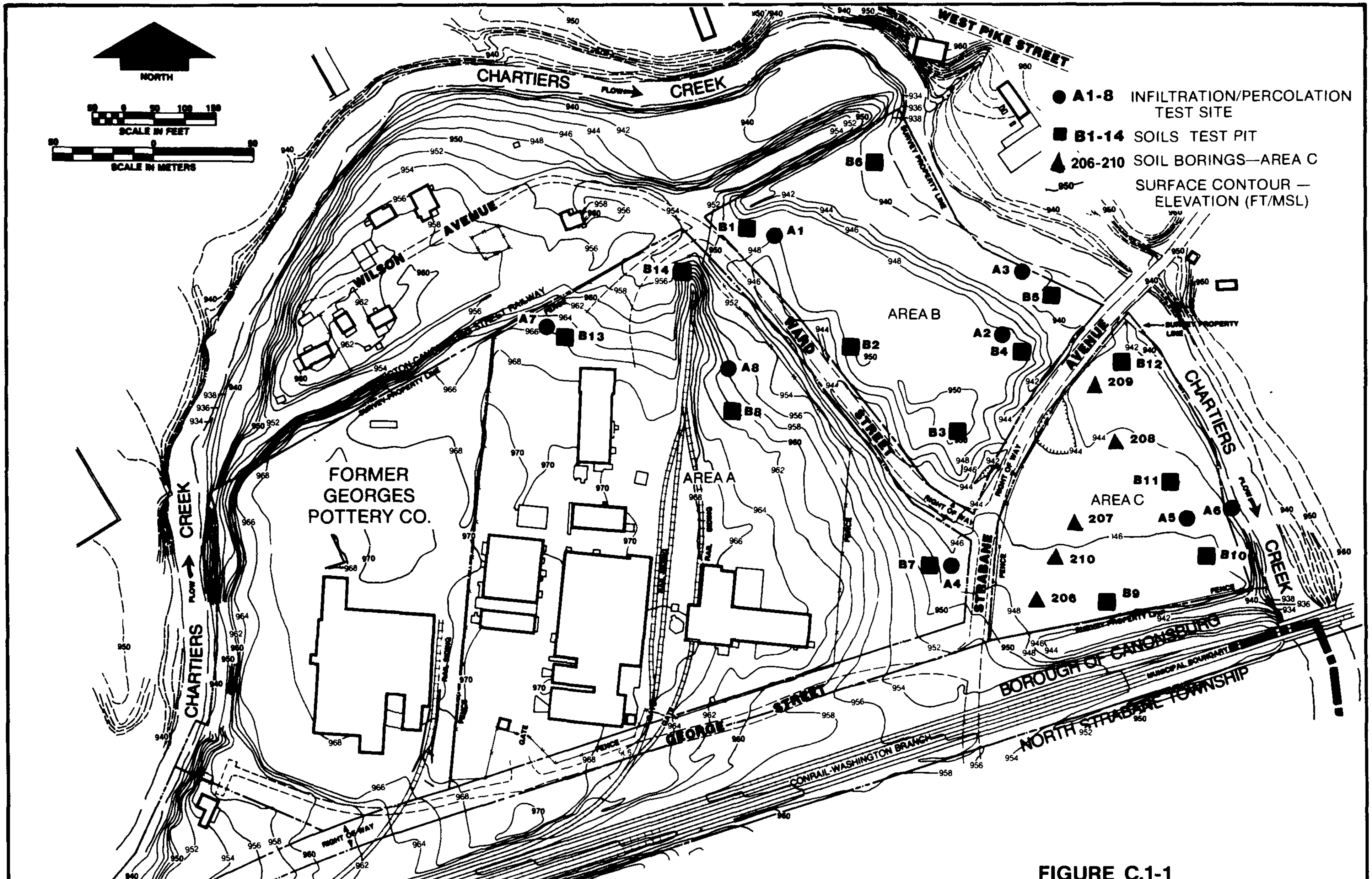
C.1.1 Canonsburg site

C.1.1.1 Background

A detailed soils investigation of the Canonsburg site was conducted in April 1979. A total of 14 test pits were excavated (Figure C.1-1) and described. The test pit descriptions are given in Table C.1-1. As part of the March 1982 radiological survey of Area C, five additional soil borings were made in this area. The locations of these borings are also shown on Figure C.1-1, and their descriptions are given in Table C.1-2.

Area A of the Canonsburg site consists of buildings, parking lots, a railroad line, and lawns. The soils identified in Area A were classified as made-land or urban land. The original soil profiles in Area A have been disturbed or completely destroyed with the construction of buildings, parking lots, and a railroad line. A total of four test pits were excavated in Area A (test pits 7, 8, 13, and 14). Test pit 7 was excavated in a lawn area adjacent to Strabane Avenue. The soil consisted of a surface layer of grey-black, heavy silt loam underlain by a mottled and gleyed yellowish-brown, silty clay loam subsoil. Moderately weathered shale bedrock was encountered at 75 inches. In the area of test pit 8, fill material covered the surface. The subsoil described was a mottled and gleyed yellowish-brown silty clay loam. An abandoned waste disposal line was encountered at 36 inches. Test pits 13 and 14 in Area A were similar to the other test pits. In Area A water was encountered in only one of the test pits--at about 8 feet in test pit 13 along the northern property line.

Area B of the Canonsburg site was initially mapped by the U.S. Department of Agriculture, Soil Conservation Service (USDA-SCS) as a flood plain of Chartiers Creek. A major portion (estimate 85 percent) of Area B has since been filled with about 8 feet of dredged material. The unfilled area is still in the flood plain of Chartiers Creek and is subject to flooding. A total of six test pits were excavated in Area B. Test pits 1, 2, 3, and 4 were excavated in the filled area. The test pits showed that 51 to 109 inches of fill material overlie the original soil material. The fill material consisted of cinders, wood, metal, bricks, and silty clay to sandy soil material. In test pit 1 the fill was underlain by sandy soil material, while test pits 2, 3, and 4 were underlain by a silty clay loam. Water was encountered in all three test pits. Test pits 5 and 6 were dug along the present flood plain of Chartiers Creek. The soil profiles were typical flood-plain soil profiles, showing deposition and stratification. The soil encountered fit the Soil Conservation Service description for Melvin silt loam.



NOTE 1 THIS MAP IS BASED ON A SURVEY AND TOPOGRAPHY BY KURCH-HOUSLEY & ASSOC, PITTSBURGH, PA, DATED MARCH 1983, AND ON MAPS OF THE CHARTIERS CREEK BASIN, PA BY THE US ARMY, CORPS OF ENGINEERS, PITTSBURGH, PA, DATED 6/3/73,

2 ALL ELEVATIONS ARE TO USGS DATUM (NGVD), CANONSBURG PA, AND ARE SHOWN IN FT/MSL, CHECK RUN BY KUR HOUSLEY & ASSOC, PITTSBURGH, PA DATED 9/8/82 FO TE UTILITIES SEE ABOVE SURVEYS AND MAPS

FIGURE C.1-1
TOPOGRAPHY AND LOCATION OF SOIL TEST PITS AND INFILTRATION/PERCOLATION TEST AREAS EXPANDED CANONSBURG SITE

Table C.1-1. Test pit descriptions[a] -- Canonsburg site

Test pit	Description
Test pit 1	
0 - 8 inches	Channery silt loam -- very dark gray; friable.
8 - 84 inches	Variable fill material -- cinders, oily roots to 8 inches only, bricks, sandy loam to silty clay loam soil material, wood, friable to firm; black, variegated in color.
84 - 98 inches	Fine sandy loam -- black.
98+ inches	Sand -- gray; stratified.
Test pit 2	
0 - 6 inches	Silt loam fill and rock -- varigated.
6 - 51 inches	Rock fill with some wood and metal.
51 - 108 inches	Silty clay loam -- dark gray brown.
Water perched on top of clay -- 51 inches. Test pit filled up -- water rushed in through the stone fill.	
Test pit 3	
0 - 7 inches	Silt loam -- gray; 15 percent coarse fragment.
7 - 78 inches	Fill material -- variegated in nature, ranging from brown to gray, black in color; stumps.
108+ inches	Silty clay loam -- brown and gray.
Water seeping in at 64 inches.	
Test pit 4	
0 - 6 inches	Channery silty clay loam -- gray.
6 - 40 inches	Silty clay loam -- variegated brown.
40 - 96 inches	Silty clay loam -- gray; wood, metal in fill.
Test pit caved in.	

[a]Test pit locations are shown on Figure C.1-1.

Source: Weston (1979) field data.

Table C.1-1. Test pit descriptions[a] -- Canonsburg site (continued)

Test pit	Description
<u>Test pit 5</u>	
0 - 8 inches	Silty clay loam -- gray.
8 - 12 inches	Silty clay loam -- gray brown.
12 - 47 inches	Silty clay loam -- brown.
47 - 55 inches	Silty clay loam -- dark gray.
55 - 96+ inches	Silty clay loam -- brown.
Water at 40 inches.	
<u>Test pit 6</u>	
0 - 7 inches	Heavy silt loam -- dark brown.
7 - 49 inches	Silty clay loam -- brown mottled.
49 - 69 inches	Heavy silt loam -- grayish brown, gleyed.
69+ inches	Silty clay loam -- dark gray, gleyed
Water seeping in at 60 inches.	
<u>Test pit 7</u>	
0 - 8 inches	Heavy silt loam -- gray black.
8 - 30 inches	Silty clay loam -- yellow brown.
30 - 49 inches	Silty clay loam -- yellow brown, mottled, manganese stains.
49 - 75 inches	Silty clay loam -- gleyed, manganese stains.
75+ inches	Moderately weathered shale.
No water detected.	
<u>Test pit 8</u>	
0 - 11 inches	Fill materials, cinders, block.
11 - 16 inches	Layered silty clay loam -- yellow and brown.
16 - 40 inches	Silty clay loam -- yellow brown.
40+ inches	Mottled silty clay -- gray.
Sewerage stone at 36 inches.	
<u>Test pit 9</u>	
0 - 14 inches	Fill -- cinders, coal, wood, loamy; gray black, firm.
14 - 69 inches	Fill, loam -- dredged material, red bricks.
Water at 65 inches.	

[a]Test pit locations are shown on Figure C.1-1.

Source: Weston (1979) field data.

Table C.1-2. Soil boring descriptions[a] -- Canonsburg site, Area C (continued)

Bore hole (depth in feet)	Description
Bore hole SB-207 (continued)	
8.0 - 10.0	Yellow brown clay loam.
10.0 - 10.5	Yellow brown clay loam.
10.5 - 12.0	Gray clay, 2.5Y5/2.
Bore hole SB-208	
0.0 - 1.5	Reddish loam, brick chips, 2.5YR5/8.
1.5 - 2.0	Gray and red mixed loam.
2.0 - 3.5	Reddish brown sandy clay loam, 5YR4/6.
3.5 - 4.0	Yellow brown sandy clay loam.
4.0 - 5.5	Yellow brown sandy clay loam, 10YR4/6.
5.5 - 6.0	Reddish brown sandy loam.
6.0 - 7.0	Reddish brown sandy clay loam.
7.0 - 8.0	Gray clay.
Bore hole SB-209	
0.0 - 1.0	Red brick material and black coal pieces.
1.0 - 2.0	Yellow brown loam, mottled M/D, 10YR4/6.
2.0 - 4.0	Yellow brown clay mottled M/D, 10YR4/6.
4.0 - 4.5	Yellow brown clay mottled M/D, 10YR4/6.
4.5 - 6.0	Gray clay.
6.0 - 6.5	Gray clay.
6.5 - 7.8	Olive gray clay.

[a]Soil boring locations are shown on Figure C.1-1.

Source: Weston (1982) field data.

Table C.1-2. Soil boring descriptions[a] -- Canonsburg site, Area C

Bore hole (depth in feet)	Description
Bore hole SB-206	
0.0 - 1.5	Black fill coal pieces.
1.5 - 2.0	Orange sandy clay.
2.0 - 4.0	Dark grey to black. Broken brick pieces in sandy clay loam, 10YR3/2.
4.0 - 6.0	Sandy clay loam, mottled, more brown in color, 10YR4/4.
6.0 - 7.5	Sludge material, sandy clay, 10YR4/4.
7.5 - 8.0	Bright yellow sandy clay, 10YR6/8.
8.0 - 10.0	Brown clay, 10YR4/4. 6-10 combined sample.
10.0 - 10.5	Sandy clay.
10.5 - 12.0	Yellow brown sandy clay.
12.0 - 14.0	Yellow brown sandy clay.
14.0 - 15.0	Yellow grey mixed clay.
Bore hole SB-207	
0.0 - 1.0	Red broken bricks, loam.
1.0 - 2.0	Black N 3/0 sandy loam, pieces of coal, metallic.
2.0 - 3.0	Reddish black sandy clay loam.
3.0 - 4.0	Black, metallic.
4.0 - 5.0	Reddish brown, sandy clay loam, 10YR4/4.
5.0 - 6.0	Gritty black sandy clay loam, 11YR3/0.
6.0 - 8.0	Slop/mud and water -- no return.

[a]Soil boring locations are shown on Figure C.1-1.

Source: Weston (1982) field data.

Table C.1-2. Soil boring descriptions[a] -- Canonsburg site, Area C (continued)

Bore hole (depth in feet)	Description
Bore hole SB-209 (continued)	
7.8 - 8.0	Dark gray to black clay, N 3/0.
8.0 - 10.0	Dark gray to black clay with a green tint.
Bore hole SB-210	
0.0 - 3.5	Black metallic (coal pieces) compact, red brick chips.
3.5 - 5.5	Red bricks, red brown sandy clay loam.
5.5 - 6.0	Red brown sandy clay loam.
6.0 - 7.5	Yellow brown clay loam, mixed with gray mottled, 10YR4/6.
7.5 - 9.0	Yellow brown clay loam, mixed with gray mottled, 10YR4/6.
9.0 - 9.5	Red sandy loam, 5YR5/4.
9.5 - 11.5	Reddish brown sandy clay loam.
11.5 - 12.0	Reddish brown sandy clay loam.
12.0 - 13.5	Gray clay.
13.5 - 14.5	Gray clay.
14.5 - 15.0	Grey and yellow brown mottled clay.
15.0	Bedrock.

[a]Soil boring locations are shown on Figure C.1-1.

Source: Weston (1982) field data.

Four test pits were excavated in Area C. The surface of the area is covered with 6 to 14 inches of red dog. The underlying material was dredged-soil material from Chartiers Creek. The dredged fill consisted of cinders, sediment, bricks, coal, wood, and other debris. Underlying the dredged-fill material was old flood-plain soil of Chartiers Creek. Water was encountered in all four of the test pits from a shallow depth of 37 inches in test pit 12, to 75 inches in test pit 11.

Additional data were collected during the 1982-1983 drilling program. Soil samples were collected with Shelby tubes and split spoons for laboratory analysis. Subsections D.2.2.2 and D.2.2.3 describe the sampling methods used.

C.1.1.2 Soil analysis

Soil samples were collected from the test pits and analyzed for particle size, soil pH, percent organic matter, and cation exchange capacity. The results of the analyses are shown in Table C.1-3.

A wide range can be seen for each parameter analyzed. Soil pH within the dredged material varied from a low of 2.8 to a high of 7.2. The low pH was only found in Area C where the red dog material was placed on the surface. In Areas A and B, the soil pH ranged from 4.9 for the original soil material, to a high of 7.5 for the alluvium along Chartiers Creek.

The percent organic matter varied from a low of 0.10 percent for natural soil material, to a high of 11.09 percent for the dredged fill material. The cation exchange capacity also followed the same trend with a low of 9.4 milliequivalent per 100 grams of soil for original soil material, to a high of 31.7 milliequivalent for the dredged fill. The high cation exchange capacity of 31.7 for the dredged fill was due to the high organic matter content of the sample and not due to a high clay content.

The particle size analysis showed a range of sandy loams to silty clay loams. The coarser materials (sandy loams) were found in the dredged material, and the finer silty and clayey soils were found in the flood-plain soil materials and in the original and disturbed in-situ soil material. Sieve analysis results are shown in Table C.1-4.

C.1.1.3 Soil permeability and soil infiltration tests

The permeability and infiltration rates of the soils were determined by onsite testing. The permeability of the soils was determined by the standard percolation method (U.S. Department of Health, Education, and Welfare, 1967). Soil infiltration rates were determined by the single-ring method (Bertrand, 1965). The tests were run at the ground surface and at depths of 12 and 24 inches. The results of the permeability and infiltration tests are shown in Tables C.1-5 and C.1-6. The locations of the tests are shown on Figure C.1-1.

Table C.1-3. Soil analysis results -- Canonsburg site

Sample location[a] (test pit no.)	Sample depth (in.)	Percent <2 mm	Percent ≥2 mm	Particle size hydrometer fractionation: 3 min.	10 min.	30 min.	90 min.	270 min.	720 min.	Soil pH	Organic matter (%)	Cation exchange capacity (meq/100 g)
1	Fill	50.8	49.2	0.076	0.141	0.247	0.435	0.762	1.245	7.4	2.85	22.8
4	7-40	51.8	48.2	0.071	0.133	0.237	0.419	0.743	1.229	7.2	1.71	12.9
4	40+	44.3	55.7	0.072	0.135	0.239	0.425	0.744	1.229	7.4	3.01	12.0
6	7-49	27.7	72.3	0.068	0.130	0.234	0.417	0.738	1.216	7.5	1.09	13.3
6	49-69	4.2	95.8	0.073	0.135	0.240	0.422	0.744	1.229	7.2	1.70	16.3
7	8-30	30.6	69.4	0.065	0.125	0.225	0.403	0.718	1.202	5.2	0.12	14.7
7	30-60	47.0	53.0	0.065	0.123	0.221	0.400	0.718	1.199	4.9	0.10	15.4
9	12-36	48.8	51.2	0.069	0.129	0.231	0.412	0.735	1.216	3.1	6.31	11.9
11	0-9	60.3	39.7	0.072	0.134	0.238	0.427	0.750	1.240	3.5	3.48	13.4
11	9-37	45.5	55.5	0.069	0.128	0.277	0.409	0.731	1.216	2.8	11.09	31.7
11	37-69	37.5	62.5	0.071	0.134	0.238	0.419	0.743	1.232	4.3	1.52	14.6
13	18-23	39.6	60.4	0.069	0.131	0.237	0.422	0.748	1.250	6.5	0.91	10.0
13	23-39	28.4	71.6	0.069	0.130	0.235	0.417	0.735	1.208	6.2	0.10	9.4
13	39+	37.8	62.2	0.075	0.138	0.241	0.424	0.738	1.208	4.9	0.11	11.0

[a]Test pits shown on Figure C.1-1.

Source: Weston (1979) field data.

Table C.1-4. Sieve analysis results -- expanded Canonsburg site

Well[a]	Depth (ft)	Unified classification	LL	PI	Sieve analysis -- accumulative percent passing 200	100	40	10	4	3/8	1/2	3/4	Moist
301S	2.0-4.0	SM	NV	NP	34	51	96	100					11.7
301S	6.0-7.5		--	--	76	80	90	100					32.7
301S	5.0-7.0	MH	71	31	69	73	87	99	100				37.3
302S	2.0-4.0	SM	32	6	30	35	45	62	60	73	---	100	7.0
302S	14.0-16.0	CL	47	23	80	93	98	99	100				33.4
303S	7.0-8.0	ML	37	7	95	97	99	100					20.3
304S	5.0-6.5	ML	42	16	95	96	98	100					15.8
305S	5.0-6.0	CL	37	16	74	79	87	93	95	96	---	100	23.0
305S	9.0-10.0		---	---	72	87	99	100					13.8
306S	0-2.0	SM	31	3	21	25	36	59	74	91	---	100	37.5
306S	8.0-10.0	CL	32	12	52	68	99	100					25.7

[a]Well locations are shown on Figure D.2-2.

Source: Weston (1983) field data; laboratory analyses conducted by Sergent, Hauskins, and Beckwith, Albuquerque, New Mexico.

Table C.1-5. Percolation and infiltration rates -- Canonsburg site

Test pit[a]	Percolation rate (in./sec)	Percolation depth (in.)	Infiltration[b] rate (in./sec)
1	1.9×10^{-5}	0	1.3×10^{-3}
2	1.1×10^{-5}	0	---[c]
3	1.6×10^{-4}	12	7.0×10^{-4}
4	1.7×10^{-4}	24	5.5×10^{-6}
5	6.2×10^{-5}	12	3.1×10^{-3}
6	5.9×10^{-4}	0	9.4×10^{-4}
7	2.2×10^{-4}	0	3.9×10^{-3}
8	1.6×10^{-3}	0	2.9×10^{-3}
$\bar{\bar{X}}$[d]	3.5×10^{-4}	6	2.2×10^{-3}

[a]Test pit locations are shown on Figure C.1-1.

[b]Infiltration tests were performed in the top 4 inches of soil.

[c]No test performed.

[d]$\bar{\bar{X}}$ = average.

Source: Weston (1979) field data.

Table C.1-6. Soil permeability --- expanded Canonsburg site

Well location[a]	Well depth	Permeability[b] (in./sec)
302S	15 ft 8 in. to 15 ft 9 in.	2.11×10^{-7} to 2.46×10^{-7}
303S	11 ft 6 in. to 11 ft 8 in.	4.09×10^{-8} to 3.59×10^{-8}
304S	5 ft 3 in. to 5 ft 5 in.	1.76×10^{-8} to 3.14×10^{-8}
305S	10 ft to 10 ft 2 in.	3.98×10^{-8} to 3.39×10^{-8}

[a]Well locations are shown on Figure D.2-2.

[b]Laboratory analyses conducted by Sergent, Hauskins, and Beckwith, Albuquerque, New Mexico, using consolidation apparatus.

The percolation rate ranged from 1.1 x 10^{-5} inches per second to 1.6 x 10^{-3} inches per second, depending on the type of soil. The natural in-situ soils, both alluvial and residual, showed permeabilities of 1.7 x 10^{-4} to 5.9 x 10^{-4} inches per second. These permeabilities are consistent with the permeabilities determined for these upland and flood-plain soil series by the U.S. Soil Conservation Service (USDA-SCS, Washington County, Pennsylvania, unpublished data).

The permeability of the dredged fill areas (Areas B and C) ranged from 1.1 x 10^{-5} to 2.2 x 10^{-4} inches per second. The slower permeabilities are due to the particle size of the dredged material. The material, since it is an alluvial deposit, will vary considerably in texture. The permeabilities found are typical for fine-textured alluvial deposits.

C.1.1.4 Soil loss

The current rate of soil loss from the Canonsburg site was determined using soil conditions and the Universal Soil Loss Equation. The result is given in Table A.5-1.

C.1.2 Burrell site

Twelve test pits were excavated to examine the soils at the Burrell site (Figure C.1-2). Soil profile descriptions were completed at each test pit and are presented in Table C.1-7. Each test pit consisted of various fill materials, such as wooden planks, metal strips, slag, gravel, and bottles. The test pits contained very little profile development as evidenced by the lack of horizonation. The few layers occurring in the profiles were caused by the different fill materials being deposited at various times. The USDA-SCS has classified these soils as "made land" (USDA-SCS et al., 1960). According to the USDA-SCS, made land is defined as a miscellaneous land type that consists of areas where the soil material has been covered, moved, or graded by man. In some areas the original soil has been covered or destroyed by earth-moving operations.

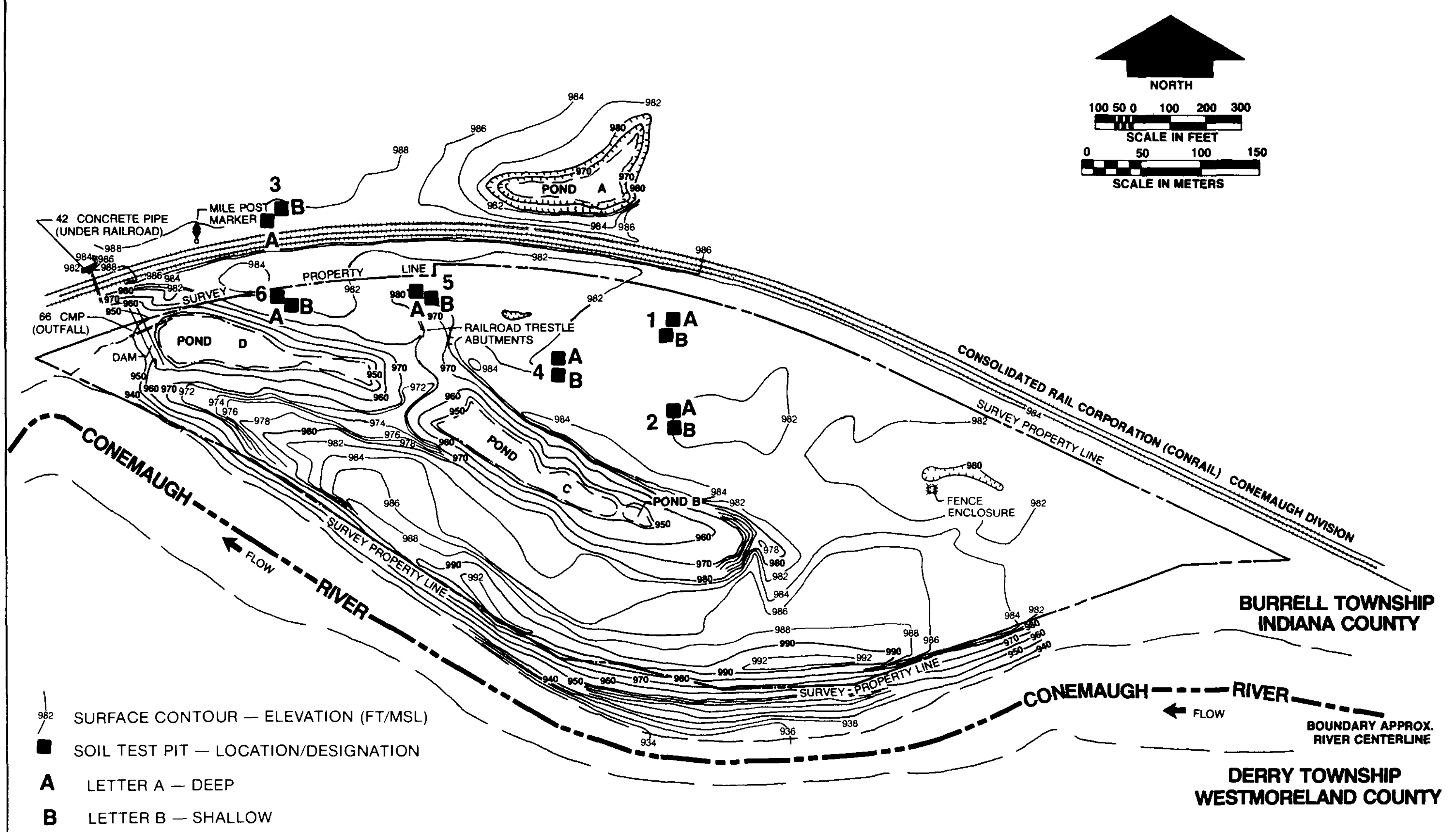
Percolation and infiltration rates for the Burrell site soils were determined using these test pits. The results are given in Table C.1-8.

C.1.3 Hanover site

Twelve test pits were excavated to examine the soils at the Hanover site (Figure C.1-3). Soil profile descriptions were completed for each test pit and are presented in Table C.1-9. Each test pit contained mostly rock fragments with only a small amount of fines present. Very little soil profile development (verified by the absence of horizons or layers) was observed at each pit.

The USDA-SCS (1979) outlines an interim classification system that attempts to provide a basis for uniformly identifying soils developed in mine spoil. Under this system, all of the soils at the Hanover site would be classified as Udorthents, sandstone, and shale. The classification of these soils means that they are young in age, contain mostly sandstone and shale boulders, and are found in a humid moisture regime.

Percolation tests were run on the soils in these test pits, and the results are given in Table C.1-10.



NOTE 1 PROPERTY LINE DATA FROM PLAN OF PROPERTY FOR UNION CARBIDE CORP BY RICHARD G BACH & ASSOC ZELIENOPLE PA-DATED 11/16/77
2 TOPOGRAPHICAL DETAIL FROM MAP TEST HOLE LOCATIONS FOR ROY F WESTON INC BY KURCH-HOUSLEY & ASSOC PITTSBURGH PA-DATED 11/6/81 REV 3/2/82
3 ALL ELEVATIONS ARE TO USGS DATUM BLAIRSVILLE PA AND ARE SHOWN IN FT/MSL ELEVATION CHECK RUN BY KURCH-HOUSLEY PITTSBURGH PA-DATED 6/11/82

FIGURE C.1-2
TOPOGRAPHY AND LOCATION OF SOIL TEST PITS
BURRELL TOWNSHIP SITE

Table C.1-7. Test pit descriptions[a] -- Burrell site

Test pit	Description
Test pit 1A	
Total depth -- 6 feet Percolation hole depth -- 7 feet	
0-12 inches	N2/0. Very abrupt boundary, probably plowed when cover was planted, friable, massive structure.
12-24 inches	10YR5/3. Massive structure, friable, contains metal strips around 24 inches long, a few snail shells (land snails), very moist conditions, gravelly sandy loam.
36 inches	Olive green/gray silty clay, mixed with gravelly sandy loam, massive to weak subangular, blocky structure, friable.
48 inches	Very wet layer, silty clay and loam textures, massive structure, friable.
Additional notes:	
The test pit contained bricks, boulders (chunks of fine-grained sandstone), and a few pieces of wood. This pit was not as gravelly as 2A, but had more gravel than the other pits. There seemed to be more natural soil than fill material. This pit looked the least like fill of all of the pits. The vegetation was a cover of grasses and broadleaves (100 percent cover). Samples were taken at depths of 6, 24, 36, and 48 inches.	
Test pit 1B	
Total depth -- 2 feet 4 inches Percolation-hole depth -- 3 feet 4 inches	Horizonation was similar to test pit 1A. However, at 24 inches there was a gravelly clay loam. All layers were firm and very moist with fine gravels.
Additional notes:	
The test pit contained a few land snails, a lot of bricks, but no pieces of wood, and a few metal pieces. This pit was a cross between test pits 1A and 2A, but was most like test pit 1A. The vegetative cover (100 percent) consisted of grasses, sweet clover, and broadleaf weeds. Samples were taken at 6 inches.	

[a]Test pit locations are shown on Figure C.1-2.

Source: Weston (1982) field data.

Table C.1-7. Test pit descriptions[a] -- Burrell site (continued)

Test pit	Description
Test pit 2A	
Total depth -- 5 feet Percolation hole depth -- 6 feet	
0- 6 inches	Contains 85 percent gravel chips, no structure, looks like gravel from a railroad bed.
6-15 inches	Firm to very firm, compacted by some type of machinery, massive structure, no other apparent horizonation.
Additional notes:	
This test pit contained a lot of smaller gravels and large cobbles, coal slag, bricks, wood, excess metal, twisted metal rods, and rubber hoses. The pit also contained many firm zones and oily or shiny spots in some areas. The color was primarily N2/0 (very black). Some chemical odors were also noted, possibly diesel fuel. The ground cover contained crown vetch, sweet clover, weeds, and grasses (covering approximately 90 percent). This pit contained the most gravel of all of the test pits (approximately 60 percent of the pit was gravel). Samples were taken at 4 inches and 24 inches.	
Test pit 2B	
Total depth -- 24 inches	This test pit was flooded to within 3 inches of the surface. It was similar to test pit 2A.
Test pit 3A	
Total depth -- 4 1/2 feet Percolation hole depth -- 5 1/2 feet	
0- 8 inches	Friable, weak granular structure, contains fine gravels.
8-18 inches	Brittle but very firm layer, massive structure.
18-24 inches	A white and orange conglomerate (chemical by-product ?), very firm, massive.

[a]Test pit locations are shown on Figure C.1-2.

Source: Weston (1982) field data.

Table C.1-7. Test pit descriptions[a] -- Burrell site (continued)

Test pit	Description
Test pit 3A (continued)	
24-38 inches	Red-brown sandy loam, massive structure.
38-50 inches	Black and dark gold loose material, massive fill.

Additional notes:

This material looked like natural material but was fill. There were rounded cobble-size material scattered throughout the soil profile. Some metal pieces, wood, and bricks were present, but were few in number. The vegetative cover (80 percent) consisted of crown vetch and foxtail. Samples were taken at 20, 30, and 40 inches.

Test pit 3B

Total depth -- 2 feet
Percolation hole depth -- 32 inches

Similiar to test pit 3A with some concrete pieces also present.

Test pit 4A

Total depth -- 4 feet
Percolation hole depth -- 56 inches

0-24 inches	Very moist, water trickling in, fine gravels, sandy loam, 10YR3/2, faint mottling, very friable. At 20 inches very firm, compacted coal-mine waste, fine coal pieces mixed with red slag layer.
24-28 inches	Red slag, very firm, clayey, pieces of coal.
36 inches	Concrete pieces, tie rods (metal), smaller gravels than test pits 5 and 6.
48 inches	Very firm, compacted, wire boxes, bricks, weathered rock, very sandy, possibly boiler waste, very lightweight, massive.

[a]Test pit locations are shown on Figure C.1-2.

Source: Weston (1982) field data.

Table C.1-7. Test pit descriptions[a] -- Burrell site (continued)

Test pit	Description
Test pit 4A (continued)	
Additional notes:	
This test pit was located in a swampy area with 80-percent vegetative cover consisting of low grasses and broadleaves. There was slag or rocks at the bottom of the percolation hole that covered the entire bottom of the pit. There was slight unpleasant chemical odor coming from the pit. Samples were collected at 10, 24, and 40 inches.	
Test pit 4B	
Total depth -- 2 1/2 feet	
0-10 inches	Loose, fine gravels, sandy loam, very wet.
18 inches	
Red layer similar to that in test pit 4A.	
Additional notes:	
The test pit flooded to within 1 foot of the surface, therefore, no percolation test was run. A few pieces of wood and bricks were noted in the pit. The vegetation consisted of grasses and tall broadleaves (80 percent cover). No samples were collected.	
Test pit 5A	
Total depth -- 4 1/2 feet Percolation hole depth -- 5 1/2 feet	
0- 6 inches	Friable, weak subangular blocky structure, small amounts of gravel.
6-10 inches	Red crumbled brick layer, firm, discontinuous.
24 inches	Firm, very dark, coal fragments, moist, cobble-size material, structure is weak, subangular and blocky due to compaction.

[a]Test pit locations are shown on Figure C.1-2.

Source: Weston (1982) field data.

Table C.1-7. Test pit descriptions[a] -- Burrell site (continued)

Test pit	Description
Test pit 5A (continued)	
30 inches	Yellowish gray sandy clay loam, waste product, white porcelain or glass pieces mixed in, possibly insulators from electric lines.
48 inches	Olive green to gray silty clay, plastic, sticky, friable.

Additional notes:

There were more color variations (bricks) and different layers of fill in this pit. There was virtually no wood or was it as gravelly as test pit 6A. There were bricks and metal bars at a depth of 36 inches. The vegetation consisted of grasses and broadleaf weeds (100 percent cover). Samples were collected at 6, 10, 30, and 48 inches.

Test pit 5B

Total depth -- 3 feet
Percolation hole depth -- 4 feet

0-10 inches	Loose, cobbles, no structure.
30 inches	Band of weathered blue gray shale, very firm.
35-37 inches	Small, discontinuous band of weathered sandstone or ironstone, loamy sand, dark rusty color, single grain.
18 and 42 inches	Pockets of crumbled red brick.

Additional notes:

This test pit contained many wooden boards and metal cable pieces. The vegetation consisted of grasses as well as broadleaf weeds with some moss. Samples were collected at 6 inches and 30 inches.

[a]Test pit locations are shown on Figure C.1-2.

Source: Weston (1982) field data.

Table C.1-7. Test pit descriptions[a] -- Burrell site (continued)

Test pit	Description
Test pit 6A	
Total depth -- 4 feet Percolation hole depth -- 5 feet	
0- 6 inches	Weak, friable, massive structure.
15 inches	Very firm slag material.
6-30 inches	Firm, metal strips and bars, dark color (N2/0), massive structure.
30 inches	Small clay layer.
48 inches	Friable, massive, interbedded white chemical by-product.
Additional notes:	
This test pit contained iron strips, electrical lines, railroad ties, bottles, bricks, rounded gravel, coal slag, and sandstone. The cover vegetation (approximately 70 percent) consisted of mosses, low-lying broadleaf cover, and tall grasses. Samples were taken at 15, 30, and 48 inches.	
Test pit 6B	
Total depth -- 3 feet Percolation hole depth -- 4 feet	
10 inches	Gravelly, black (N3/0), very coarse material, compacted layer (roadbed gravel?).
30 inches	Mottled, gray brown, loam, higher clay content, massive structure, firm.
Additional notes:	
This test pit contained many wooden boards, railroad ties, bricks, cement chunks, metal trash, and pieces of rubber. The ground cover (70 percent) consisted of broadleaf cover and grasses. Samples were collected at depths of 10 and 30 inches.	

[a]Test pit locations are shown on Figure C.1-2.

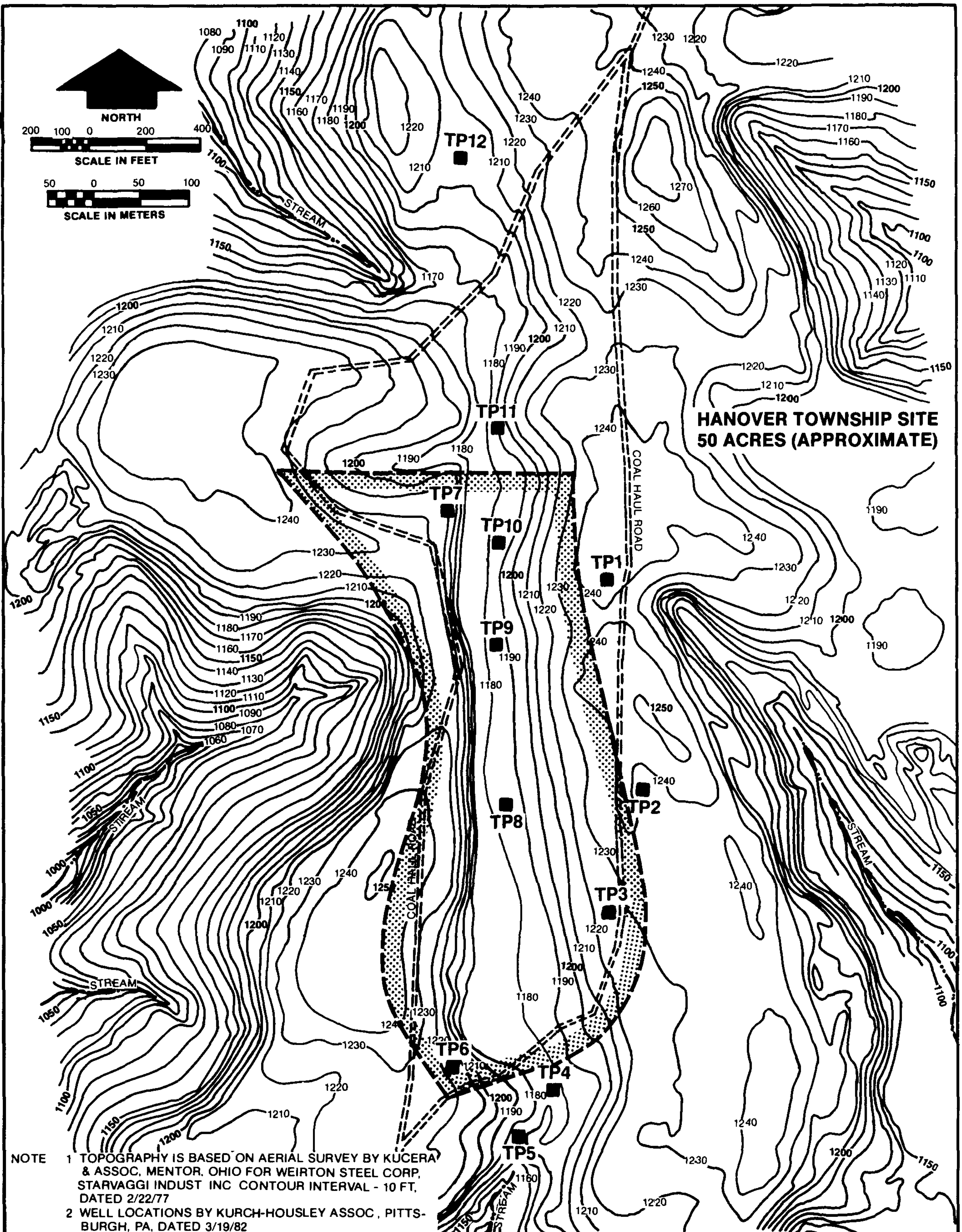
Source: Weston (1982) field data.

Table C.1-8. Percolation and infiltration rates -- Burrell site

Test pit[a]	Percolation rate (in./sec)	Test depth (in.)	Infiltration rate (in./sec)
1A	2.6×10^{-3}	84	2.2×10^{-3}
1B	9.2×10^{-4}	40	8.3×10^{-4}
2A	2.4×10^{-3}	72	2.0×10^{-3}
2B	Flooded	--	7.3×10^{-3}
3A	6.7×10^{-4}	66	6.2×10^{-3}
3B	2.8×10^{-3}	32	9.7×10^{-3}
4A	1.2×10^{-3}	56	6.7×10^{-4}
4B	Flooded	--	2.2×10^{-3}
5A	8.3×10^{-3}	0	1.7×10^{-4}
5B	1.4×10^{-3}	48	1.5×10^{-3}
6A	1.2×10^{-3}	60	1.7×10^{-3}
6B	7.8×10^{-4}	48	9.2×10^{-3}
$\bar{X}$[b]	1.5×10^{-3}	57.2	3.6×10^{-3}

[a]Test pit locations are shown on Figure C.1-2.
[b]$\bar{X}$ = average.

Source: Weston (1982) field data.



TP1 SOIL TEST PIT LOCATION/DESIGNATION

1240 SURFACE CONTOUR — ELEVATION (FT)

**FIGURE C.1-3
TOPOGRAPHY AND LOCATION
OF SOIL TEST PITS
HANOVER TOWNSHIP SITE**

Table C.1-9. Test pit descriptions[a,b] -- Hanover site

Test pit	Description
Test pit 1	
90 percent coarse fragments	
0-12 inches	Loam, 10YR5/4, granular, friable, heaviest growth of roots
12-59 inches	Yellow orange, coarse sandstone, gravelly loamy sand, 10YR6/8. Gray-white coarse sandstone, gravelly loamy sand, 10YR5/4, predominant unit. Very soft black fractured shale, pockets of heavy silt loam, 10YR3/1. Highly weathered dark brown sandstone, loamy coarse sand, 5YR3/2
Test pit 2	
90 percent coarse fragments	
0- 8 inches	Sandy loam to loam, variegated colors, main root zone.
8-57 inches	Micaceous gray shale, gravelly silt loam, 10YR5/3, friable. Gray-white coarse sandstone, loamy coarse sand, 10YR6/3, predominant unit. Yellow-orange coarse sandstone, gravelly loamy sand, 10YR6/8.

[a]Test pit locations are shown on Figure C.1-3.

[b]Soils at the Hanover site were not in a natural state. Coal-mining operations had disturbed the original soil and mixed it with fractured bedrock. The only identifiable horizon in the test pits was the depth of the root zone. Therefore, soil scientists looked at rock fragment components found in each test pit. These components are described to give information on the strata underlying the Hanover site.

Source: Weston (1982) field data.

Table C.1-9. Test pit descriptions[a,b] -- Hanover site (continued)

Test pit	Description
Test pit 3	
90 percent coarse fragments	
0- 9 inches	Sandy loam to loam to silt loam, 10YR4/3, granular, weak, friable, main root zone.
9-60 inches	Gray-white sandstone, loamy coarse sand, predominant rock unit. Brown sandstone, sandy loam, 10YR4/3 predominant soil color. Black shale, pockets of silt loam.
Test pit 4	
90 percent coarse fragments	
0-24 inches	Sandy loam and loam, 10YR4/3, predominant soil color, main root zone.
24-52 inches	Light gray shale, siltstone, and very fine-grained sandstone. Coarse gray sandstone, coarse sandy loam predominant unit. Brown coarse sandstone with pockets of hard coal.

[a]Test pit locations are shown on Figure C.1-3.

[b]Soils at the Hanover site were not in a natural state. Coal-mining operations had disturbed the original soil and mixed it with fractured bedrock. The only identifiable horizon in the test pits was the depth of the root zone. Therefore, soil scientists looked at rock fragment components found in each test pit. These components are described to give information on the strata underlying the Hanover site.

Source: Weston (1982) field data.

Table C.1-9. Test pit descriptions[a,b] -- Hanover site (continued)

Test pit	Description
Test pit 5	
90 percent coarse fragments	
0-15 inches	Loamy coarse sand, 10YR4/3, main root zone.
15-57 inches	Coarse brown sandstone, predominant unit, several tree branches and pieces of wood present. Yellow-orange sandstone, loamy sand. Light gray shale, silt loam.
Test pit 6	
80 percent coarse fragments	
0-28 inches	Loamy sand, 10YR4/3, main root zone.
28-55 inches	Gray-white sandstone, sandy loam. Yellow-orange sandstone, sandy loam. Light gray fine siltstone, loam to silt loam, pockets of lignite.

[a]Test pit locations are shown on Figure C.1-3.

[b]Soils at the Hanover site were not in a natural state. Coal-mining operations had disturbed the original soil and mixed it with fractured bedrock. The only identifiable horizon in the test pits was the depth of the root zone. Therefore, soil scientists looked at rock fragment components found in each test pit. These components are described to give information on the strata underlying the Hanover site.

Source: Weston (1982) field data.

Table C.1-9. Test pit descriptions[a,b] -- Hanover site (continued)

Test pit	Description
Test pit 7	
98 percent coarse fragments	
0-60 inches	Sandy loam, 10YR4/3, main root zone, granular, weak, friable. Alternating bands of loamy sand, yellow orange and silt loam, black-gray lignite, subangular blocky, weak, friable.
Test pit 8	
70 percent coarse fragments	
0-10 inches	Main root zone, silt loam, 10YR4/3.
10-60 inches	Gray-white sandstone, gravelly coarse sandy loam, 10YR4/3. Black shale and lignite pockets, gravelly loam to silt loam.
Test pit 9	
90 percent coarse fragments	
0-11 inches	Gravelly sandy loam, 10YR4/3, main root zone.

[a]Test pit locations are shown on Figure C.1-3.

[b]Soils at the Hanover site were not in a natural state. Coal-mining operations had disturbed the original soil and mixed it with fractured bedrock. The only identifiable horizon in the test pits was the depth of the root zone. Therefore, soil scientists looked at rock fragment components found in each test pit. These components are described to give information on the strata underlying the Hanover site.

Source: Weston (1982) field data.

Table C.1-9. Test pit descriptions[a,b] -- Hanover site (continued)

Test pit	Description
Test pit 9 (continued)	
11-56 inches	Gray-white coarse sandstone, gravelly coarse sandy loam. Yellow-orange coarse sandstone, coarse sandy loam, lignite and coal pockets.
Test pit 10	
90 percent coarse fragments	
0-22 inches	Gravelly loam, 10YR4/3, granular, weak, main root zone.
22-56 inches	Gray-white sandstone, gravelly coarse sandy loam, subangular, blocky, weak. Fine-grained black siltstone, loam to silt loam. Yellow-orange sandstone, sandy loam. Limestone, light gray, gravelly silt loam.
Test pit 11	
90 percent coarse fragments	
0- 9 inches	Gravelly loam, 10YR5/2, main root zone.

[a]Test pit locations are shown on Figure C.1-3.

[b]Soils at the Hanover site were not in a natural state. Coal-mining operations had disturbed the original soil and mixed it with fractured bedrock. The only identifiable horizon in the test pits was the depth of the root zone. Therefore, soil scientists looked at rock fragment components found in each test pit. These components are described to give information on the strata underlying the Hanover site.

Source: Weston (1982) field data.

Table C.1-9. Test pit descriptions[a,b] -- Hanover site (continued)

Test pit	Description
Test pit 11 (continued)	
9-36 inches	Gray-white sandstone, gravelly loam. Yellow-orange sandstone, gravelly loam. Gray shale, loam.
Test pit 12	
90 percent coarse fragments	
0-12 inches	Sandy loam, 10YR4/3, granular, very weak, friable, main root zone.
12-58 inches	Gray-white sandstone, sandy loam, large pockets of lignite. Coarse brown sandstone, sandy loam. Yellow-orange sandstone, sandy loam.

[a]Test pit locations are shown on Figure C.1-3.

[b]Soils at the Hanover site were not in a natural state. Coal-mining operations had disturbed the original soil and mixed it with fractured bedrock. The only identifiable horizon in the test pits was the depth of the root zone. Therefore, soil scientists looked at rock fragment components found in each test pit. These components are described to give information on the strata underlying the Hanover site.

Source: Weston (1982) field data.

Table C.1-10. Percolation rates -- Hanover site

Test pit[a]	Percolation rate (in./sec)	Percolation depth (in.)
1	5.5×10^{-5}	73
2	1.1×10^{-4}	69
2	1.2×10^{-3}	41
3	1.4×10^{-4}	75
3	3.3×10^{-4}	45
6	1.1×10^{-4}	69
7	3.9×10^{-4}	45
8	No movement	72
8	1.1×10^{-4}	45
10	3.3×10^{-4}	72
10	2.8×10^{-4}	44
$\bar{X}$[b]	3.0×10^{-4}	59

[a]Test pit locations are shown on Figure C.1-3.

[b]$\bar{X}$ = average.

Source: Weston (1982) field data.

Appendix C.2

GEOLOGICAL INFORMATION

Appendix C.2

GEOLOGICAL INFORMATION

Geological investigations were conducted at the expanded Canonsburg site, and at the Burrell and Hanover sites to determine the following:

1. Site stratigraphy.
2. Depth to bedrock.
3. Regional setting.
4. Geological structure.
5. Mineral resources.

At each site the investigations utilized the extensive regional data in the literature. The regional data were augmented and verified during the site-specific drilling programs conducted for hydrogeological analysis. These drilling programs are described in Appendix D.2.

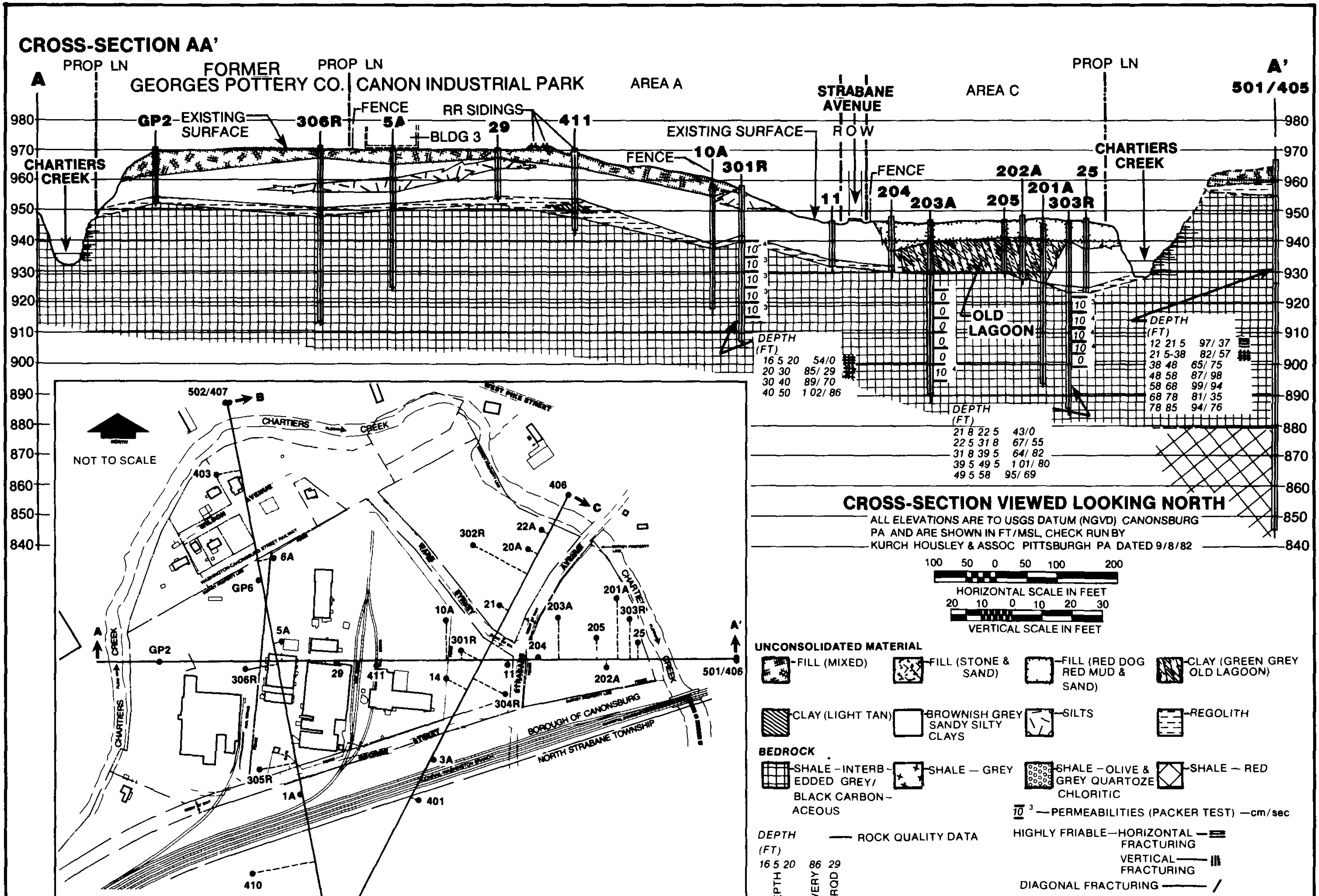


FIGURE C.2-1
GEOLOGICAL CROSS-SECTION AA'
EXPANDED CANONSBURG SITE

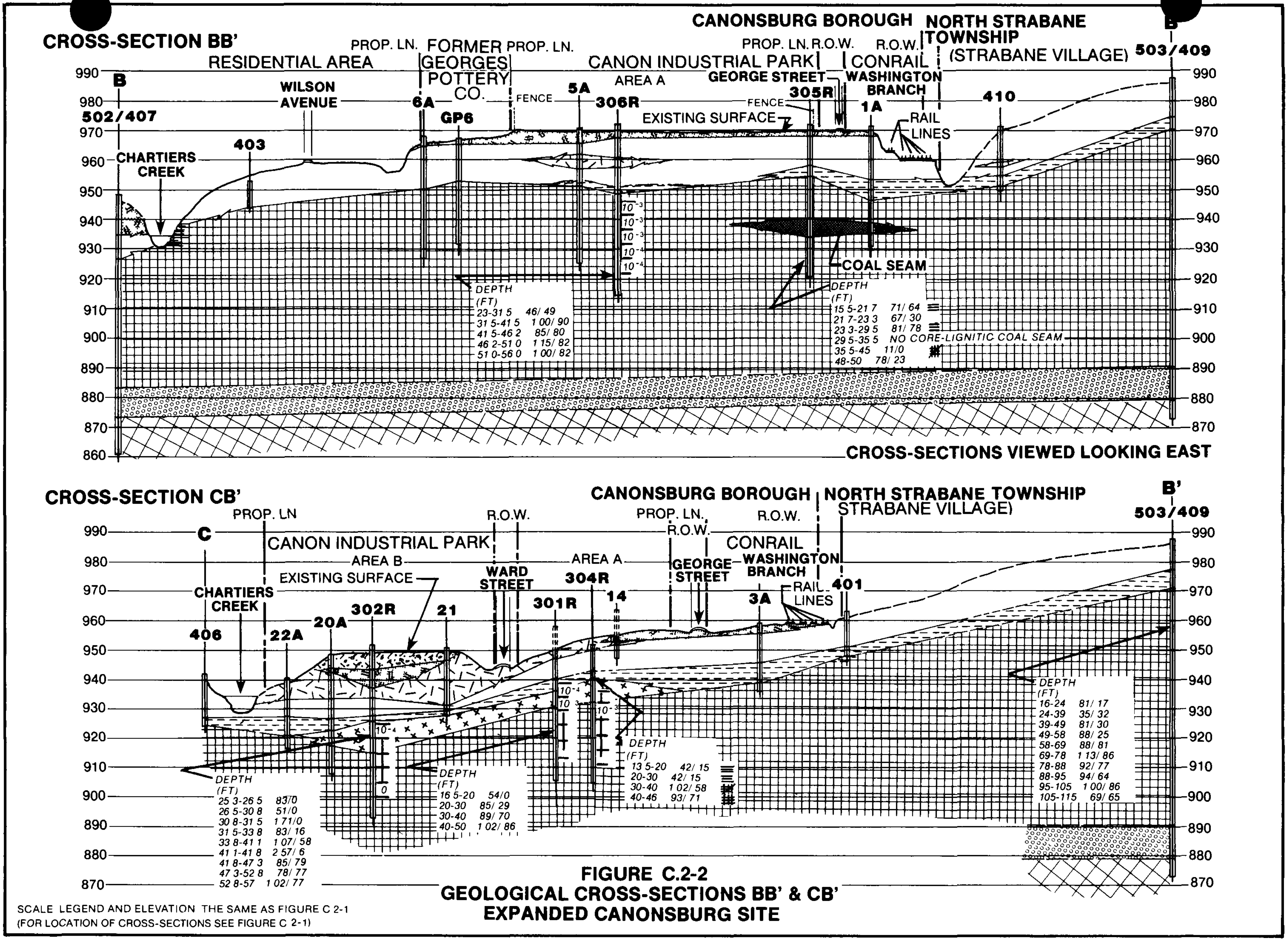
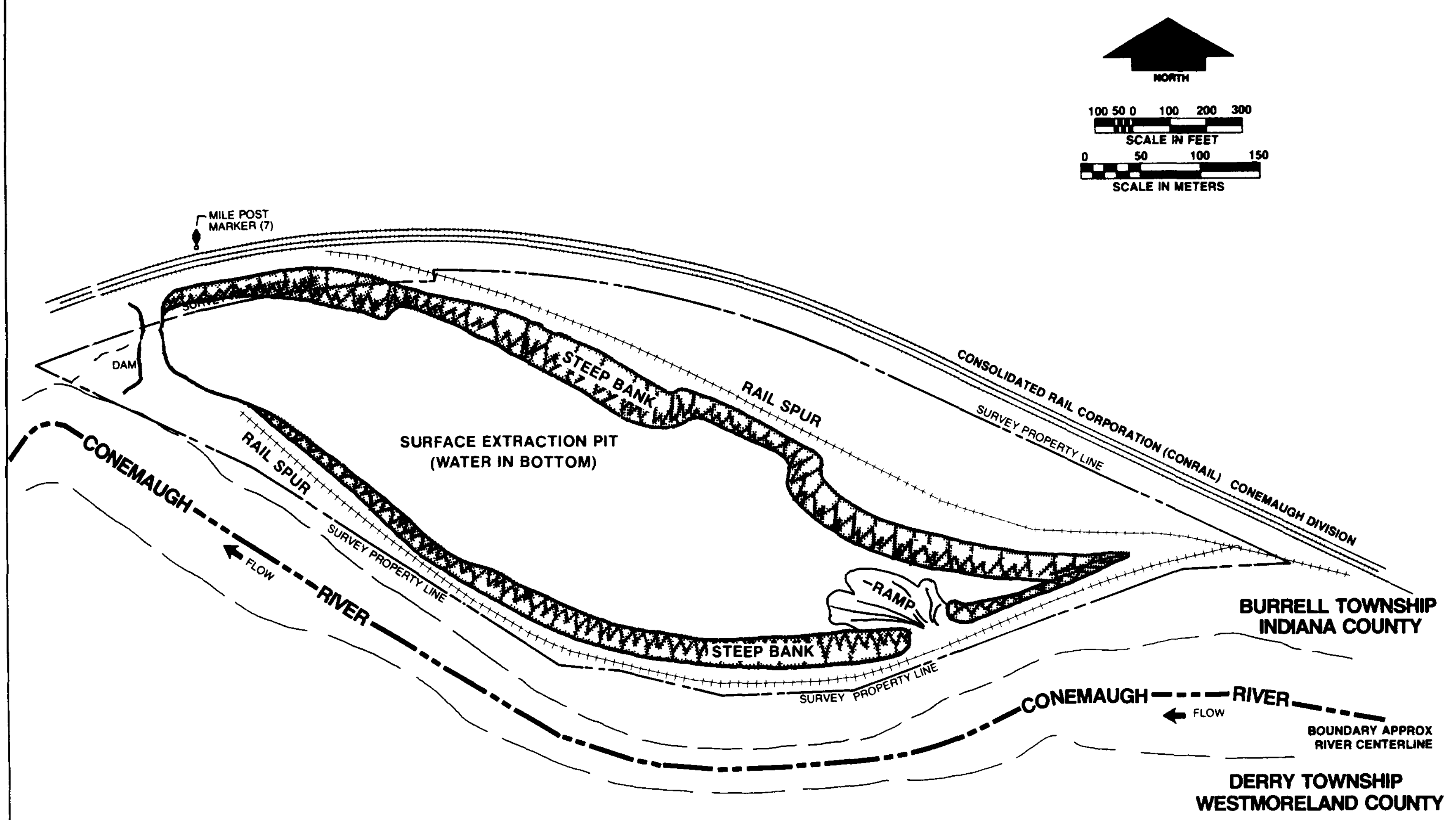


FIGURE C.2-2
GEOLOGICAL CROSS-SECTIONS BB' & CB'
EXPANDED CANONSBURG SITE



FROM HISTORICAL AERIAL PHOTOGRAPHY USDA
DATE 10/13/49

NOTE 1 PROPERTY LINE DATA FROM PLAN OF PROPERTY FOR UNION CARBIDE CORP BY RICHARD G BACH & ASSOC ...ENOPLE PA DATED 11/16/77

FIGURE C.2-3
SITE CONFIGURATION — 1949
BURRELL TOWNSHIP SITE

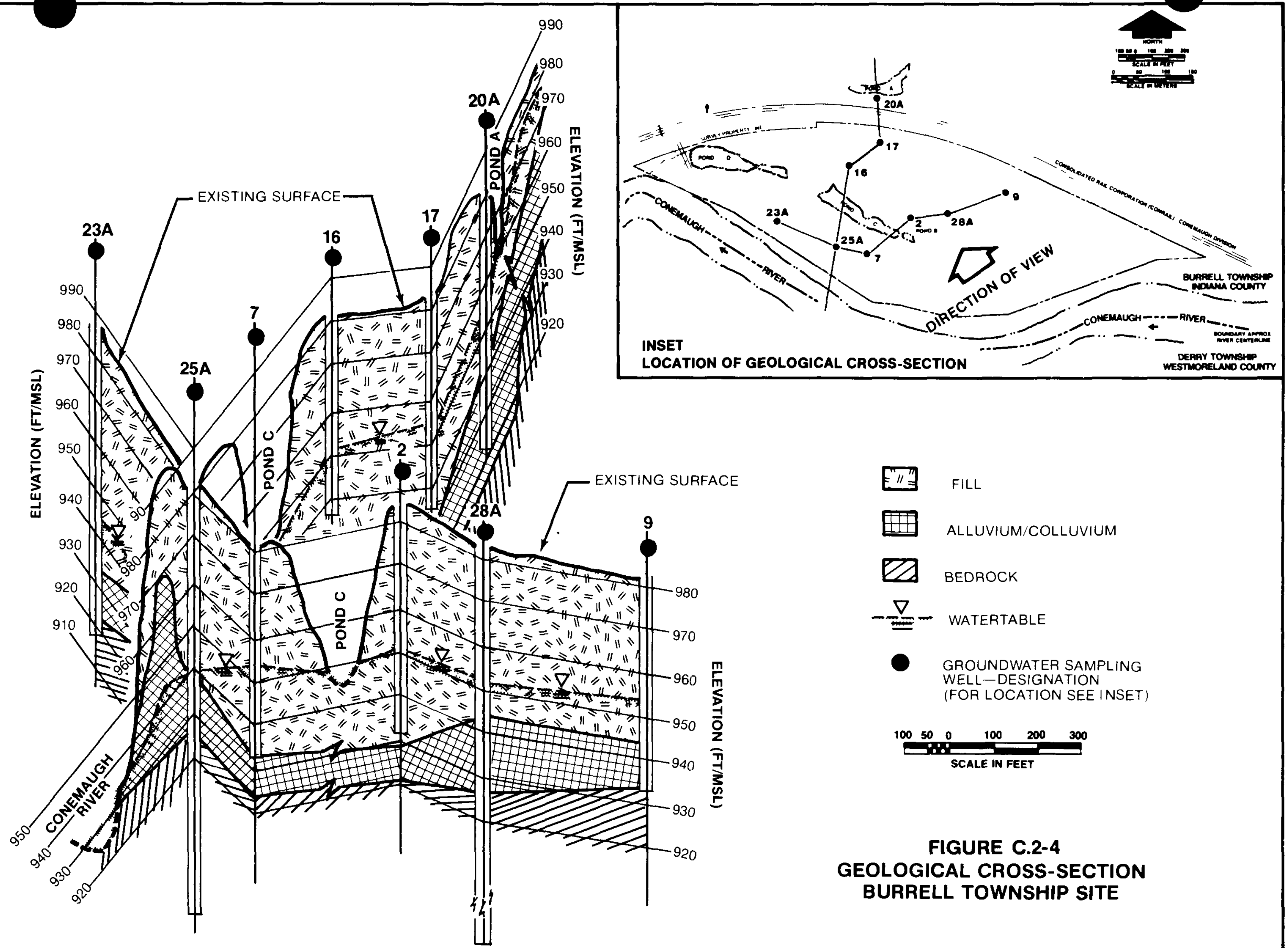


FIGURE C.2-4
GEOLOGICAL CROSS-SECTION
BURRELL TOWNSHIP SITE

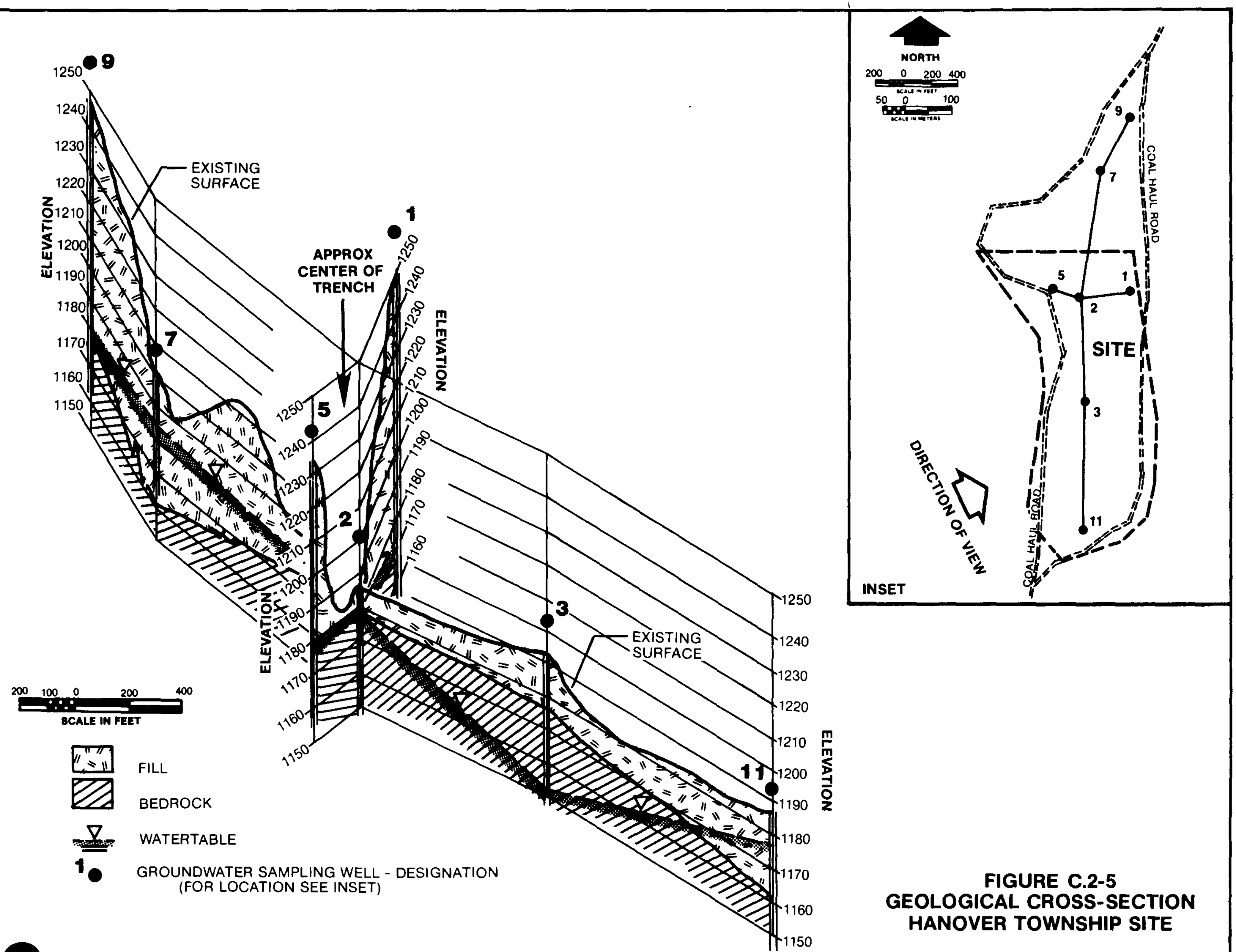
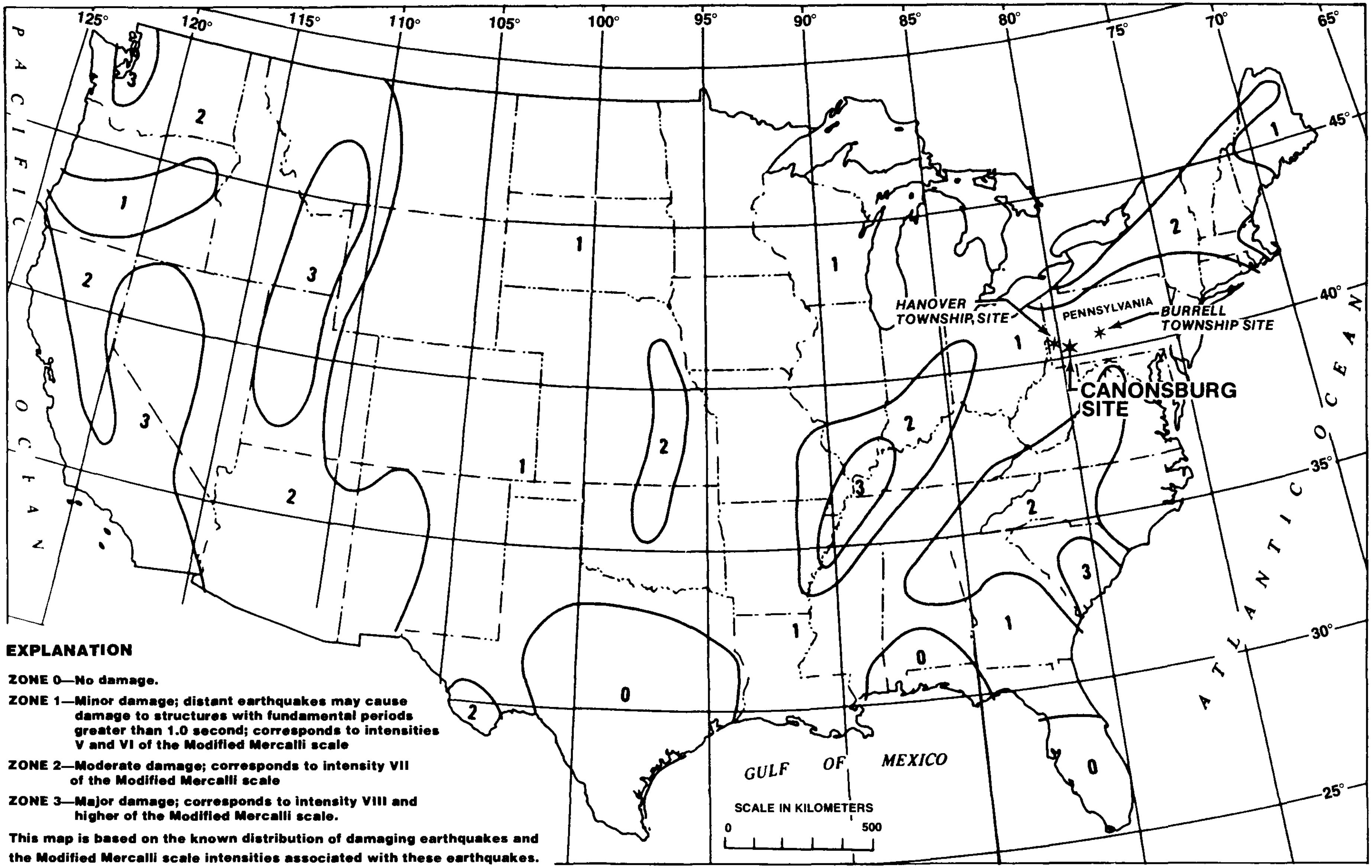


FIGURE C.2-5
GEOLOGICAL CROSS-SECTION
HANOVER TOWNSHIP SITE



EXPLANATION

ZONE 0—No damage.

ZONE 1—Minor damage; distant earthquakes may cause damage to structures with fundamental periods greater than 1.0 second; corresponds to intensities V and VI of the Modified Mercalli scale

ZONE 2—Moderate damage; corresponds to intensity VII of the Modified Mercalli scale

ZONE 3—Major damage; corresponds to intensity VIII and higher of the Modified Mercalli scale.

This map is based on the known distribution of damaging earthquakes and the Modified Mercalli scale intensities associated with these earthquakes.

FROM U S GEOLOGICAL SURVEY PP 1114 (1980) —AFTER ALGERMISSEN 1969

FIGURE C.2-6
SEISMIC RISK ZONES IN THE UNITED STATES

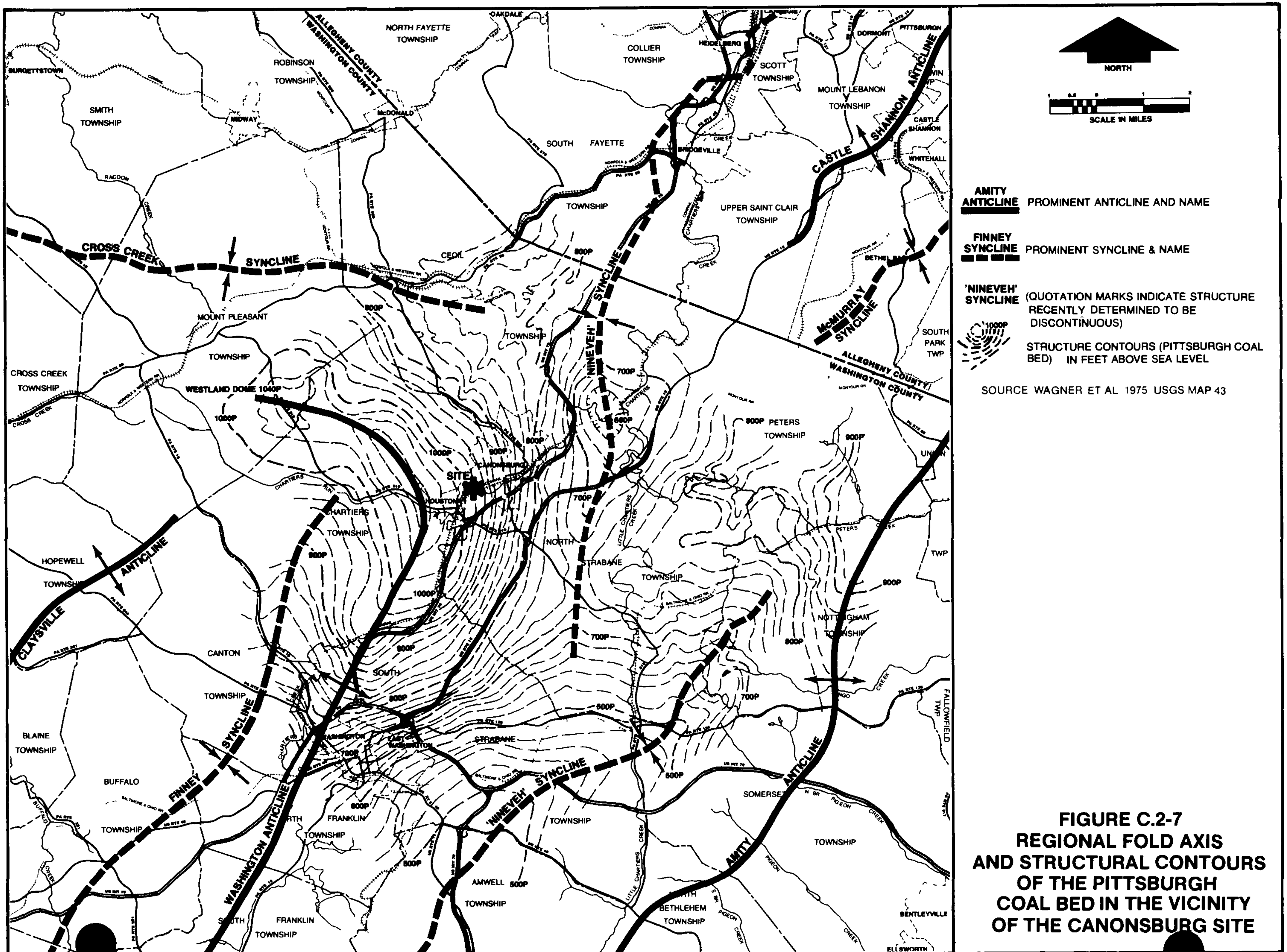


FIGURE C.2-7
REGIONAL FOLD AXIS AND STRUCTURAL CONTOURS OF THE PITTSBURGH COAL BED IN THE VICINITY OF THE CANONSBURG SITE

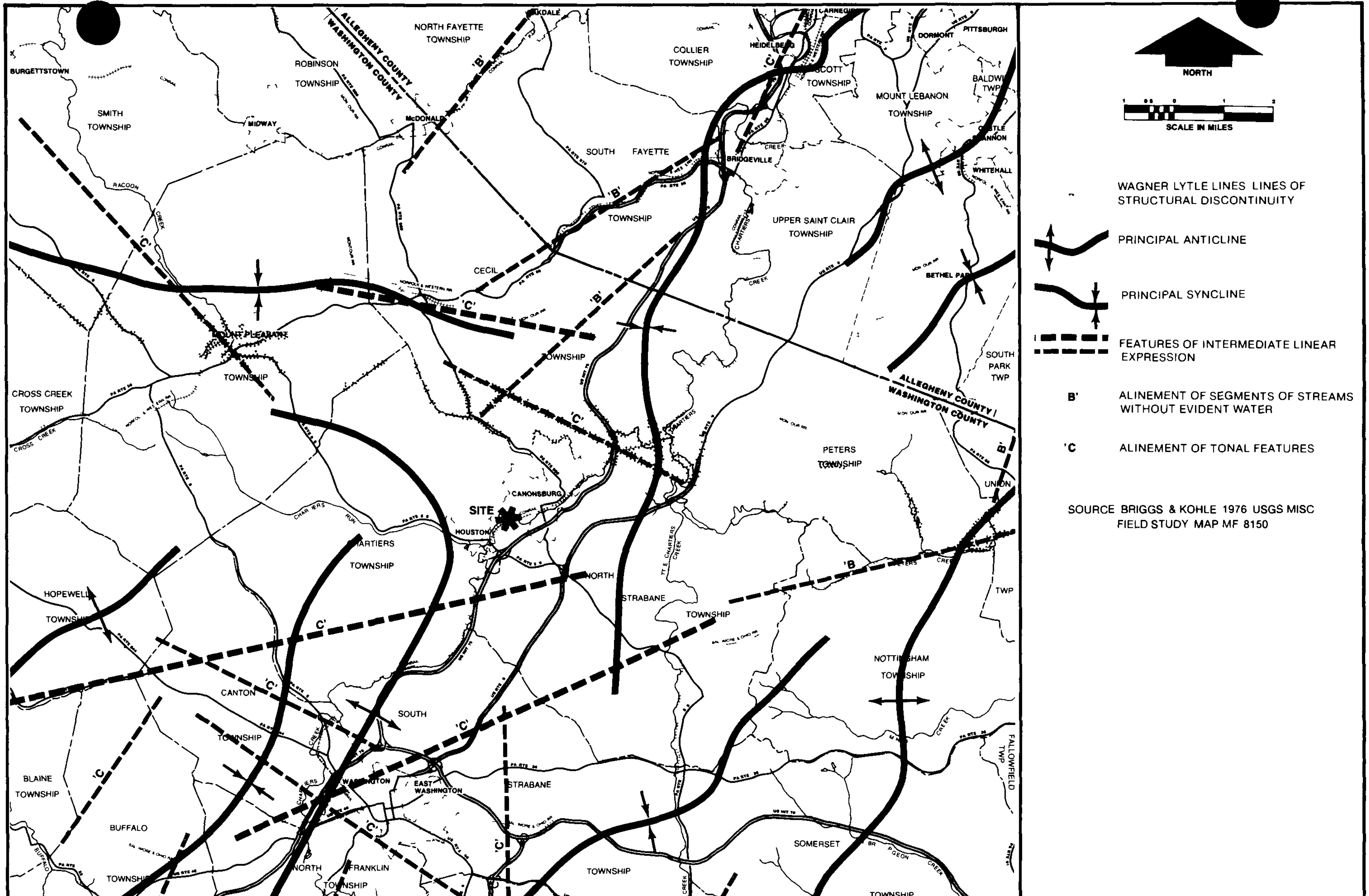
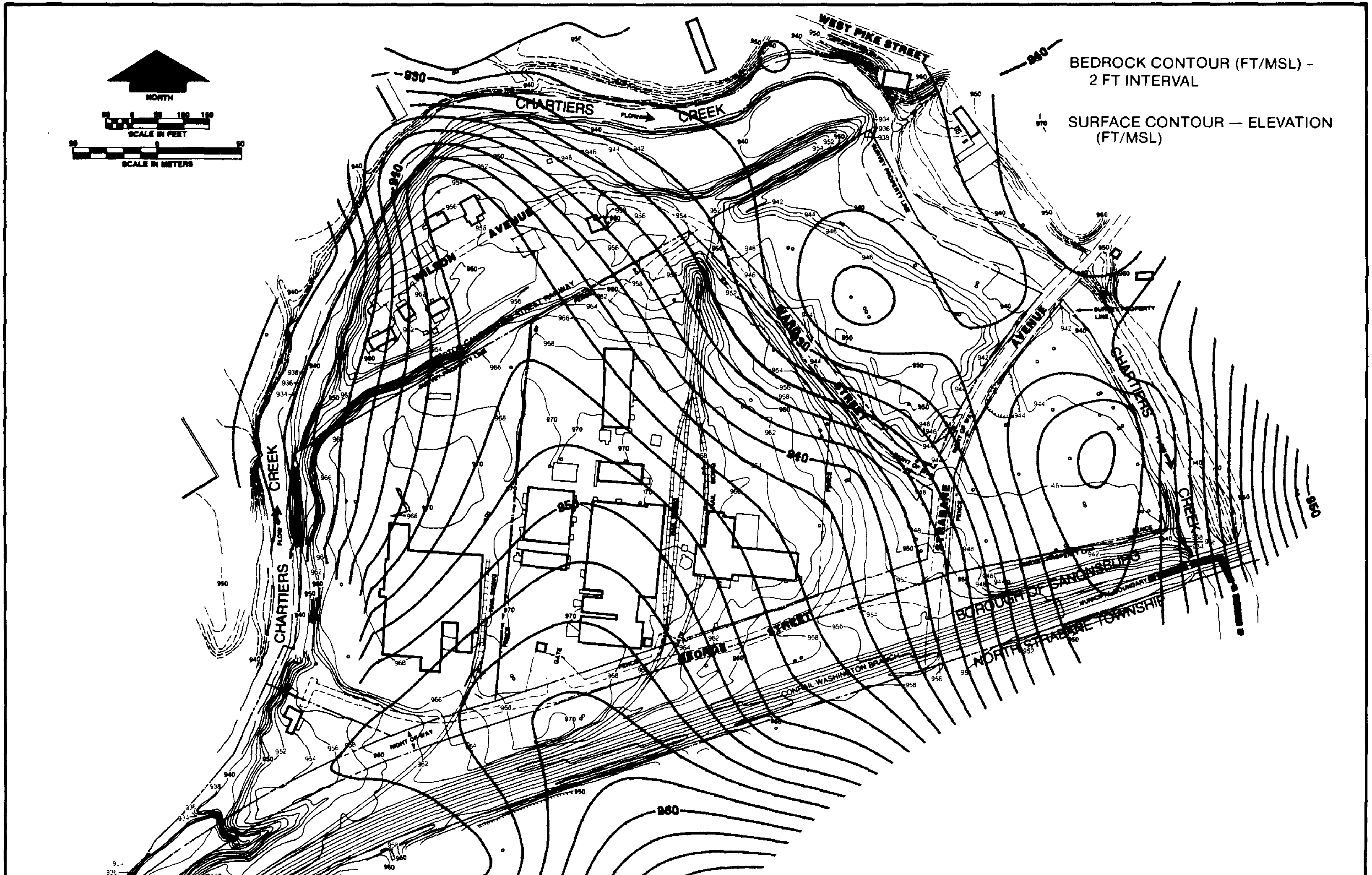


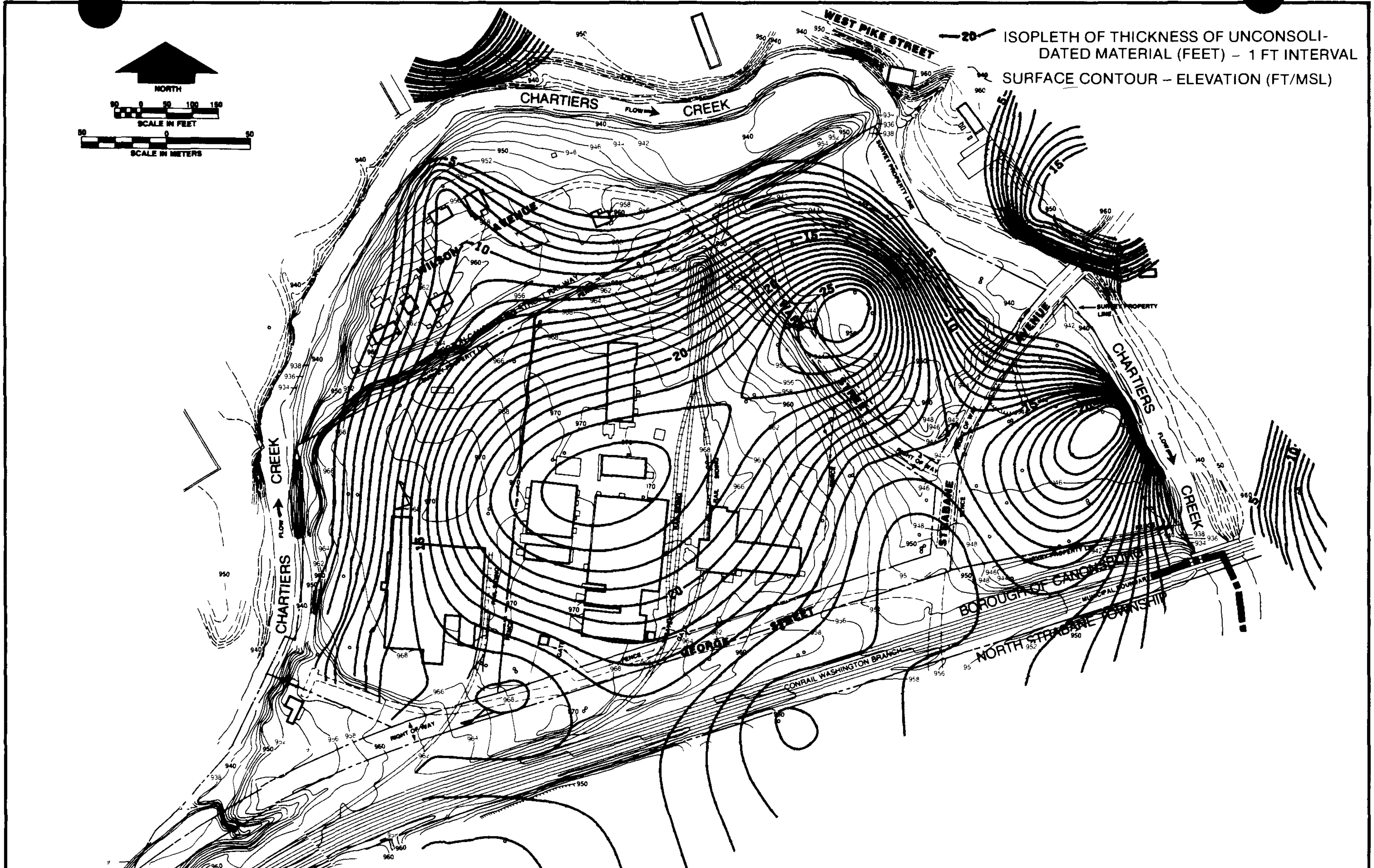
FIGURE C.2-8
MAJOR GEOLOGIC STRUCTURAL FEATURES IN THE VICINITY OF THE CANONSBURG SITE



NOTE: 1. THIS MAP IS BASED ON A SURVEY AND TOPOGRAPHY BY *KURCH-HOUSLEY & ASSOC., PITTSBURGH, PA, DATED* MARCH 1983; AND ON MAPS OF THE CHARTIERS CREEK BASIN, PA BY THE US ARMY, CORPS OF ENGINEERS, PITTSBURGH, PA, DATED 6/3/73,

2. ALL ELEVATIONS ARE TO USGS DATUM (NGVD), CANONSBURG PA, AND ARE SHOWN IN FT/MSL, CHECK RUN BY KURCH-HOUSLEY & ASSOC., PITTSBURGH, PA. DATED 9/8/82 FOR SITE UTILITIES SEE ABOVE SURVEYS AND MAPS.

FIGURE C.2-9
BEDROCK SURFACE CONTOURS
EXPANDED CANONSBURG SITE



NOTE 1 THIS MAP IS BASED ON A SURVEY AND TOPOGRAPHY BY KURCH-HOUSLEY & ASSOC., PITTSBURGH, PA, DATED MARCH 1983, AND ON MAPS OF THE CHARTIERS CREEK BASIN, PA BY THE US ARMY, CORPS OF ENGINEERS, PITTSBURGH, PA, DATED 6/3/73.

2 ALL ELEVATIONS ARE TO USGS DATUM (NGVD), CANONSBURG PA, AND ARE SHOWN IN FT/MSL, CHECK RUN BY KURCH-HOUSLEY & ASSOC., PITTSBURGH, PA DATED 9/8/82 FOR ON SITE UTILITIES SEE ABOVE SURVEYS AND MAPS

FIGURE C.2-10
THICKNESS OF UNCONSOLIDATED MATERIAL
EXPANDED CANONSBURG SITE

REFERENCES FOR APPENDIX C

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Appendix D

WATER RESOURCES INFORMATION

Appendix D.1

SURFACE-WATER INFORMATION

Appendix D.1

SURFACE WATERS

Information on existing water quality and flow conditions in Chartiers Creek and the Conemaugh River was obtained from the Pennsylvania DER's STORET system. In addition, Weston performed a surface-water sampling effort at the Canonsburg site in July 1979 (the results are given in Table D.1-4) to determine the nonradiological-contaminant loading of Chartiers Creek from the site, and to compare it to input from other local sources.

An EPA-water quality study (Downie and Petrone, 1980) was performed in May 1980 on the surface waters in the vicinity of the Hanover site, as part of a permit application by the site's owner (Starvaggi Industries) to construct an industrial landfill. The results of this study, along with the results from an owner-performed water-quality testing program conducted in October 1980 were used to characterize the waters in the Hanover site area.

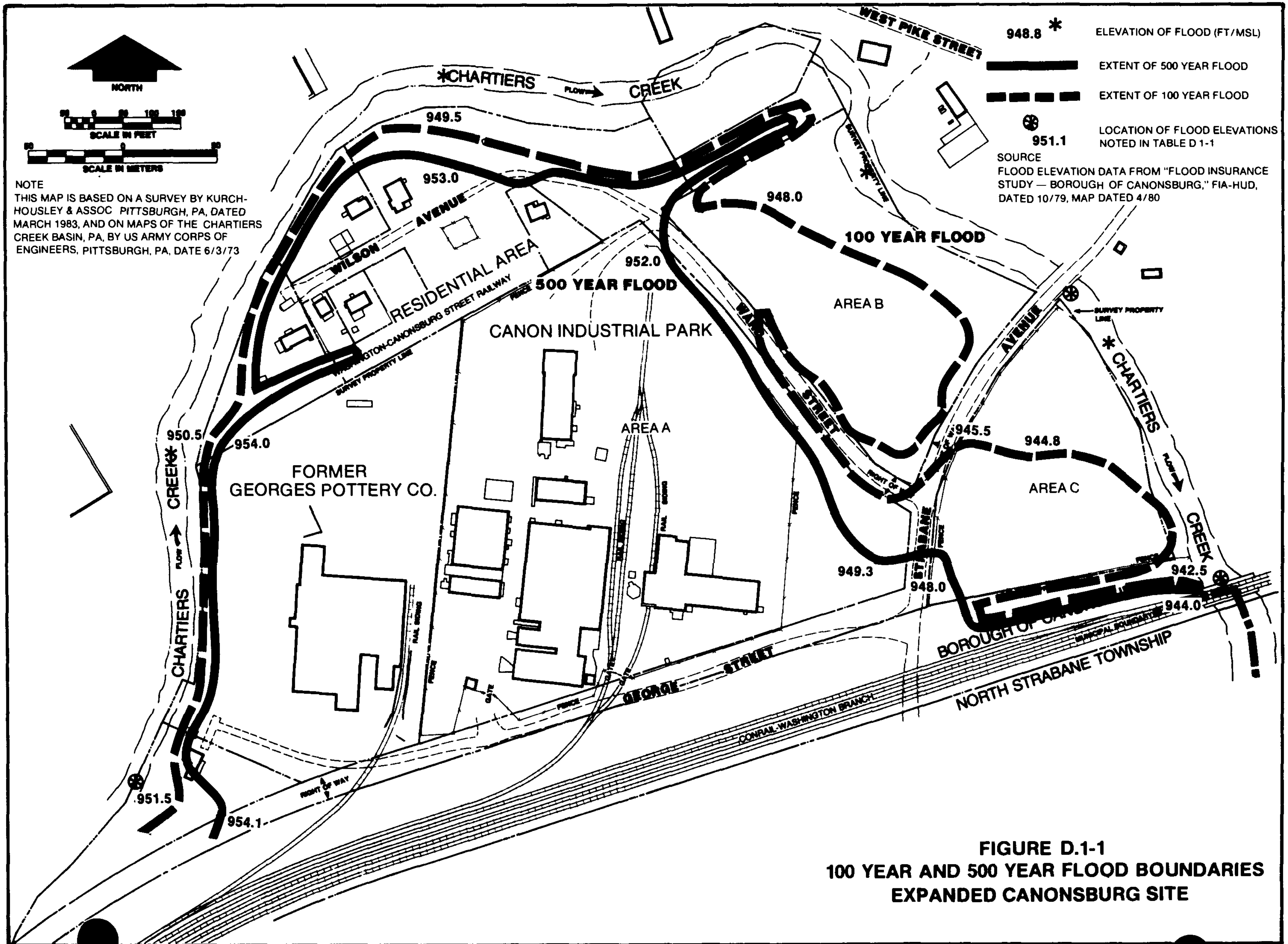
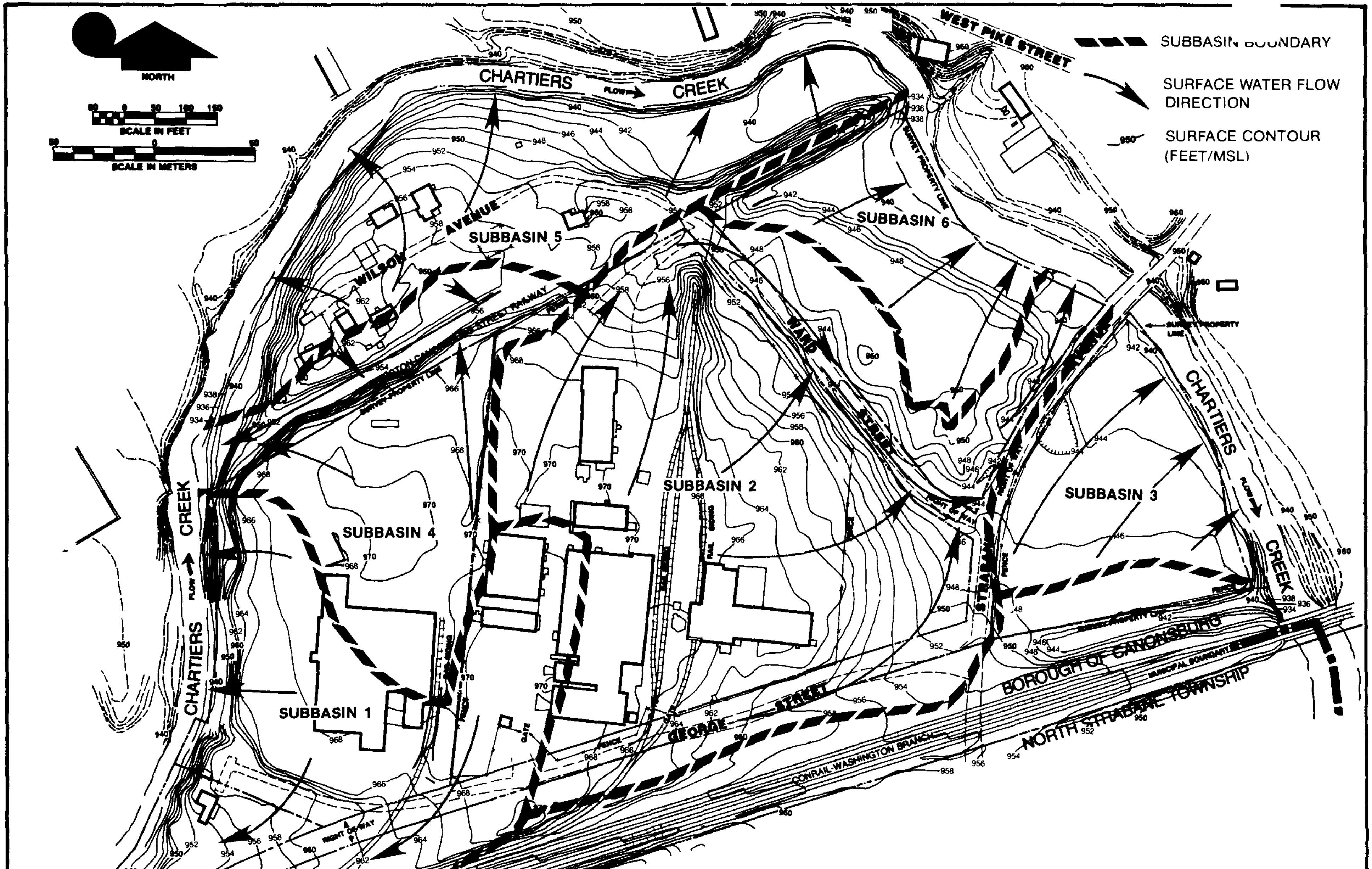


FIGURE D.1-1
100 YEAR AND 500 YEAR FLOOD BOUNDARIES
EXPANDED CANONSBURG SITE



NOTE 1 THIS MAP IS BASED ON A SURVEY AND TOPOGRAPHY BY KURCH-HOUSLEY & ASSOC , PITTSBURGH, PA, DATED MARCH 1983, AND ON MAPS OF THE CHARTIERS CREEK BASIN, PA BY THE US ARMY, CORPS OF ENGINEERS, PITTSBURGH, PA, DATED 6/3/73,

2 ALL ELEVATIONS ARE TO USGS DATUM (NGVD), CANONSBURG PA, AND ARE SHOWN IN FT/MSL, CHECK RUN BY KURCH-HOUSLEY & ASSOC , PITTSBURGH, PA DATED 9/8/82 FOR ON SITE UTILITIES SEE ABOVE SURVEYS AND MAPS

FIGURE D.1-2
SURFACE WATER RUNOFF PATTERN
EXPANDED CANONSBURG SITE

Table D.1-1. Flood elevations and discharges on Chartiers Creek adjacent to the Canonsburg site

Stream location	Flood elevations (USGS data) (mean sea level)			
	10 yr	50 yr	100 yr	500 yr
ConRail railroad bridge	938	941.5	942.5	944
Strabane Ave. bridge	940	943.5	945.5	949.3
Just upstream of site	945.5	949.5	951.5	954.1
	Stream discharge (cfs)			
Near site	5,600	10,100	12,600	19,400

Source: U.S. Department of Housing and Urban Development (1979).

Notes: Flood elevations reflect the completion of a portion of the ongoing channelization project in the Canonsburg-Houston area. The channel-improvement project has been completed from the North Central Avenue bridge crossing upstream to the ConRail bridge crossing, just downstream of the site. As channel improvements continue, flood elevations will be reduced.

Refer to the U.S. Army Corps of Engineers (1975).

Flooding patterns are shown on Figure D.1-1.

Table D.1-2. Estimated runoff volume (acre-feet) from the Canonsburg site

			Subbasin 1[b]			Subbasin 2[b]			Subbasin 3[b]			Subbasin 4[b]			Subbasin 5[b]			Subbasin 6[b]			
Return period (yrs)	Duration (hrs)	Intensity[a] (in./hr)	Area (acres)	Runoff coeffi- cient	Runoff volume (acre-ft)	Area (acres)	Runoff coeffi- cient	Runoff volume (acre-ft)	Area (acres)	Runoff coeffi- cient	Runoff volume (acre-ft)	Area (acres)	Runoff coeffi- cient	Runoff volume (acre-ft)	Area (acres)	Runoff coeffi- cient	Runoff volume (acre-ft)	Area (acres)	Runoff coeffi- cient	Runoff volume (acre-ft)	Total runoff volume (acre-ft)
2	0.25	2.5	8.5	0.22	0.10	11.7	0.29	0.18	4.4	0.07	0.02	5.9	0.15	0.05	5.0	0.10	0.03	2.5	0.12	0.02	0.40
2	1	1.1	8.5	0.22	0.17	11.7	0.29	0.31	4.4	0.07	0.03	5.9	0.15	0.08	5.0	0.10	0.05	2.5	0.12	0.03	0.67
2	6	0.27	8.5	0.22	0.25	11.7	0.29	0.46	4.4	0.07	0.04	5.9	0.15	0.12	5.0	0.10	0.07	2.5	0.12	0.04	0.98
2	12	0.15	8.5	0.22	0.28	11.7	0.29	0.51	4.4	0.07	0.05	5.9	0.15	0.13	5.0	0.10	0.08	2.5	0.12	0.05	1.10
10	0.25	3.3	8.5	0.22	0.13	11.7	0.29	0.23	4.4	0.07	0.02	5.9	0.15	0.06	5.0	0.10	0.03	2.5	0.12	0.02	0.49
10	1	1.5	8.5	0.22	0.23	11.7	0.29	0.42	4.4	0.07	0.04	5.9	0.15	0.11	5.0	0.10	0.06	2.5	0.12	0.04	0.90
10	6	0.4	8.5	0.22	0.37	11.7	0.29	0.68	4.4	0.07	0.06	5.9	0.15	0.18	5.0	0.10	0.10	2.5	0.12	0.06	1.45
10	12	0.22	8.5	0.22	0.41	11.7	0.29	0.75	4.4	0.07	0.07	5.9	0.15	0.19	5.0	0.10	0.11	2.5	0.12	0.07	1.60
50	0.25	4.0	8.5	0.25	0.18	11.7	0.32	0.31	4.4	0.08	0.03	5.9	0.18	0.09	5.0	0.12	0.05	2.5	0.13	0.03	0.69
50	1	2.0	8.5	0.25	0.35	11.7	0.32	0.62	4.4	0.08	0.06	5.9	0.18	0.18	5.0	0.12	0.10	2.5	0.13	0.05	1.36
50	6	0.5	8.5	0.25	0.53	11.7	0.32	0.94	4.4	0.08	0.09	5.9	0.18	0.27	5.0	0.12	0.12	2.5	0.13	0.08	2.03
50	12	0.28	8.5	0.25	0.60	11.7	0.32	1.05	4.4	0.08	0.10	5.9	0.18	0.30	5.0	0.12	0.17	2.5	0.13	0.09	2.31
100	0.25	4.50	8.5	0.25	0.18	11.7	0.32	0.35	4.4	0.08	0.03	5.9	0.18	0.10	5.0	0.12	0.06	2.5	0.13	0.03	0.75
100	1	2.20	8.5	0.25	0.39	11.7	0.32	0.69	4.4	0.08	0.06	5.9	0.18	0.19	5.0	0.12	0.11	2.5	0.13	0.06	1.50
100	6	0.53	8.5	0.25	0.56	11.7	0.32	0.99	4.4	0.08	0.09	5.9	0.18	0.28	5.0	0.12	0.16	2.5	0.13	0.09	2.17
100	12	0.30	8.5	0.25	0.64	11.7	0.32	1.09	4.4	0.08	0.11	5.9	0.18	0.32	5.0	0.12	0.18	2.5	0.13	0.10	2.55

[a]Rainfall intensity -- U.S. Department of Commerce (1955).

[b]Runoff patterns are shown on Figure D.1-2.

Methodology: Modified rational formula, $V = CiA$

Where: V = Runoff volume (acre-feet).
C = Runoff coefficient.
i = Total inches of rainfall divided by 12.
A = Drainage area (acres).

Table D.1-3. Water-quality data for Chartiers Creek

Parameter	State water-quality criteria (25 PA Code 93)	Canonsburg[a] Average	Canonsburg[a] Extreme	Carnegie[b] Average	Carnegie[b] Extreme
		(in mg/l, unless otherwise indicated)			
Bacteria (fecal coliforms)	5/1 through 9/30 -- ≤200/100 ml (geometric average of five consecutive samples collected on different days) 10/1 through 4/30 -- ≤2000/100 ml (geometric average of five consecutive samples collected on different days)	2,794[c,d] 14,760[e]	6,700[c,d] 20,000[e]	3,337[c,d] 2,300[e]	20,000[c,d] 6,000[e]
Total dissolved solids	Monthly average ≤500 mg/l ≤750 mg/l at all times	549[c] 696[e]	778[c] 1,180[e]	729[c] 853[e]	972[c] 1,340[e]
Total iron	≤1.5 mg/l	1.27[c] 1.38[e]	4.68[c] 3.25[e]	3.45[c] 6.09[e]	5.00[c] 10.00[e]
Sulfate	NS[f]	193[c] 299[e]	334[c] 630[e]	323[c] 276[e]	400[c] 405[e]
Dissolved oxygen	2/15 through 7/31 -- minimum daily average = 6.0 mg/l, ≥5.0 mg/l at all times 8/1 through 2/14 -- minimum daily average = 5.0 mg/l, ≥4.0 mg/l at all times	11.2[e]	7.0 (low)[e]	9.4[e]	9.4[e]
pH	≥6.0 ≤ 9.0	7.3[c,g] 7.0[e]	7.8[c,g] 8.2[e]	7.1[c,g] 6.9[e]	8.1[c,g] 6.8[e]
Total manganese	≤1.0 mg/l	0.6[e]	0.6[e]	3.0[e]	3.0[e]
Alkalinity	≥20 mg/l as $CaCO_3$	148[c] 136[e]	112 (low)[c] 108 (low)[e]	116[c] 100[e]	100 (low)[c] 74 (low)[e]
NO_2 and NO_3	≤10 mg/l as nitrate nitrogen	3.41[c] 2.80[e]	6.2[c] 4.0[e]	2.1[c] 2.5[e]	3.8[c] 4.0[e]

[a]Pennsylvania DER, STORET retrieval, Water Quality No. 0916.
[b]Pennsylvania DER, STORET retrieval, Water Quality No. 0914.
[c]Data from 1982 STORET file.
[d]Units per 100 ml.
[e]Data from 1978 STORET file.
[f]NS = No standard.
[g]In standard units (SU).

Table D.1-4. Concentration of parameters in surface-water samples taken from Chartiers Creek

Parameter	State water quality criteria (25 PA Code 93) (mg/l)	Analysis results (mg/l unless noted) Sampling date -- July 22, 1979: Chartiers Creek -- upstream[a]	Ditch corner of Strabane Ave. and Ward St.	Chartiers Creek -- downstream[b]	Sampling date -- July 26, 1979: Chartiers Creek -- upstream[a]	Ditch -- Strabane Ave. near Chartier Creek	Chartiers Creek -- downstream[b]	Estimated annual pollutant load[c]: lbs/yr	lbs/acre-in.	Comparable pollutant load[d] lbs/acre-in.
BOD_5	NS[e]	2	5	1	---	2	2	126	0.005	0.35
Suspended solids	NS	42	753	15	---	253	39	19,000	0.76	2.0
NH_3-N	NS	0.4	<0.14[f]	<0.14	---	0.8	0.8	<3.5	0.00014	---
NO_3-N	≤10[g]	6.7	1.5	2.9	---	0.76	2.9	38	0.0015	---
Silicon	NS	7.3	4.9	7.2	---	10.4	8.6	124	0.005	---
Total phosphorus	NS	1.21	0.61	1.08	---	0.96	0.65	15	0.0006	0.007
TOC	NS	5	13	12	---	---	6	328	0.013	---
Silver	NS	<0.02	<0.02	<0.02	---	<0.02	<0.02	<0.5	0.00002	---
Arsenic	<0.05[h]	0.018	0.182	0.014	---	0.096	0.015	4.6	0.00018	---
Selenium	NS	0.045	0.047	0.044	---	0.025	0.049	1.2	0.000047	---
Iron	≤1.5[h]	3.21	22.2	1.05	---	8.8	1.51	560	0.022	---
Nickel	≤0.01[i]	<0.02	<0.2	<0.02	---	<0.02	<0.02	<0.5	0.00002	0.064
Lead	≤0.05	0.02	0.44	0.02	---	0.06	0.02	11	0.00044	0.01
Chromium	≤0.05[j]	<0.02	0.03	<0.02	---	<0.02	<0.02	0.75	0.00003	0.105
Barium	NS	<0.2	<0.2	<0.2	---	<0.2	<0.2	<5.0	0.0002	---
Mercury	NS	<0.2	<0.2	<0.2	---	<0.2	<0.2	<5.0	0.0002	---
Cadmium	NS	<0.02	<0.02	<0.02	---	<0.02	<0.02	<0.5	0.00002	---
Boron	NS	<0.12	0.11	0.16	---	0.12	0.15	2.8	0.00011	---
Sulfate	NS	335	126	322	---	155	262	3,180	0.13	---
Turbidity (JTU)	NS	17.5	860	13	---	400	22	---	---	---

[a]Approximately 4700 feet upstream from the Strabane Avenue bridge.

[b]Approximately 50 feet downstream from the Strabane Avenue bridge.

[c]Based on July 22, 1979 storm. During this storm approximately 0.57 inch of rain fell on the Canonsburg site. The runoff volume from this storm was estimated at 0.14 acre-feet based on a runoff coefficient of 0.29 and a drainage area of 10.4 acres. The pollutant loads measured during the July 22, 1979 storm were scaled up to an annual estimate using a value of 36.9 inches of annual precipitation for the Canonsburg site area.

[d]Heartland Industrial Park, Long Island, New York.

[e]NS = No standard.

[f]"<" in an analytical results column indicates a detection limit; actual concentrations may actually be lower.

[g]In combination with NO_2-N concentrations.

[h]Total.

[i]Not to exceed the stated amount of the 96-hour LC_{50} for representative important species.

[j]Hexavalent chromium only.

Source: Weston (1979) field data.

Table D.1-5. Public water suppliers within 3 miles of the sites.

Canonsburg site

Western Pennsylvania Water Company, Washington District
62 East Wheeling Street
Washington, Pennsylvania 15301

Burrell site

Blairsville Borough Water Authority
244 South Stewart Street
Blairsville, Pennsylvania 15717

Lower Indiana County Municipal Authority
P.O. Box 444
Black Lick, Pennsylvania 15716

Central Pennsylvania Water Supply Company
P.O. Box 367
10th and Chestnut Streets
New Florence, Pennsylvania 15944

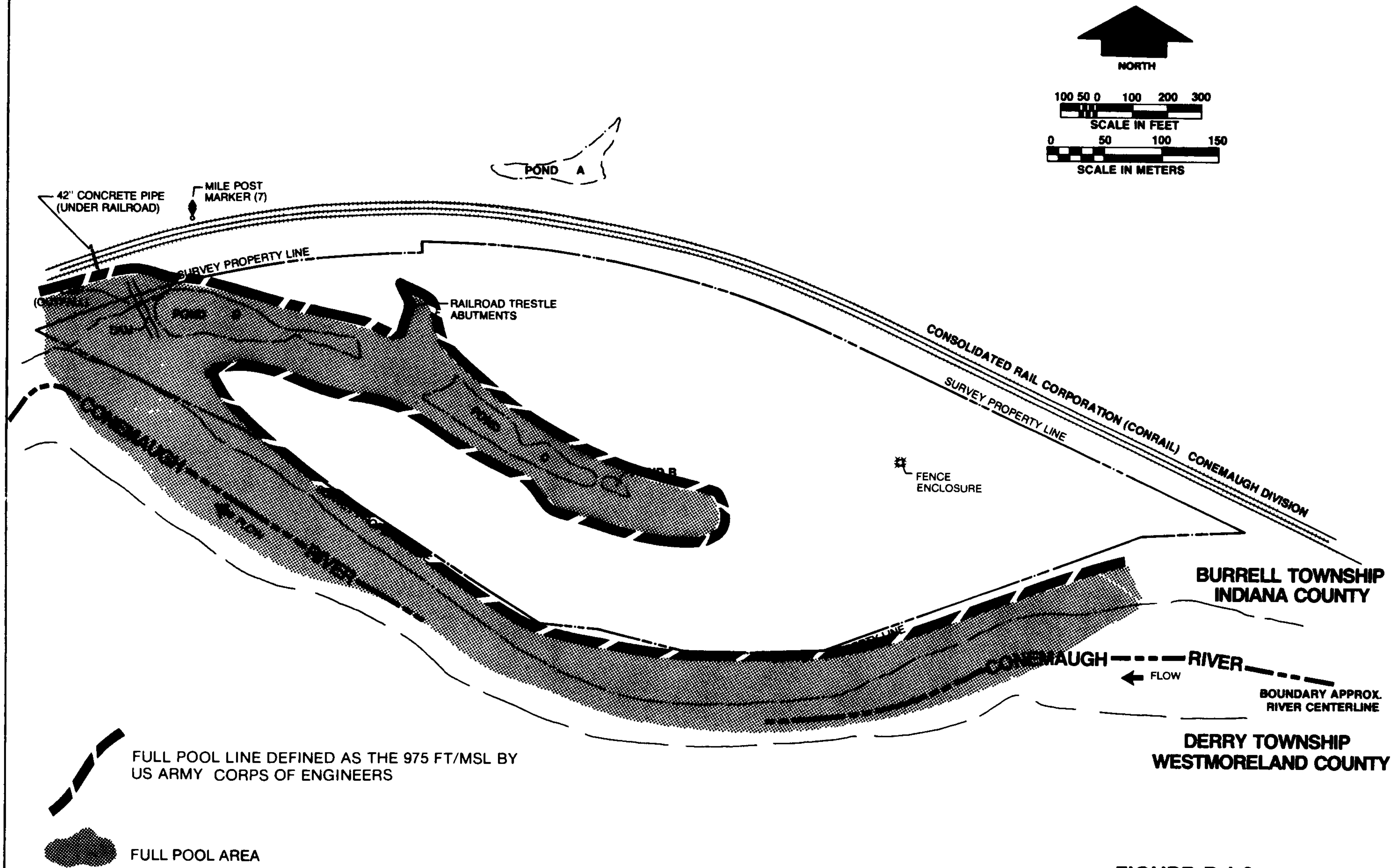
Hanover site

Smith Township Municipal Authority
P.O. Box 387
Burgettstown, Pennsylvania 15021

Western Pennsylvania Water Supply Company
Burgettstown District

Paris - Florence Area Water Association

Source: Chnupa (1983)



NOTE 1 PROPERTY LINE DATA FROM PLAN OF PROPERTY FOR UNION CARBIDE CORP. BY RICHARD G BACH & ASSOC., ZELIENOPLE, PA-DATED 11/16/77

FIGURE D.1-3
"FULL POOL" BOUNDARY
BURRELL TOWNSHIP SITE

Table D.1-6. Estimated runoff volume (acre-feet) from the Burrell site

Return period (yrs)	Duration (hrs)	Intensity[a] (in./hr)	Subbasins -- Groundwater recharge and discharge ponds[b]: Area (acres)	Subbasins -- Groundwater recharge and discharge ponds[b]: Runoff coefficient	Subbasins -- Groundwater recharge and discharge ponds[b]: Runoff volume (acre-ft)	Subbasins -- Direct river discharge: Area (acres)	Subbasins -- Direct river discharge: Runoff coefficient	Subbasins -- Direct river discharge: Runoff volume (acre-ft)	Total runoff volume (acre-ft)
2	0.5	1.9	32.6	0.35	0.90	16.4	0.35	0.45	1.35
2	1	1.17	32.6	0.35	1.11	16.4	0.35	0.56	1.67
2	6	0.32	32.6	0.35	1.83	16.4	0.35	0.92	2.75
2	12	0.2	32.6	0.35	2.28	16.4	0.35	1.15	3.43
10	0.5	2.9	32.6	0.35	1.38	16.4	0.35	0.69	2.07
10	1	1.8	32.6	0.35	1.72	16.4	0.35	0.86	2.58
10	6	0.48	32.6	0.35	2.74	16.4	0.35	1.38	4.12
10	12	0.28	32.6	0.35	3.19	16.4	0.35	1.61	4.80
50	0.5	3.7	32.6	0.39	1.96	16.4	0.39	0.99	2.95
50	1	2.35	32.6	0.39	2.49	16.4	0.39	1.25	3.74
50	6	0.63	32.6	0.39	4.00	16.4	0.39	2.01	6.01
50	12	0.37	32.6	0.39	4.70	16.4	0.39	2.36	7.06
100	0.5	4.2	32.6	0.39	2.22	16.4	0.39	1.12	3.34
100	1	2.6	32.6	0.39	2.75	16.4	0.39	1.39	4.14
100	6	0.67	32.6	0.39	4.26	16.4	0.39	2.14	6.40
100	12	0.41	32.6	0.39	5.21	16.4	0.39	2.62	7.83

[a]Rainfall intensity -- U.S. Department of Commerce (1955).
[b]See subsection 4.6.2.2.

Methodology: Modified rational formula, $V = CiA$
Where: V = Runoff volume (acre-feet).
C = Runoff coefficient.
i = Total inches of rainfall divided by 12.
A = Drainage area (acres).

Table D.1-7. Water-quality data for the Conemaugh River -- Burrell site

Parameter	State water-quality criteria (25 PA Code 93)	Water-quality data (mg/l)[a] Seward, 1977 Average	Seward, 1977 Extreme	Vandergrift, 1979 Average	Vandergrift, 1979 Extreme	Tunnelton, 1970-1979 Average	Tunnelton, 1970-1979 Extreme	Josephine, 1977 Average	Josephine, 1977 Extreme
Fecal coliforms	5/1 through 9/30 -- ≤200/100 ml 10/1 through 4/30 -- ≤2000/100 ml	13,500	25,000	18,000	25,000	---	---	---	---
Suspended solids	NS[b]	303	561	---	---	---	---	506	1,246
Total iron	≤1.5 mg/l	5.0	9.5	2.9	5.5	5.5	17.7	12.0	21.0
Dissolved sulfate (SO_4)	≤250 mg/l	221	360	144	270	144	144	262	820
Dissolved oxygen	Minimum daily average = 5.0 mg/l; ≥4.0 mg/l at all times	10.0	7.5	11.5	10.0	10.0	13.0	9.8	7.0
pH	≥6.0 ≤9.0	4.7	4.2	5.1	4.7	4.6	3.4	4.3	3.3
Total manganese	≤1.0 mg/l	1.5	3.2	0.9	1.6	1.6	5.0	1.0	1.8
Total dissolved solids	Monthly average ≤500 mg/l, ≤750 mg/l at all times	257	257	402	322	538	538	---	---
Alkalinity	20 mg/l as $CaCO_3$	3.2	0	1.2	0	8	8	0.3	0
Ammonia nitrogen	1.5 mg/l	1.02	2.7	0.4	1.0	0.5	0.5	0.52	2.5
Temperature °F	No measurable rise when the ambient temperature reaches 87°F or above; not more than a 5°F rise above the ambient temperature until the stream reaches 87°F -- not to be changed by more than 2°F during any 1-hour period.	55.1	32/81	46.8	32/66	45	---	48.0	32/81
Location from site downstream		15 miles upstream		30 miles downstream		10 miles downstream		7 miles north (on Black Lick Creek)	

[a]U.S. Geological Survey (1977).
[b]NS = No standard.

Table D.1-8. Water supply surface intakes -- Allegheny River.

River mile	Water plant	County
29.4	Freehold Water Company 1705 Rear Freeport Road Natrona Heights, Pennsylvania 15065	Armstrong
24.2	Clearview Water Company 1705 Rear Freeport Road Natrona Heights, Pennsylvania 15065	Allegheny
23.2	Brackenridge Water Works 1000 Brackenridge Avenue Brackenridge, Pennsylvania 15014	
22.4	Tarentum Water Works c/o J. Lemmer 304 Lock Street Tarentum, Pennsylvania 15084	Allegheny
20.8	New Kensington Municipal Authority Box 577, 720 Fourth Avenue New Kensington, Pennsylvania 15068	Westmoreland
13.3	Oakmont Municipal Water Authority 721 Allegheny Avenue Oakmont, Pennsylvania 15139	Allegheny
10.8	Fox Chapel Water Authority 1389 Old Freeport Road Pittsburgh, Pennsylvania 15238	Allegheny
8.8	Wilkinsburg-Penn Joint Water Authority 2200 Robinson Boulevard Wilkinsburg, Pennsylvania 15221	Allegheny
8.2	Pittsburgh Water Works 226 Delafield Road Pittsburgh, Pennsylvania 15215	Allegheny
3.8	Millvale Water Works 501 Lincoln Avenue Millvale, Pennsylvania 15209	Allegheny

Table D.1-9. Pond surface-water quality -- Burrell site

Pond[a]	pH	Specific conductance (μmhos/cm)	Cl^- (mg/l)	SO_4 (mg/l)	NO_3N (mg/l)	Fe (mg/l)	Pb (mg/l)	Ba (mg/l)	B (mg/l)
Pond A	7.0	1250	19.7	420	ND[b]	ND	ND	0.02	0.76
Pond B	6.9	1200	20.2	290	ND	ND	ND	0.03	0.41
Pond C	5.7	12	22.3	440	0.72	ND	ND	ND	0.07
State water quality criteria (25 PA Code 93)	≥ 6.0 ≤ 9.0	NS[c]	NS	≤ 250	≤ 10[d]	≤ 1.5[e]	≤ 0.05	NS	NS

[a]Pond locations given on Figure 1-5.
[b]ND = None detectable.
[c]NS = No standard.
[d]In combination with NO_2-N concentrations.
[e]Total.

Source: Weston (1982) field data.

Table D.1-10. Estimated runoff volume (acre-feet) from the Hanover site

Return period (yrs)	Duration (hrs)	Intensity[a] (in./hr)	To Harmon Creek			To unnamed tributary			To Ward Run			Total runoff volume (acre-ft)
			Area (acres)	Runoff coeffi-cient	Runoff volume (acre-ft)	Area (acres)	Runoff coeffi-cient	Runoff volume (acre-ft)	Area (acres)	Runoff coeffi-cient	Runoff volume (acre-ft)	
2	0.25	2.5	201	0.35	3.66	90	0.35	1.64	136	0.35	2.48	9.7
2	1	1.1	201	0.35	6.45	90	0.35	2.89	136	0.35	4.36	13.7
2	6	0.3	201	0.35	10.55	90	0.35	4.73	136	0.35	7.14	22.4
2	12	0.2	201	0.35	14.07	90	0.35	6.30	136	0.35	9.52	29.9
10	0.25	3.3	201	0.35	4.84	90	0.35	2.17	136	0.35	3.27	10.3
10	1	1.5	201	0.35	8.79	90	0.35	3.94	136	0.35	5.95	18.7
10	6	0.4	201	0.35	14.07	90	0.35	6.30	136	0.35	9.52	29.9
10	12	0.2	201	0.35	14.07	90	0.35	6.30	136	0.35	9.52	29.9
50	0.25	4.0	201	0.39	6.5	90	0.39	2.92	136	0.39	4.42	13.9
50	1	2.0	201	0.39	13.06	90	0.39	5.85	136	0.39	8.84	27.8
50	6	0.5	201	0.39	19.60	90	0.39	8.78	136	0.39	13.26	41.6
50	12	0.3	201	0.39	23.52	90	0.39	10.53	136	0.39	15.91	50.0
100	0.25	4.5	201	0.39	7.35	90	0.39	3.29	136	0.39	4.97	15.6
100	1	2.2	201	0.39	14.37	90	0.39	6.43	136	0.39	9.72	30.5
100	6	0.6	201	0.39	23.52	90	0.39	10.53	136	0.39	15.91	50.0
100	12	0.3	201	0.39	23.52	90	0.39	10.53	136	0.39	15.91	50.0

[a]Rainfall intensity - U.S. Department of Commerce (1955).

Methodology: Modified rational formula, $V = CiA$

Where: V = Runoff volume (acre-feet).
C = Runoff coefficient.
i = Total inches of rainfall divided by 12.
A = Drainage area (acres).

Table D.1-11. Results of EPA surface-water analysis -- Hanover site, May 7, 1980

Parameter	State water quality criteria (25 PA Code 93)	Sample location		
		At chemical seep on the site	Upstream -- unnamed tributary	Downstream -- unnamed tributary
Sample type		Grab	Grab	Grab
Temperature (water), °F	No measurable rise when the ambient temperature reaches 87°F or above; not more than a 5°F rise above the ambient temperature until the stream reaches 87°F -- not to be changed by more than 2°F during any 1-hour period.	55	57	57
pH	$\geq 6.0 \leq 9.0$	3.2	6.1	6.1
COD (mg/l)	NS[a]	40	15	20
Total arsenic (mg/l)	≤ 0.05	0.028	0.003	0.004
Total cadmium (mg/l)	NS	0.025	0.003	0.005
Total lead (mg/l)	≤ 0.05	0.011	0.038	0.028
Total mercury (mg/l)	NS	0.0004	0.0006	0.0004
Toxicity	---	Very toxic	---	---
Volatile organics	NS	ND[b]	ND	ND

[a]NS = No standard.
[b]ND = Not detectable.

Source: Downie and Petrone (1980).

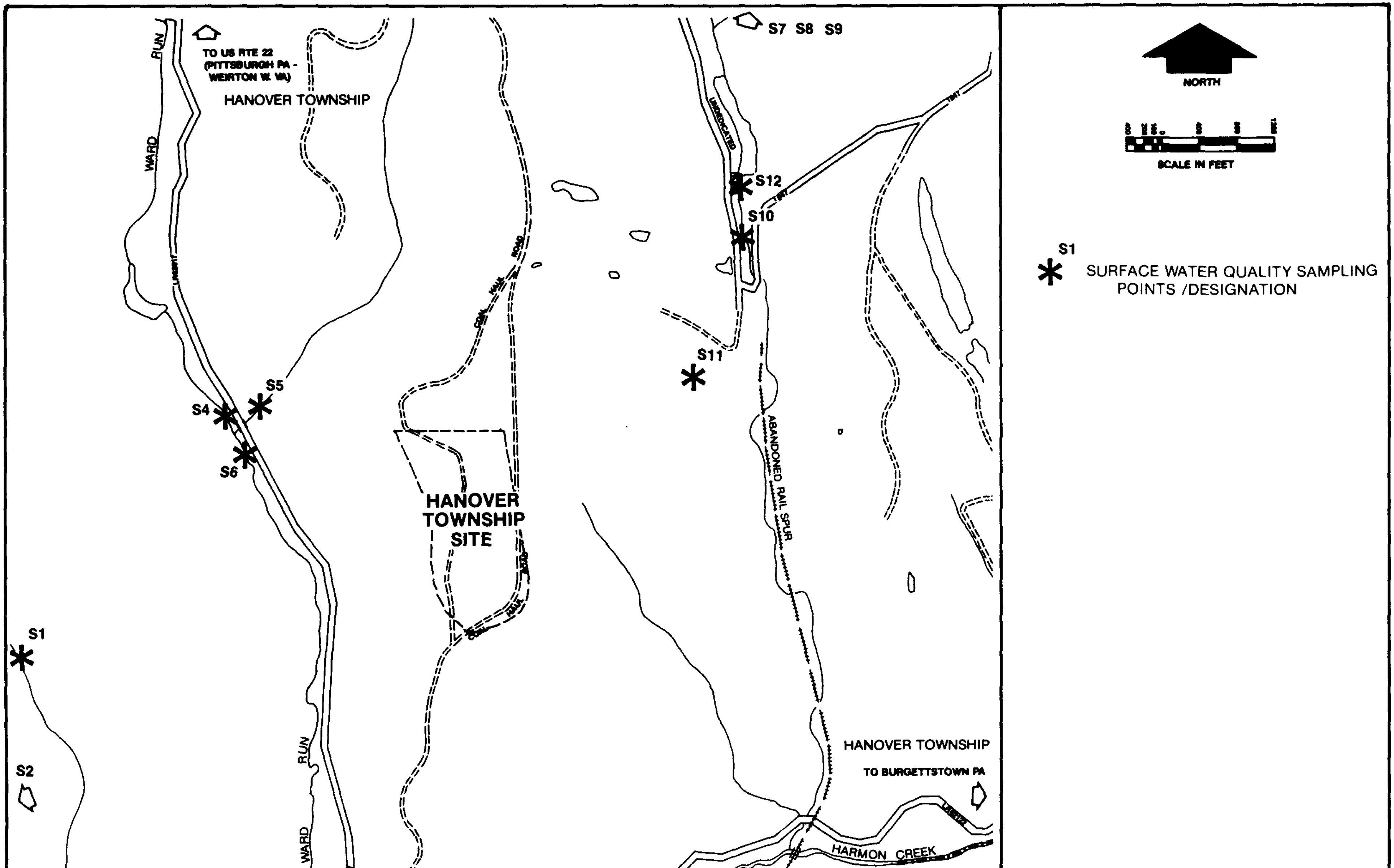


FIGURE D.1-4
LOCATION OF SURFACE WATER QUALITY SAMPLING POINTS IN THE VICINITY OF THE HANOVER TOWNSHIP SITE

Table D.1-12. Results of surface-water sampling program, Starvaggi Industries landfill, Hanover Township -- October 6, 1980

Sample location[a]	TOC (mg/l)	COD (mg/l)	BOD (mg/l)	Chloride (mg/l)	Oil and grease (mg/l)	Phenol (mg/l)	Cyanide (mg/l)	Alkalinity (mg/l)	pH (SU)	Ammonia (mg/l)
S-1	5	784	4	4	1.7	0.001	0.005	2	5.2	0.15
S-2	3	792	2	23	0.4	0.001	0.004	92	7.9	0.13
S-3	3	878	4	4	0.4	0.002	0.006	34	7.6	0.12
S-4	6	893	2	20	0.4	0.001	0.004	24	7.2	0.125
S-5	8	901	5	104	0.6	0.001	0.008	2	5.0	0.16
S-6	8	945	3	42	0.2	0.004	0.004	10	6.2	0.11
S-7	7	890	3	9	0.2	0.001	0.004	26	7.0	0.175
S-8	10	941	2	5	0.4	0.001	0.006	56	7.1	0.16
S-9	8	956	2	7	0.8	0.000	0.004	24	6.9	0.14
S-10	7	439	2	814	1.6	0.000	0.003	4	5.0	0.15
S-11	52	461	25	12,922	0.8	0.013	0.003	6	5.2	1.95
S-12	15	358	11	1,436	0.8	0.000	0.005	4	5.1	0.19
State water quality criteria (25 PA Code 93)	NS[b]	NS	NS	NS	NS	≤0.005	≤0.005 (free Cn)	≥20 (as $CaCO_3$)	≥6.0 ≤9.0	NS

Sample location[a]	TSS (mg/l)	Total dissolved solids (mg/l)	Zinc (mg/l)	Lead (mg/l)	Nickel (mg/l)	Magnesium (mg/l)	Cadmium (mg/l)	Chromium (mg/l)	Iron (mg/l)	Aluminum (mg/l)
S-1	6	3,187	0.70	0.002	0.63	90	0.01	0.02	0.02	4.4
S-2	0.1	1,363	0.01	0.002	0.04	20	<0.002	0.01	0.20	0.3
S-3	7	1,626	0.02	0.003	0.05	32	0.002	0.01	0.13	0.3
S-4	0.5	1,608	0.04	0.002	0.08	34	0.002	0.01	0.20	0.1
S-5	19	2,518	0.40	0.001	0.34	68	0.006	0.02	2.32	10.0
S-6	13	1,883	0.14	0.001	0.15	44	0.002	0.02	0.76	28.6
S-7	22	1,607	0.36	0.002	0.21	100	0.002	0.01	5.34	3.8
S-8	16	3,087	0.11	0.001	0.22	116	0.002	0.02	6.80	2.4
S-9	7	2,774	0.11	0.002	0.14	102	0.004	0.02	3.52	0.7
S-10	5	3,370	0.15	0.002	0.20	78	0.004	0.02	0.57	5.0
S-11	15	30,171	0.40	0.008	1.50	175	0.052	0.11	7.02	4.6
S-12	47	4,365	0.34	0.002	0.36	84	0.008	0.02	4.62	16.0
State water quality criteria (25 PA Code 93)	NS[b]	Monthly average ≤500 mg/l;≤750 mg/l at all times.	≤0.01 of the 96-hr LC_{50} for representative important species.	≤0.05	≤0.01 of the 96-hr LC_{50} for representative important species.	NS	NS	≤0.05 (as hexavalent chromium)	≤1.5 (total iron)	≤0.1 of the 96-hr LC_{50} for representative important species.

[a]Sample locations are shown on Figure D.1-4.

[b]NS = No standard.

Appendix D.2

GROUND-WATER INFORMATION

Appendix D.2

GROUND-WATER INFORMATION

D.2.1 Description of hydrogeological data collection program

D.2.1.1 Expanded Canonsburg site

The objectives of the data collection program at the expanded Canonsburg site were as follows:

1. Determine the extent to which ground water is currently being radioactively contaminated by the radioactively contaminated materials.

2. Define the ground-water system at the expanded Canonsburg site.

3. Project future conditions.

The collection of hydrogeological and ground-water quality data began in the spring of 1979 with the completion of shallow and deep ground-water wells on the Canonsburg site. At this time the following constraints were placed on the data collection program:

1. Wells were restricted to the Canonsburg site.

2. Wells could only be drilled on the periphery of Area C because of the suspected high levels of radioactive contamination in the area.

3. Aquifer pump tests were prohibited because of the potential for withdrawing radioactively contaminated ground water.

To obtain data on aquifer characteristics of the Canonsburg site, slug tests were conducted on a number of wells. The slug tests were performed by instantaneously injecting a known volume of water into a well after measuring the well's static water level. The rate at which the water level returned to the static level was determined by measuring the water levels as a function of time. The success of slug tests can be affected by the nature of subsurface materials, and, at the Canonsburg site, the highly variable nature of the onsite materials led to widely-varying measurements.

Aquifer slug tests are used to estimate values of transmissivity and storage within a small radius of the bore hole and are greatly influenced by the material that surrounds the bore hole. Most of the 1979 bore holes at the Canonsburg site were completed in the fill material and well construction limited the ability of the wells to accept water. Therefore, slug test results were variable and not considered useful in determining the true conditions at the Canonsburg site. Additional slug tests conducted in 1983 used wells that were constructed with gravel packs and a screen size that did not limit water flow.

Ground-water elevations in the wells were determined approximately once a month. In addition, one well (well 10B) was fitted with a continuous water-level recorder. Water levels in the unconsolidated material varied through the period of record; the variation of most of the wells was 5 feet or less. The curves resulting from plotting changes in ground-water elevations are, with only a few exceptions, remarkably similar. The shallowest water levels occurred May 21, 1979, August 27, 1979, and October 11, 1979. The deepest water levels occurred on May 1, 1979, July 23, 1979, and November 20, 1979. The shallow-water levels correlate well with periods of high precipitation, and are of significantly shorter duration than the periods of deeper water levels. These data were reduced and plotted.

Based on the initial ground-water contours and flow directions, it appeared that a ground-water high existed in Area A, suggesting that ground water was flowing into the former Georges Pottery property. Permission was requested, and granted, to drill wells on the former Georges Pottery property. This program, conducted in 1980, confirmed this suspicion.

In March 1982 permission was obtained to drill in Area C to further characterize the ground-water regime and to obtain data on radiological contamination in the subsurface materials.

At the conclusion of the 1982 field program it was apparent that there were still significant data gaps in the expanded Canonsburg site's hydrogeological information. In particular, additional information was needed in the following areas:

1. Onsite background ground-water quality data needed to be updated and expanded.

2. Background ground-water quality was needed in the offsite areas across Chartiers Creek.

3. Surface-water levels were needed in Chartiers Creek and ground-water levels in the areas across the creek. (This was needed to determine the hydrological relationship between the ground waters and Chartiers Creek.)

4. Hydrogeological data for the expanded Canonsburg site needed to be updated and expanded.

In order to fill these data gaps, a field program was developed, approved and performed. The field work was conducted from December 1982 through March 1983, and included the following:

1. Construction of onsite monitoring wells in the overburden and in the bedrock.

2. Construction of offsite monitoring wells south of the expanded Canonsburg site and across Chartiers Creek.

3. Completion of a stream survey (water level) on Chartiers Creek.

4. Collection of aquifer data in the unconsolidated material and in the bedrock.

5. Collection of structural data on and near the expanded Canonsburg site.

The results of this data collection program have been incorporated into this document.

Table D.2-1 is a summary of the various drilling programs that have been conducted at the expanded Canonsburg site. The data collection methods and data summaries are presented in the following subsections.

D.2.1.2 Burrell site

The data collection program at the Burrell site began with the installation of four ground-water wells in 1980. These wells were installed to determine the current levels of contamination. From the analysis results, it was determined that additional data were required. Therefore, additional wells were drilled to more completely define the contaminant levels, and to define the relationship between ground water in the fill, alluvium and colluvium, and bedrock.

Because the contaminant levels in the ground water at the Burrell site were negligible, pump tests were conducted on selected wells in unconsolidated material and bedrock. These data, in conjunction with water-level measurements, were used to construct a flow net and develop a ground-water budget for the site.

D.2.1.3 Hanover site

The purpose of hydrogeological data collection at the Hanover site was to provide sufficient baseline data to determine whether it is feasible to use the site as a disposal area, and to project the impacts of using the site.

Wells were constructed in both bedrock and the overlying mine rubble on the upper slopes of the site. A limited amount of aquifer data were collected during pump tests on selected wells. These data were used to determine flow patterns in the site and its immediate vicinity. Samples were collected and analyzed to determine the baseline water quality.

Table D.2-1. Drilling programs at the Canonsburg site

Well number	Date installed	Screen type	Screen location	Remarks
1-31	1979	Field slotted	Overburden	Some wells are no longer usable.
1A-31A	1979	No screen	Bedrock - open hole	"A" wells were constructed adjacent to selected wells in the 1 to 31 series.
GP1-GP7	1980	Field slotted	Overburden	This series includes only wells on the Georges Pottery portion of the site.
GP2A-GP4A	1980	No screen	Bedrock - open hole	
201-205	March 1982	Johnson wound screen	Overburden	This series of wells was installed in Area C.
202A-204A	March 1982	No screen	Bedrock - open hole	
301S-306S	December 1982 to January 1983	PVC screen - No. 10 slots	Overburden	
301R-306R	December 1982 to January 1983	No screen	Bedrock - open hole	
401-411	December 1982 to January 1983	PVC screen - No. 10 slots	Overburden	
501-503	December 1982 to January 1983	PVC screen - No. 10 slots	Deep bedrock	

D.2.2 Methods and procedures

D.2.2.1 Drilling procedures

Auger boring

Hollow-stem augers were used for drilling and clearing in completing all borings in the overburden, the 300-series, the 400-series, and the 500-series surface casing holes. This method was used for drilling the overburden and for collecting standard penetration test samples.

The depth to the first-encountered free water was determined during augering. When encountered, drilling ceased immediately and the water level was allowed to stabilize inside the auger for a minimum of 15 minutes. This established the depth of the top of the screen in each of the screened wells in the 300 and 400 series. (The top of the screen was set at 1 foot above the stabilized depth to water.)

The auger borings were advanced until the bedrock was encountered. For the purposes of this study, bedrock was defined during drilling as the refusal of the auger to advance, a standard penetration test of 50 blows for 6 inches or less of penetration, and evidence in the sampler of rock fragments indicative of regolith.

Pneumatic Rotary Boring

Pneumatic rotary drilling with heavy (type NW) rods and a tri-cone roller bit of not less than 6 inches diameter was used for all overburden drilling where auger drilling was not feasible or unnecessary. This drilling was used to emplace screened casing or surface casing in an open hole.

Air rotary drilling with NW rods and a tri-cone roller bit of not less than 4 inches diameter was used for reaming rock holes where required, and for clearing the inside of surface casings prior to coring rock.

Air rotary coring of the bedrock was conducted with NW rods and a diamond coring bit on a core barrel with a free-rotating inner core sleeve. The core barrel was capable of a minimum run of 10 feet.

Pneumatic rotary boring eliminates the artificial prejudice of water quality samples by introducing water to the formation by hydraulic rotary drilling.

Major Drilling Equipment

The drilling equipment used in this project was primarily of the following types:

1. CME 55 drill rig (or equivalent) equipped for drilling with appropriate hollow-stem augers and for sampling by standard penetration test and by thin-walled sampler (Shelby tube).

2. Mobile B-80 drill rig (or equivalent) equipped for drilling by pneumatic rotary as just described, and for drilling with an auger for boring and sampling as described previously.

D.2.2.2 Sampling procedures

Overburden

Samples were collected in the overburden using the standard penetration test methods described in ASTM D-1586 and D-1584. The most commonly used method was the standard penetration test. Where required, standard methods of sampling by thin-walled sampler were employed. Standard penetration test samples were continuous from the surface to bedrock in all borings of the 300 series. Standard penetration test samples were taken at 5-foot intervals from the surface for penetrations of 24 inches in all wells of the 400 series.

Rock

Rock coring was conducted using NX core barrels. The cores were recovered as nearly intact as practical. The optimum run of the core was 10 feet. Coring runs were continuous, depending on drilling conditions, from the top of the bedrock to the target depth of the boring. The target depth for the 300-series rock wells was approximately 30 to 35 feet into rock; and for the 500-series wells, approximately 100 to 150 feet into rock. These depths were adjusted by the field geologist in consultation with project management.

Ground water

Selected wells at each of the three sites were sampled for ground-water quality analyses. Samples were obtained from the wells by pumping and bailing.

Before sampling, the static water level in the well was measured using a Soiltest water-level indicator (Model DR-762A). The volume of standing water in the well was calculated. A standard (one-half horsepower) submersible pump was placed in the well, and five times the volume of standing water was removed from the casing. Samples were then obtained from the discharge line of the pump. In cases where the well would not sustain pumping, a hand bailer was used to remove five volumes of water from the casing. The well was allowed to recover and samples were taken with the bailer. Between wells, the pump and bailer were rinsed with deionized water to prevent cross contamination. The sampling was conducted in accordance with Weston's Standard Operating Procedure No. 2.1, as follows:

1. Measure the depth from the top of the casing to the top of the water. Record the depth for future use in the development of the ground-water contour map. All measuring devices used in the well must be thoroughly rinsed with distilled water prior to use.

2. Measure the depth from the top of the casing to the bottom of the well casing (total depth of cased hole) for initial sampling of a new well or use the previously-recorded depth for resampling an established well.

3. Subtract the depth to the top of the water from the depth to the bottom of the casing to determine the height of standing water in the casing.

4. Remove a quantity of water from the well equal to five times the calculated volume of water in the well.

5. If the well goes dry during pumping or bailing, allow the well to recover and again empty the well.

6. Obtain a sample for chemical analysis immediately after pumping or bailing is completed. In case a well is pumped or bailed dry, obtain a ground-water sample as soon as possible while the well is recovering.

7. The sampling bailer or pump should be flushed with distilled water after sampling to prevent cross contamination between sampling wells. Materials incidental to sampling, such as bailer ropes and tubing, must also be flushed with distilled water. Sampling equipment must be protected from the ground surface by clean plastic sheeting. No sampling should be accomplished when windblown particles may contaminate the sample or sampling equipment.

8. All samples for organic chemical analysis should be placed in specially-cleaned amber glass bottles with Teflon-lined lids. Samples for inorganic chemical analysis should be placed in polyethylene bottles. The sample bottle should be partially filled, and the contents should be agitated and discarded. The cap should be rinsed with the water to be sampled. The bottle should be filled to the top and capped securely. The sample bottle should be placed in a temperature-controlled (4°C) chest immediately after sampling and delivered to the laboratory as soon as possible.

D.2.2.3 Sample processing

<u>Overburden</u>

Overburden samples taken for use by Weston were placed in prepared pint or quart brown glass jars or double-lined plastic bags directly from the sampler. The samples were appropriately marked on the jars and this information noted in the field log. USATHAMA procedures were used.

Overburden samples from either the standard penetration test sampler or the thin-walled sampler were described as soon as practical after collection.

Descriptive procedures follow USATHAMA requirements and use the Munsell Soil Color Charts. In addition, the thin-walled samples had field penetrometer tests performed on the open bottom end after trimming. All descriptions were recorded in the permanent field notes log and in the boring log when practical.

Rock

Rock cores were placed in appropriate core boxes. The boxes were marked and the core runs were segregated by dividers. The boxes were closed and secured.

Rock cores were described as soon as practical after recovery from the core barrel. Field description consisted of the following:

1. Measurement of the recovery ratio as the length of the recovered core divided by the length of the run of the core.

2. Calculation of the rock quality data (index) of all fragments above 0.25 foot in length (RQD25) and all fragments of the core above 0.50 foot in length (RQD50); the index is derived from the sum of the lengths of the respective fragments divided by the total length of the recovered core.

3. Standard physical descriptions followed USATHAMA procedures and the Munsell Soil Color Charts.

A fixed number of rock cores (approximately 20 percent) were redundantly described in a peer-review fashion.

Ground water

Ground-water samples were of two types: those for metals analysis and those for analysis of field parameters and gross properties. These samples were taken in a common working container at the discharge of the pump, or from the bailer. This working container was rinsed a minimum of three volumes with the water from the well to be sampled prior to sampling. The samples for gross properties and field parameters were transferred to a clean container(s) immediately. The samples were filtered with a vacuum apparatus with a 0.45-micron filter and introduced into a prepared sample bottle, with preservation by HNO_3 to a pH of less than 5 as soon as practical, but no more than 4 hours after collection. All samples were stored at a temperature of about 4°C. USATHAMA and standard EPA procedures were followed. One liter minimum volume was preserved for gross properties analysis; 500 milliliters was preserved for metals analysis. Samples were transferred to Weston laboratories for ionic analysis, and to Teledyne Isotopes, Inc. or Bendix Corporation for radiological analysis. Samples to be analyzed at laboratories other than Weston were handled according to the protocols required by the particular laboratory.

Within 4 hours after collection, all samples of ground water and surface water were tested, mainly while transferring the sample from the working container to the discrete containers, for pH and specific conductance (SC) prior to preservation and storage for shipment. As part of these tests, the calibration of the device was noted along with the reading value.

D.2.2.4 Aquifer analysis

Hydrogeological information, such as the ground-water flow rate and the rate of recharge specific to the expanded Canonsburg site area, was obtained through a series of onsite pump- and slug-testing.

<u>Pump tests</u>

Three individual pump tests were conducted at three different locations that had been selected to provide the best overall expanded Canonsburg site coverage. These locations were in the former Georges Pottery property, in Area B, and in Area C. A submersible pump was used for withdrawing a constant amount of water from the pumping well over a continuous 24-hour period. In addition to the well being pumped, at least four other surrounding wells were used for monitoring changes in ground-water levels during the test. All water levels were measured using graduated flexible tapes or graduated flexible electric probes. Simultaneous measurements were taken at each well over a predetermined schedule.

After measuring the ground-water levels for 24 hours the pumping was discontinued, and all of the monitoring wells were measured in the same format to assess the rate of ground-water recovery in each well. This was conducted for 200 minutes or until 90-percent recovery was achieved.

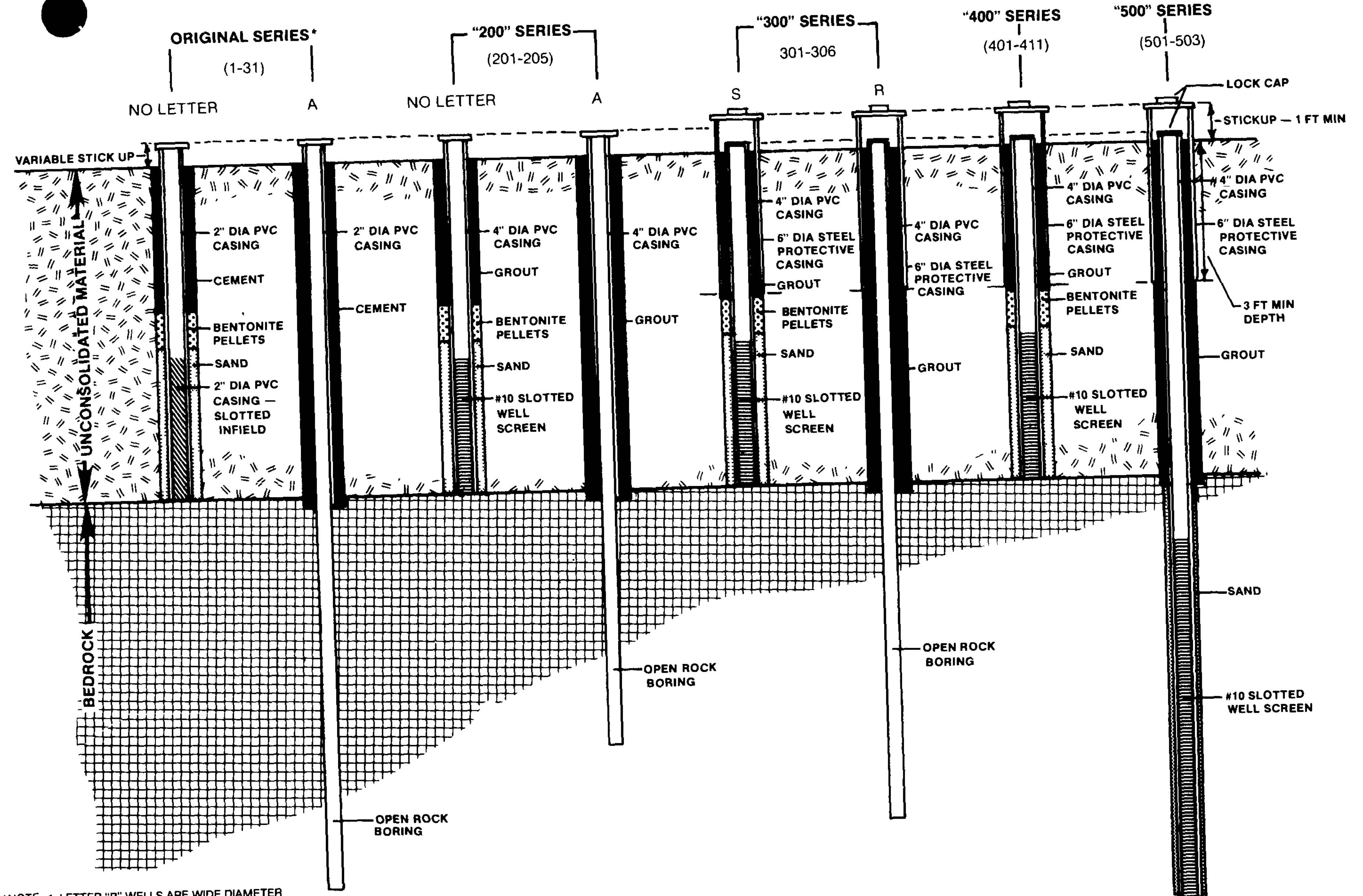
<u>Slug tests</u>

Slug tests also provide site-specific information on ground-water flow and recharge rates. While pump tests involve monitoring ground-water levels during long-term ground-water withdrawal, slug tests measure the water-level response to a single injection of water. Thus, a slug covers a smaller portion of an aquifer than a pump test. This also makes slug tests unsuited to aquifers with high transmissivities where ground-water recharge is rapid.

In 1983 four slug tests were conducted at the expanded Canonsburg site to supplement the results of the pump tests.

The first step was the selection of appropriate test (monitor) wells. Care was taken to avoid wells with inconsistencies in the well intake screen since this could cause artificially increased conductivity in the gravel pack. Next, the water level, or hydraulic head, was "instantaneously" raised by injecting a known volume of water, a slug, directly into the well. Immediately following injection, the water-level changes were monitored using a flexible calibrated tape or a flexible calibrated electronic water probe. The water level was monitored until it reached 80 percent recovery.

Interpretation of test data from the pump and slug tests was performed in accordance with the type of aquifer encountered (e.g., confined, leaky confined, or unconfined). Values for permeability and transmissivity were developed using standard methods (Bouwer and Rice, 1976). These methods, as well as documentation of the test validity, are on computer programs filed at Weston in West Chester, Pennsylvania.



*NOTE 1 LETTER "B" WELLS ARE WIDE DIAMETER (6" PVC CASING) WELLS INTO BEDROCK INSTALLED THE SAME AS THE "A" WELLS
2 GP (GEORGES POTTERY) WELLS SIMILARLY INSTALLED

NOT TO SCALE

FIGURE D.2-1
DIAGRAMS OF TYPICAL WELL CONSTRUCTION
EXPANDED CANONSBURG SITE

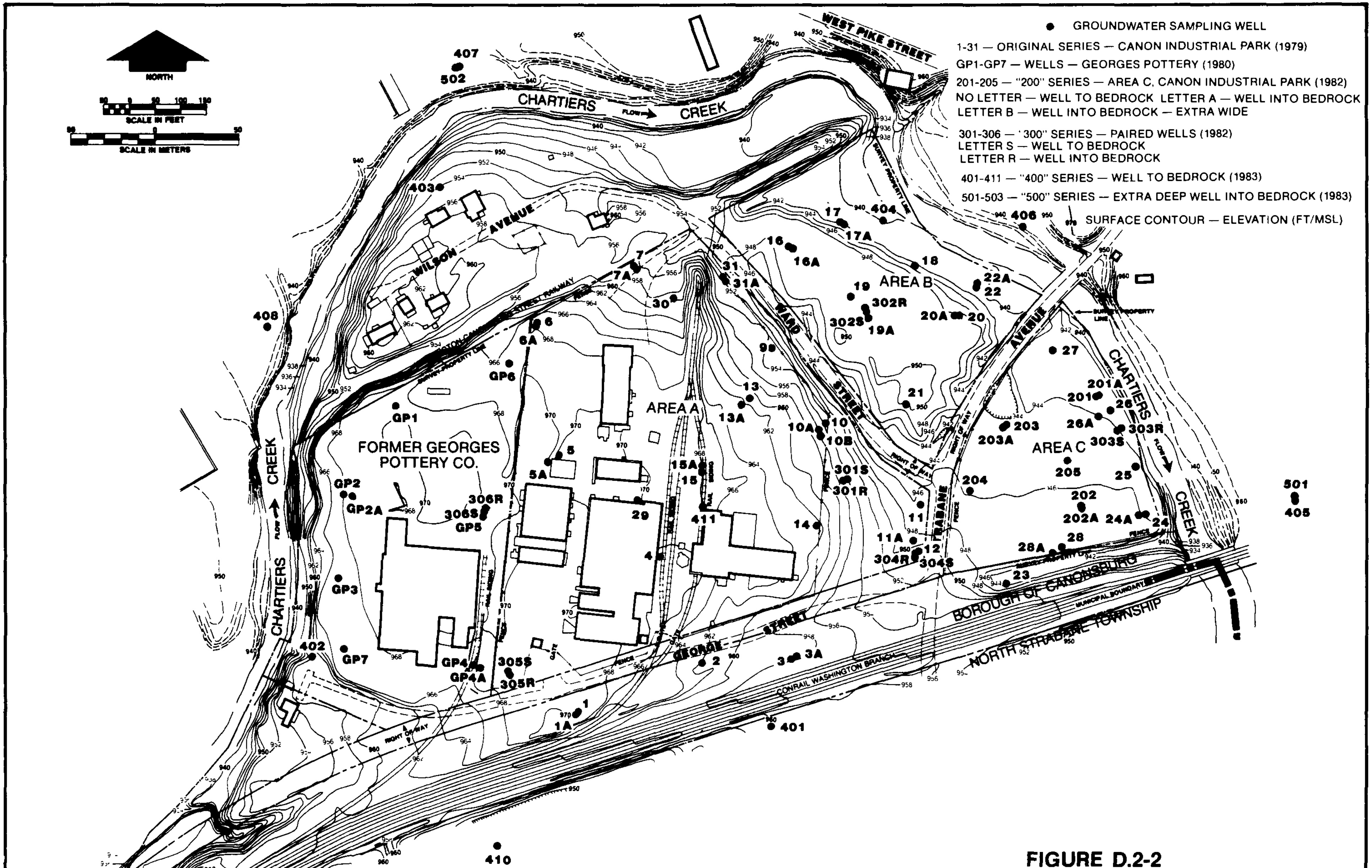


FIGURE D.2-2
GROUNDWATER SAMPLING WELL LOCATIONS
EXPANDED CANONSBURG SITE

NOTE 1 THIS MAP IS BASED ON A SURVEY AND TOPOGRAPHY BY KURCH-HOUSLEY & ASSOC., PITTSBURGH, PA, DATED MARCH 1983; AND ON MAPS OF THE CHARTIERS CREEK BASIN, PA BY THE US ARMY, CORPS OF ENGINEERS, PITTSBURGH, PA, DATED 6/3/73,

2. ALL ELEVATIONS ARE TO USGS DATUM (NGVD). CANONSBURG P[...] AND ARE SHOWN IN FT/MSL, CHECK RUN BY [...]H-HOUSLEY & ASSOC., PITTSBURGH, PA. DATED 9/8/82 [...]N SITE UTILITIES SEE ABOVE SURVEYS AND MAPS.

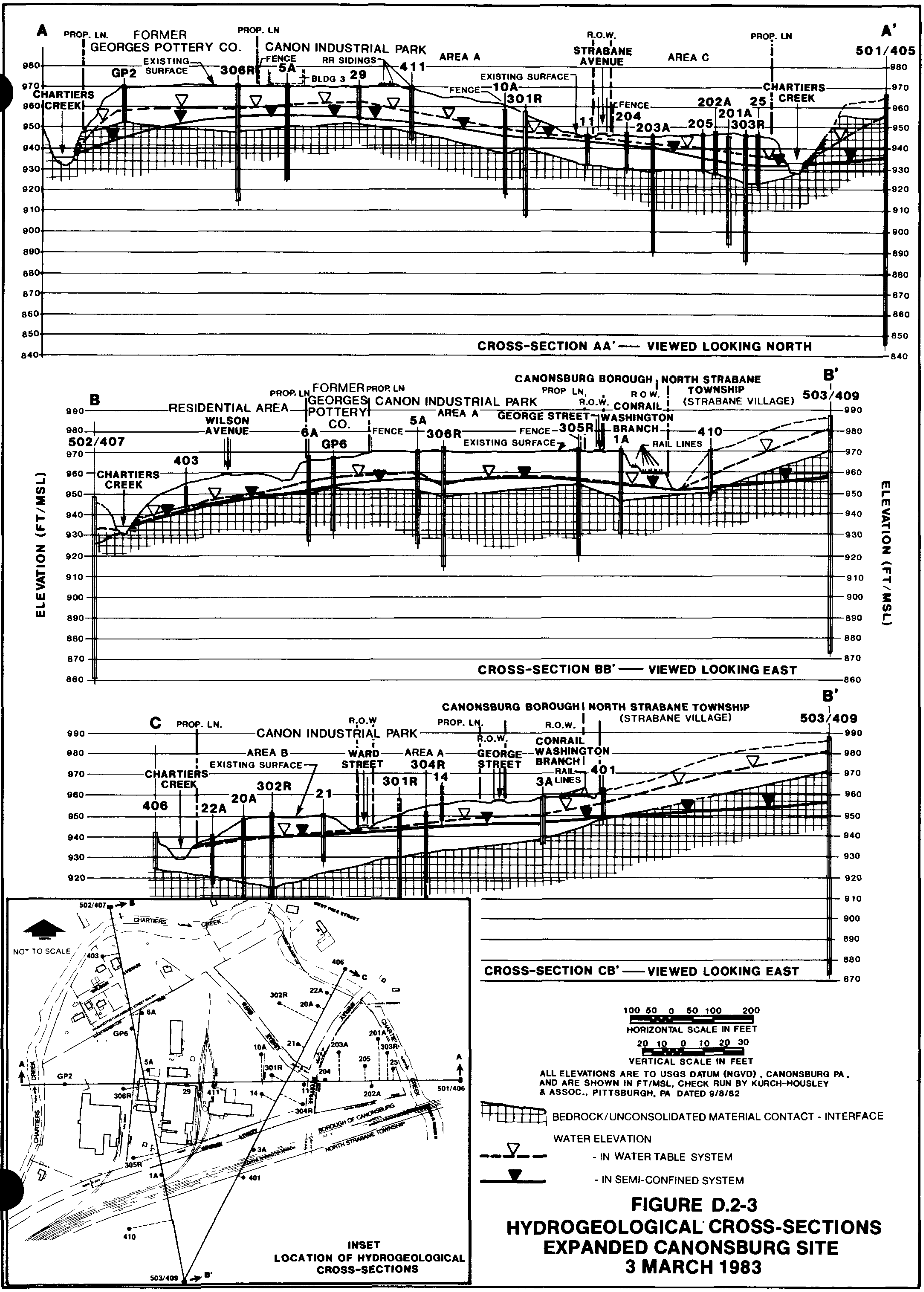


FIGURE D.2-3
HYDROGEOLOGICAL CROSS-SECTIONS
EXPANDED CANONSBURG SITE
3 MARCH 1983

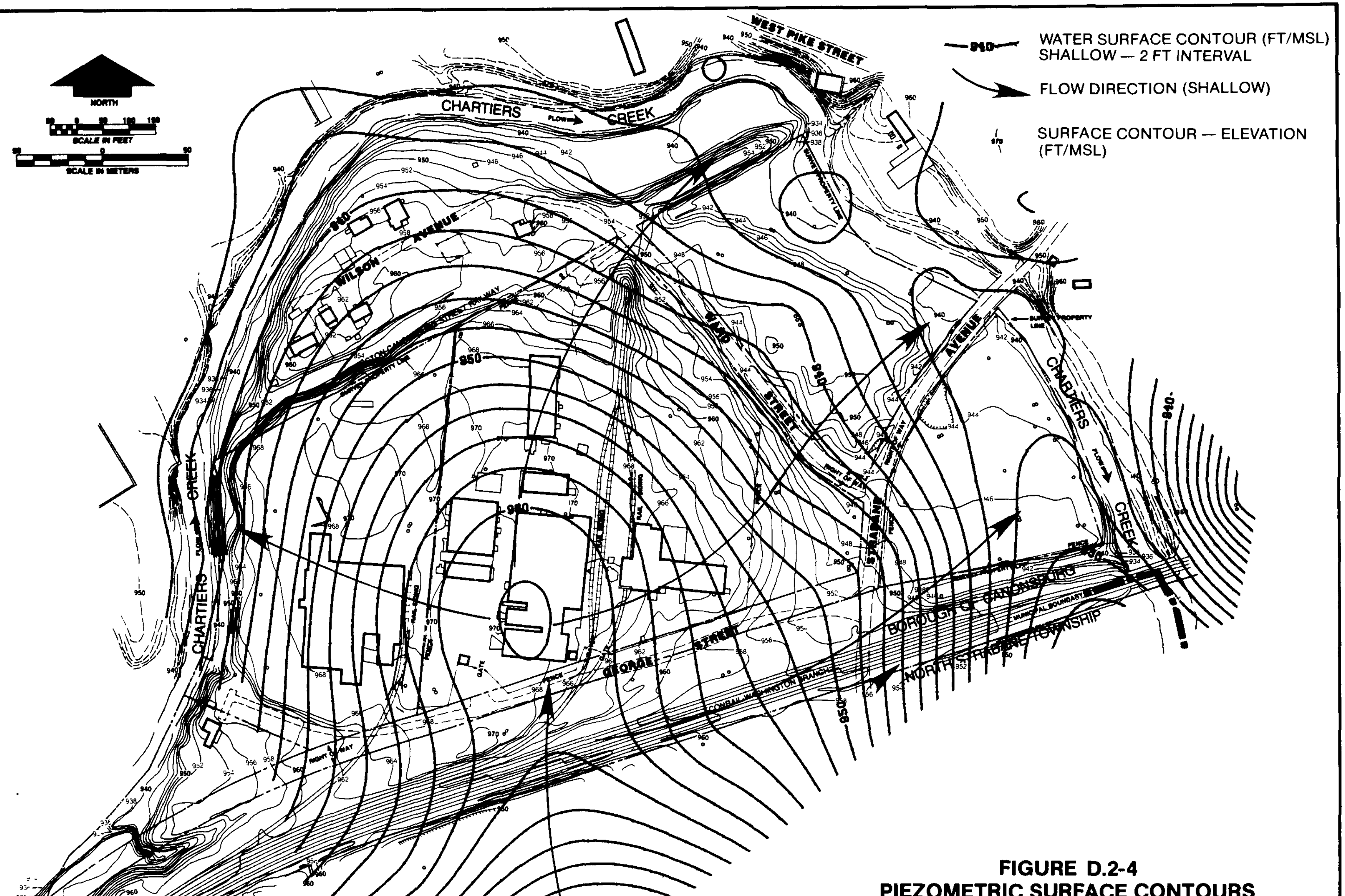


FIGURE D.2-4
PIEZOMETRIC SURFACE CONTOURS
UNCONSOLIDATED MATERIAL — 14 MARCH 1983
EXPANDED CANONSBURG SITE

NOTE: 1. THIS MAP IS BASED ON A SURVEY AND TOPOGRAPHY BY KURCH-HOUSLEY & ASSOC., PITTSBURGH, PA, DATED MARCH 1983; AND ON MAPS OF THE CHARTIERS CREEK BASIN, PA BY THE US ARMY, CORPS OF ENGINEERS, PITTSBURGH, PA, DATED 6/3/73,

2. ALL ELEVATIONS ARE TO USGS DATUM (NGVD), CANONSBURG PA, AND ARE SHOWN IN FT/MSL, CHECK RUN BY KU[illegible]HOUSLEY & ASSOC., PITTSBURGH, PA. DATED 9/8/82

F[illegible]ITE UTILITIES SEE ABOVE SURVEYS AND MAPS.

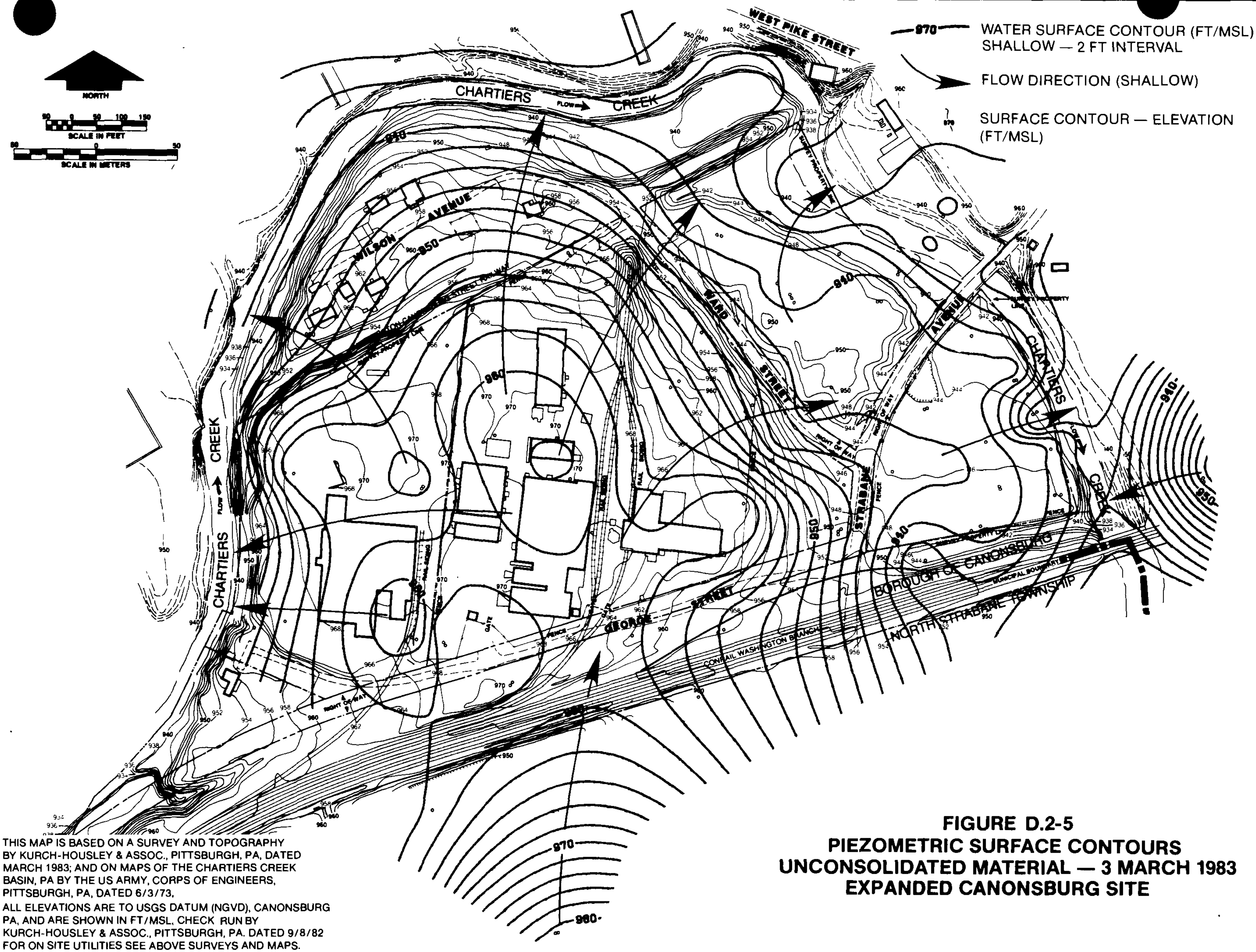


FIGURE D.2-5
PIEZOMETRIC SURFACE CONTOURS UNCONSOLIDATED MATERIAL — 3 MARCH 1983 EXPANDED CANONSBURG SITE

NOTE: 1. THIS MAP IS BASED ON A SURVEY AND TOPOGRAPHY BY KURCH-HOUSLEY & ASSOC., PITTSBURGH, PA, DATED MARCH 1983; AND ON MAPS OF THE CHARTIERS CREEK BASIN, PA BY THE US ARMY, CORPS OF ENGINEERS, PITTSBURGH, PA, DATED 6/3/73.

2. ALL ELEVATIONS ARE TO USGS DATUM (NGVD), CANONSBURG PA, AND ARE SHOWN IN FT/MSL, CHECK RUN BY KURCH-HOUSLEY & ASSOC., PITTSBURGH, PA. DATED 9/8/82 FOR ON SITE UTILITIES SEE ABOVE SURVEYS AND MAPS.

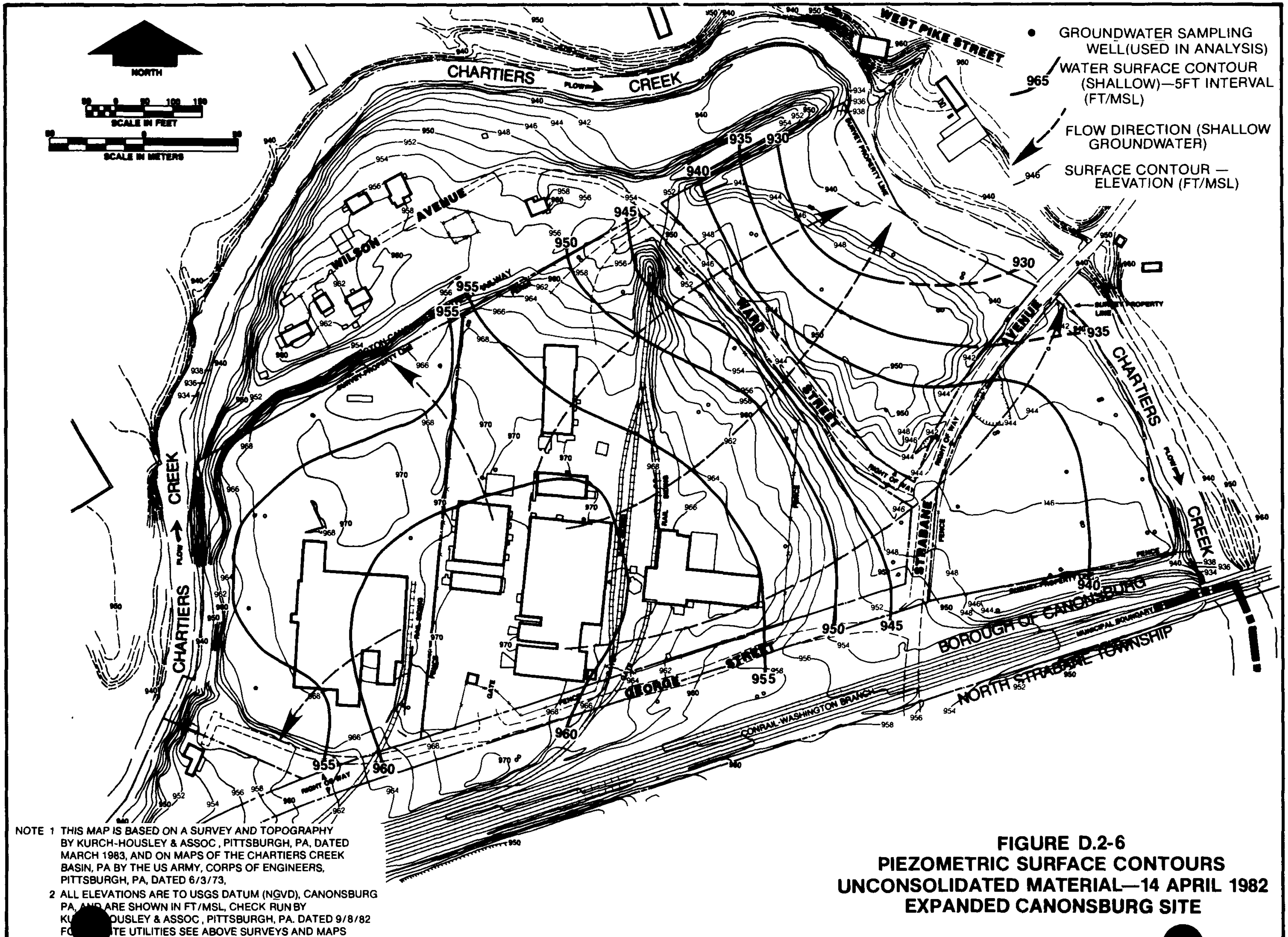


FIGURE D.2-6
PIEZOMETRIC SURFACE CONTOURS
UNCONSOLIDATED MATERIAL—14 APRIL 1982
EXPANDED CANONSBURG SITE

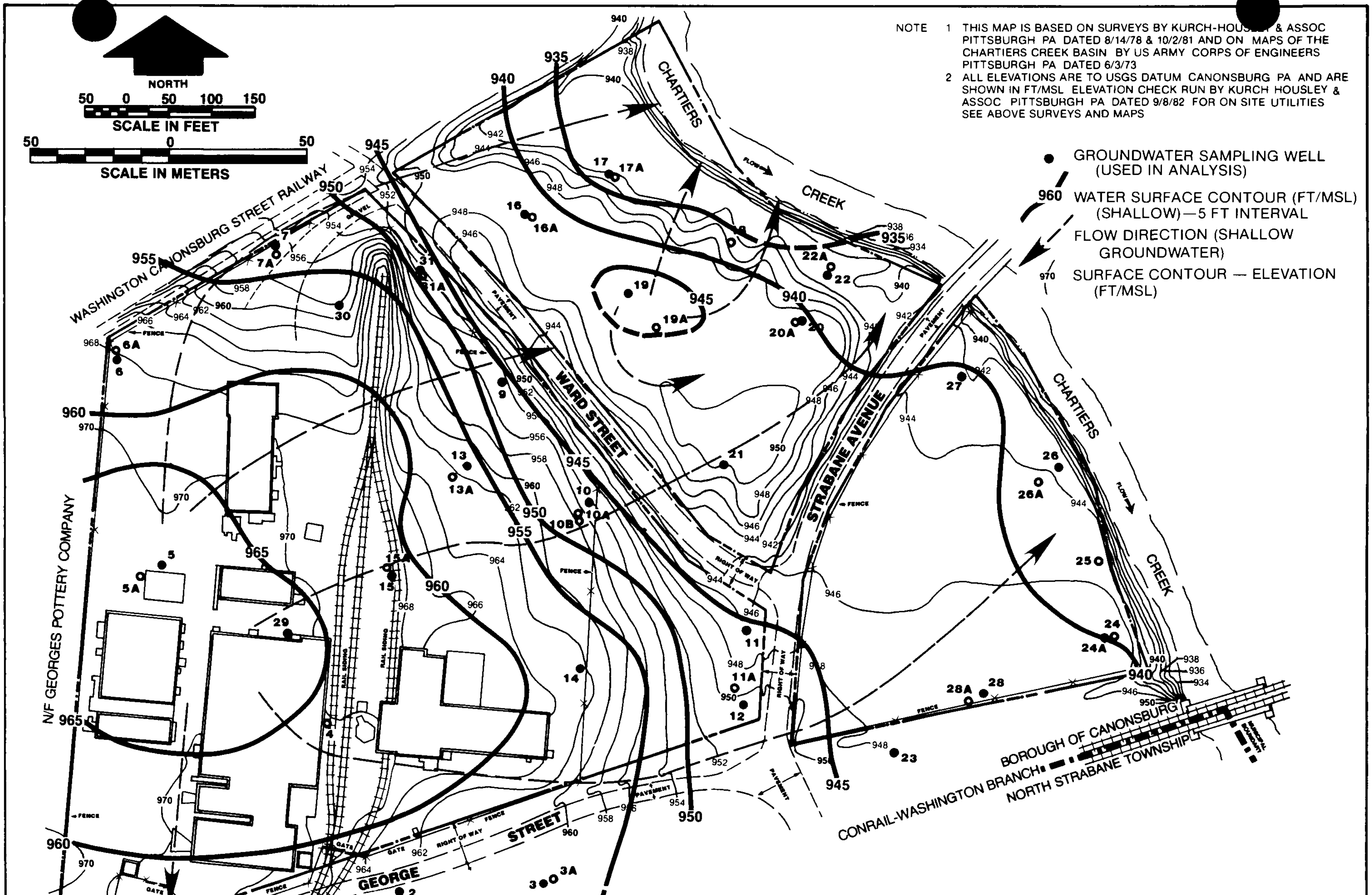


FIGURE D.2-7
PIEZOMETRIC SURFACE CONTOURS
UNCONSOLIDATED MATERIAL—11 OCTOBER 1979
CANONSBURG SITE

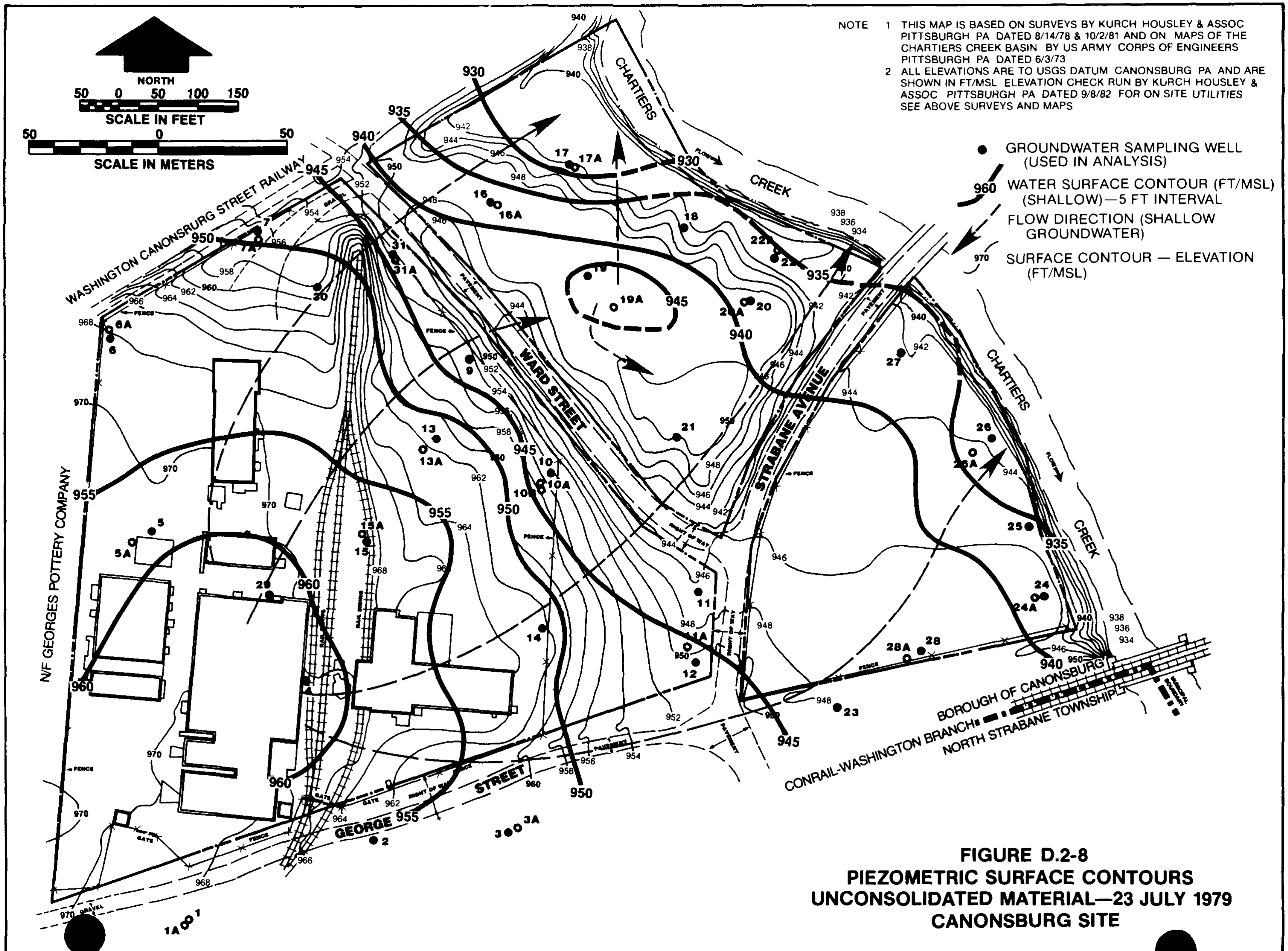


FIGURE D.2-8
PIEZOMETRIC SURFACE CONTOURS
UNCONSOLIDATED MATERIAL—23 JULY 1979
CANONSBURG SITE

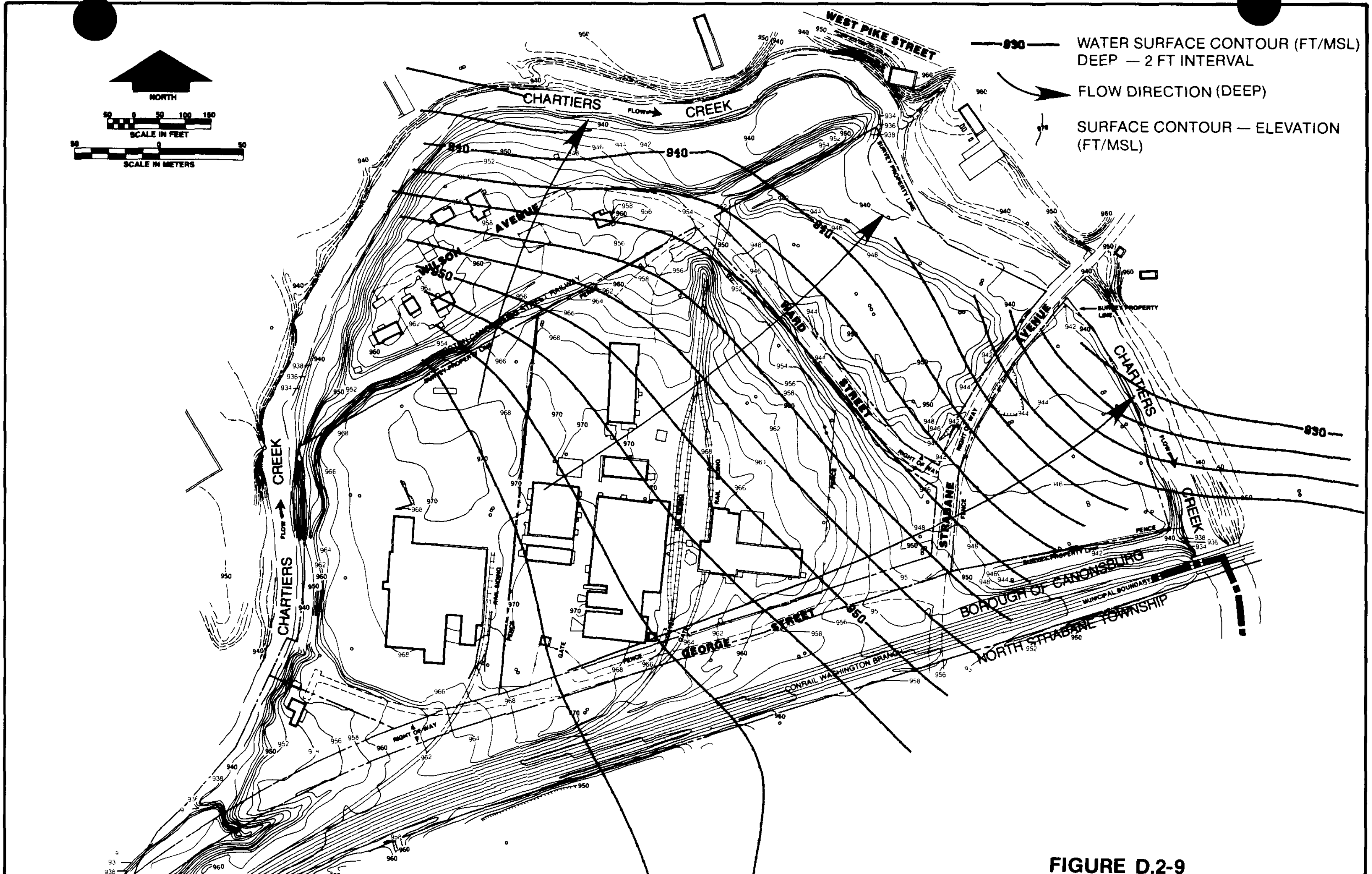


FIGURE D.2-9
PIEZOMETRIC SURFACE CONTOURS
BEDROCK — 14 MARCH 1983
EXPANDED CANONSBURG SITE

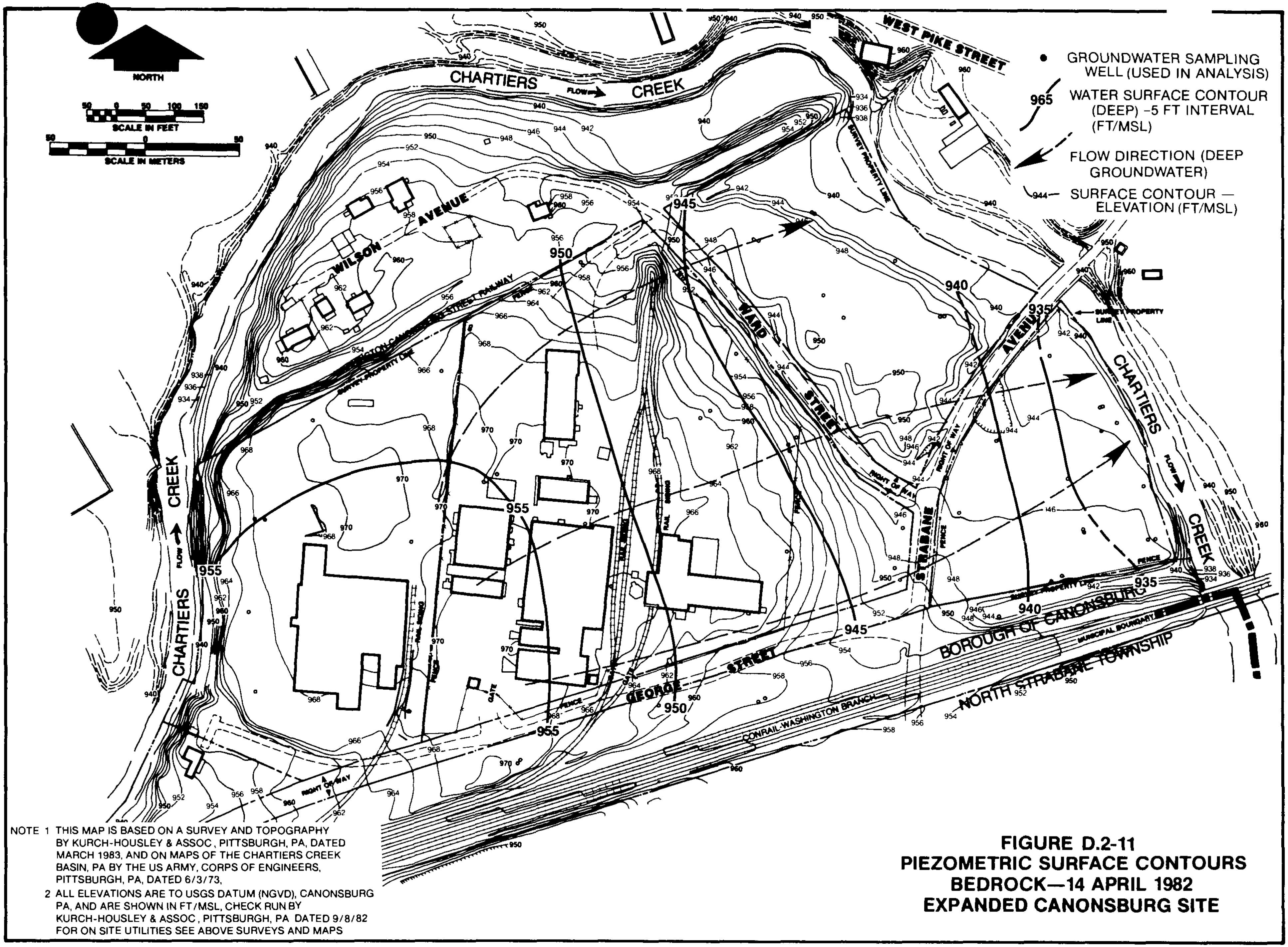
NOTE 1 THIS MAP IS BASED ON A SURVEY AND TOPOGRAPHY BY KURCH-HOUSLEY & ASSOC PITTSBURGH, PA, DATED MARCH 1983, AND ON MAPS OF THE CHARTIERS CREEK BASIN, PA BY THE US ARMY, CORPS OF ENGINEERS, PITTSBURGH, PA, DATED 6/3/73,

2 ALL ELEVATIONS ARE TO USGS DATUM (NGVD), CANONSBURG PA, AND ARE SHOWN IN FT/MSL, CHECK RUN BY KURCH-HOUSLEY & ASSOC PITTSBURGH PA DATED 9/8/82 FOR ON SITE UTILITIES SEE ABOVE SURVEYS AND MAPS

NOTE: 1. THIS MAP IS BASED ON A SURVEY AND TOPOGRAPHY BY KURCH-HOUSLEY & ASSOC., PITTSBURGH, PA, DATED MARCH 1983; AND ON MAPS OF THE CHARTIERS CREEK BASIN, PA BY THE US ARMY, CORPS OF ENGINEERS, PITTSBURGH, PA, DATED 6/3/73,

2. ALL ELEVATIONS ARE TO USGS DATUM (NGVD), CANONSBURG PA, AND ARE SHOWN IN FT/MSL, CHECK RUN BY KUR[illegible]USLEY & ASSOC., PITTSBURGH, PA. DATED 9/8/82 FOR [illegible]E UTILITIES SEE ABOVE SURVEYS AND MAPS.

FIGURE D.2-10
PIEZOMETRIC SURFACE CONTOURS
BEDROCK — 3 MARCH 1983
EXPANDED CANONSBURG SITE



NOTE 1 THIS MAP IS BASED ON A SURVEY AND TOPOGRAPHY BY KURCH-HOUSLEY & ASSOC, PITTSBURGH, PA, DATED MARCH 1983, AND ON MAPS OF THE CHARTIERS CREEK BASIN, PA BY THE US ARMY, CORPS OF ENGINEERS, PITTSBURGH, PA, DATED 6/3/73,

2 ALL ELEVATIONS ARE TO USGS DATUM (NGVD), CANONSBURG PA, AND ARE SHOWN IN FT/MSL, CHECK RUN BY KURCH-HOUSLEY & ASSOC, PITTSBURGH, PA DATED 9/8/82 FOR ON SITE UTILITIES SEE ABOVE SURVEYS AND MAPS

FIGURE D.2-11
PIEZOMETRIC SURFACE CONTOURS BEDROCK—14 APRIL 1982
EXPANDED CANONSBURG SITE

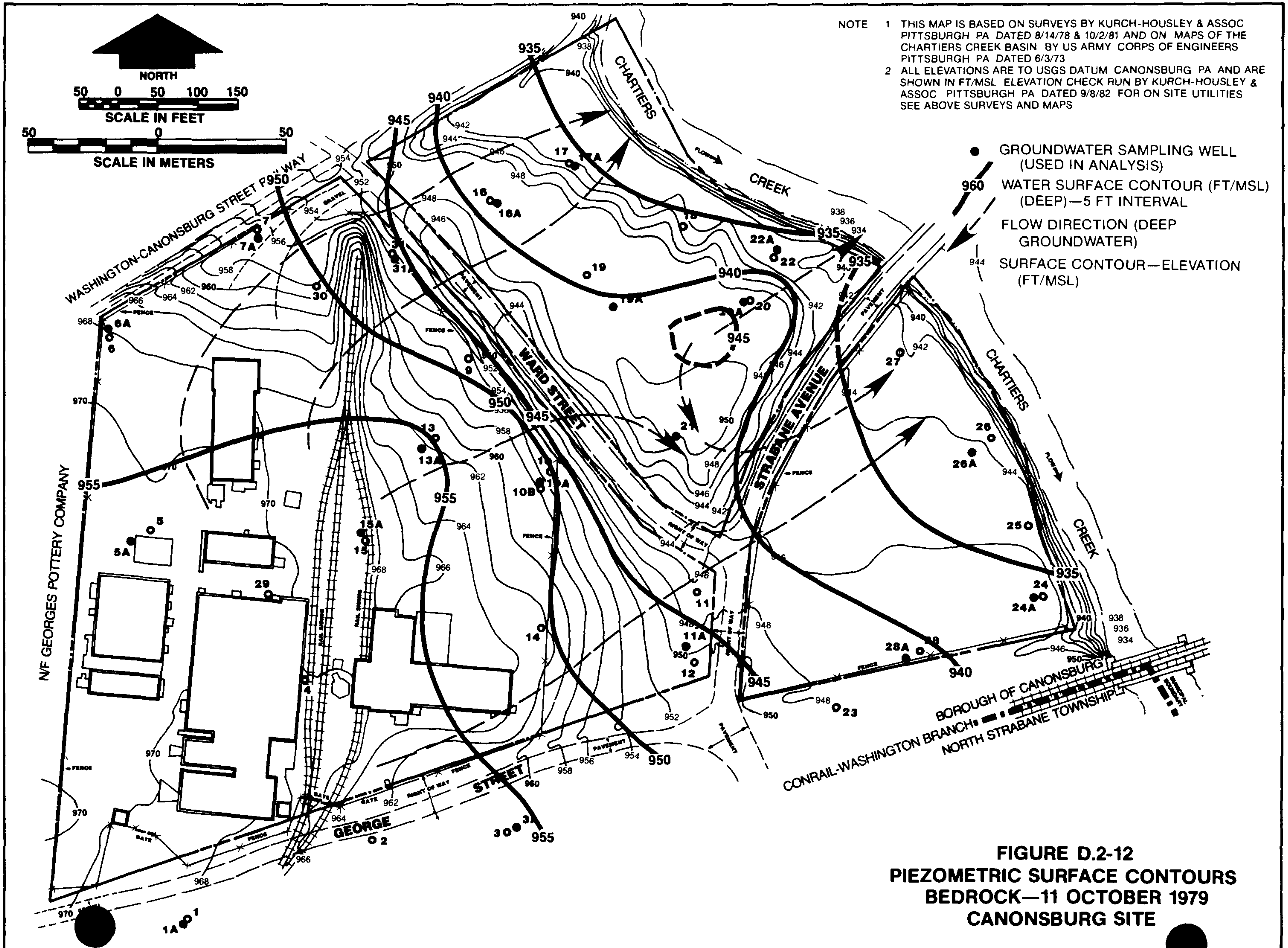


FIGURE D.2-12
PIEZOMETRIC SURFACE CONTOURS
BEDROCK—11 OCTOBER 1979
CANONSBURG SITE

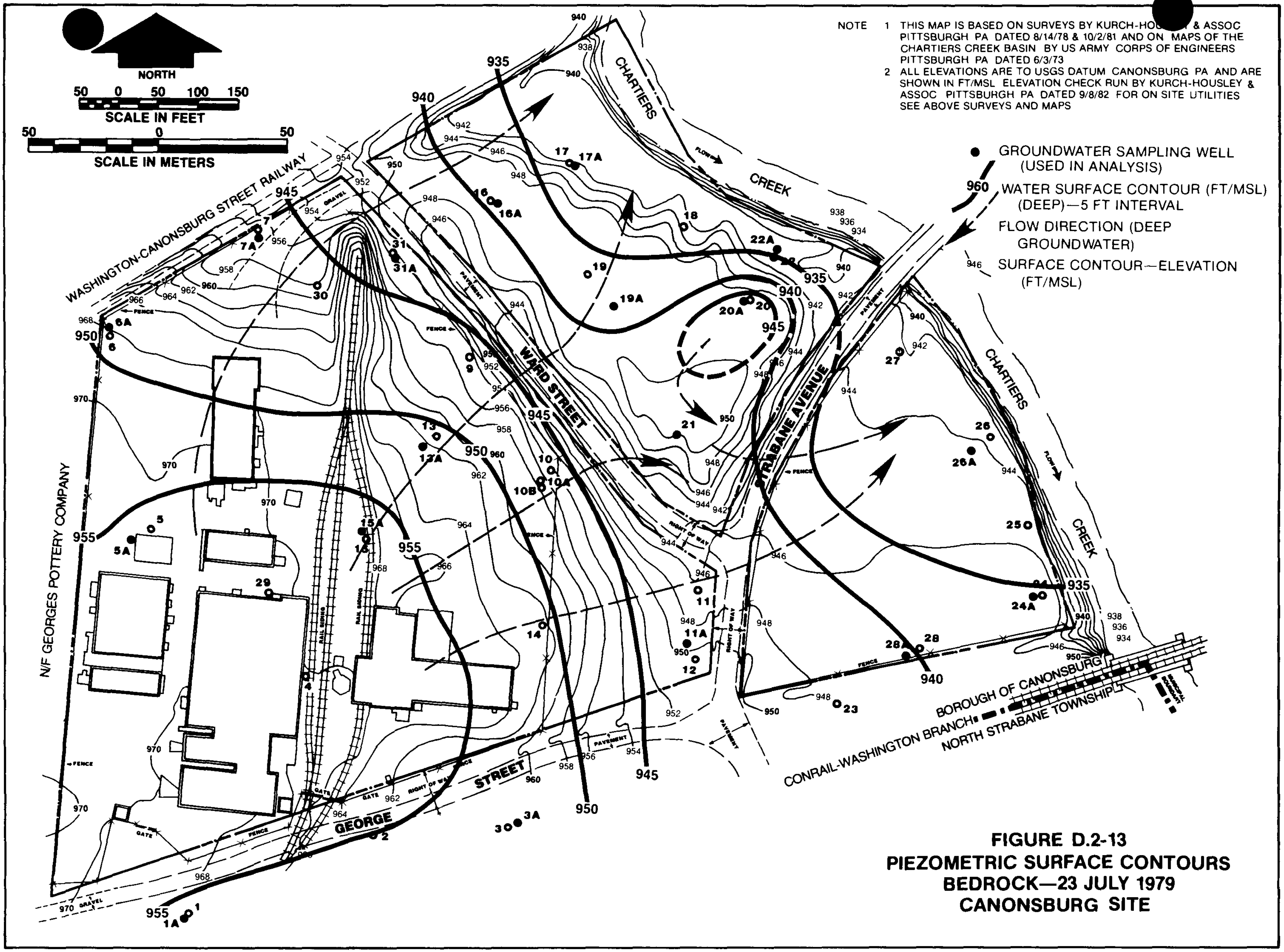


FIGURE D.2-13
PIEZOMETRIC SURFACE CONTOURS
BEDROCK—23 JULY 1979
CANONSBURG SITE

Table D.2-2. Concentrations of parameters in ground-water samples taken from the expanded Canonsburg site and adjacent offsite areas

Well[a] number	Number of samples	Arsenic (mg/l)	Boron (mg/l)	Barium (mg/l)	Cadmium (mg/l)	Calcium (mg/l)	Chloride (mg/l)	Chromium (mg/l)	Iron (mg/l)	Lead (mg/l)	Magnesium (mg/l)	Molybdenun (mg/l)	Nickel (mg/l)	Nitrate (mg/l)	pH Filtered	pH Unfiltered	Phosphate (mg/l)	Potassium (mg/l)	Selenium (mg/l)	Silicon (mg/l)	Silver (mg/l)	Sodium (mg/l)	Sulfate (mg/l)	Vanadium (mg/l)
1	1	<0.002[b]	0.16	<0.2	<0.02	---[c]	---	<0.02	<0.02	0.02	---	---	<0.02	0.02	---	---	---	---	0.004	9.3	<0.02	---	256	---
1A	1	<0.002	0.15	<0.2	<0.02	---	---	<0.02	<0.02	0.02	---	---	<0.02	0.07	---	---	---	---	0.003	9.8	<0.02	---	162	---
5	6	---	0.19	---	---	---	---	---	11.0	---	---	---	---	---	---	---	---	---	0.009	12.7	---	---	66	---
5A	8	<0.025	0.08	---	---	---	82	---	4.3, 255	---	---	---	---	<15	---	---	---	---	0.008, <0.01	4.8	---	---	282	---
6	8	---	0.18	---	---	---	---	---	17.0	---	---	---	---	---	---	---	---	---	0.012	7.3	---	---	809	---
6A	8	---	0.11	---	---	---	---	---	2.3	---	---	---	---	---	---	---	---	---	0.010	8.8	---	---	522	---
10	1	<0.02	0.10	<0.2	<0.02	---	---	<0.02	<0.02	0.02			<0.02	1.91	---	---	---	---	0.003	11.2	<0.2	---	140	---
17	8	---	0.28	---	---	---	---	---	1.4	---	---	---	---	---	---	---	---	---	0.016	13.2	---	---	845	---
17A	8	---	0.005	---	---	---	---	---	28.0	---	---	---	---	---	---	---	---	---	0.014	10.9	---	---	751	---
22	8	---	0.15	---	---	---	---	---	61.0	---	---	---	---	---	---	---	---	---	0.011	9.7	---	---	305	---
22A	7	---	---	---	---	---	---	---	5.9	---	---	---	---	---	---	---	---	---	0.010	8.2	---	---	364	---
24	1	0.043	0.17	<0.2	<0.02	---	---	<0.02	0.16	0.02	---	---	<0.02	4.13	---	---	---	---	0.017	52.5	<0.2	---	730	---
24A	1	0.051	0.06	<0.2	<0.02	---	---	<0.02	12.9	0.02	---	---	<0.02	0.16	---	---	---	---	0.086	14.4	<0.2	---	1940	---
201	1	---	---	---	---	---	14.2	---	ND[d]	ND	---	---	---	ND	---	---	---	---	---	---	---	---	995	---
201A	1	---	---	---	---	64	493	---	ND	ND	17	<0.025	---	ND,38	7.9	8.1	<0.10	4	---.	6.4	---	403	306	<0.025
201A	1	0.029	---	---	---	---	397, 394	---	ND, <0.01	ND	---	---	---	ND,ND	---	---	---	---	<10	---	---	---	278, 259	---
202	1	---	---	---	---	---	16.3	---	ND	ND	---	---	---	1.4	---	---	---	---	---	---	---	---	2070	---
202A	1	<0.025	---	---	---	310	214, 173	---	ND, 0.009	ND	48	<0.025	---	ND, <15	7.4	6.7	<0.10	3	<10	9.7	---	293	555, 209	<0.025
203	1	---	---	---	---	---	48.9	---	ND	ND	---	---	---	ND	---	---	---	---	---	---	---	---	1010	---
203A	1	---	---	---	---	---	723	---	ND	ND	---	---	---	ND	---	---	---	---	---	---	---	---	220	---
204	1	---	---	---	---	---	124	---	ND	ND	---	---	---	ND	---	---	---	---	---	---	---	---	1810	---
205	1	1.013	---	---	---	490	10.6, 16	---	ND, 0.006	ND	114	0.113	---	ND, <15	7.8	7.0	<0.10	10	<10	19.4	---	245	1430, 815	<0.025
301R	---	<0.025	0.05	---	---	290	190.0, 211	---	0.002	---	34	<0.025	---	---	7.3	6.8	<0.10	2	0.047, <0.01	11.0	---	242	520, 411	<0.025
301S	---	<0.025	---	---	---	260	32	---	<0.010	---	21	<0.025	---	<15	7.9	6.8	<0.10	5	18	8.0	---	141	423	<0.025
302S	---	<0.025	0.20	---	---	240	37.9, 63	---	0.001	---	23	<0.025	---	<15	---	---	<0.10	1	0.032, <0.01	4.6	---	96	376, 363	<0.025
302R	---	<0.025	0.07	---	---	330	295.0, 315	---	0.001	---	53	<0.025	---	<15	7.6	7.1	<0.10	3	0.044, <0.01	11.0	---	264	470, 538	<0.025
303[e]	---	---	0.17	---	---	---	50.0	---	---	---	---	---	---	---	---	---	---	---	0.016	---	---	---	120	---
303S	---	<0.025	0.26	---	---	410	85.8, 60	---	0.049	---	71	<0.025	---	<15	6.6	6.2	<0.10	11	0.190, <0.01	12.4	---	383	1950, 1875	<0.025
303R	---	<0.025	0.11	---	---	270	178.0, 262	---	0.001	---	49	<0.025	---	---	7.7	6.9	<0.10	5	0.140, <0.01	8.9	---	236	1210, 916	<0.025
304S	---	<0.025	0.17	---	---	65	32.7, 33	---	<0.010	---	21	<0.025	---	<15	7.4	6.8	<0.10	2	0.040, <0.036	5.5	---	85	156, 148	<0.025
304R	---	<0.025	0.06	---	---	104	182.0, 32	---	0.010	---	21	<0.025	---	<15	7.9	7.2	<0.10	3	0.046, <0.017	6.4	---	115	460, 182	<0.025
305R	---	<0.025	0.18	---	---	210	29.2, 38	---	0.045	---	14	<0.025	---	<15	7.3	6.9	<0.10	1	0.021, <0.01	7.6	---	35	140, 137	<0.025
305S	---	---	---	---	---	---	---	---	---	---	---	---	---	---	Dry well	---	---	---	---	---	---	---	---	---
306S	---	<0.025	7.66	---	---	151	20.6, 21	---	0.020	---	12	<0.025	---	<15	7.4	8.0	<0.10	2	0.029, <0.01	7.3	---	110	268, 224	<0.025
306R	---	<0.025	0.17	---	---	230	125.0, 141	---	0.001	---	21	<0.025	---	<15	7.4	7.0	<0.10	3	0.076, <0.01	9.8	---	411	806, 670	0.196
401[f]	---	<0.025	ND	---	---	147	28.8, 29	---	<0.010	---	15	<0.025	---	<15	7.4	7.1	<0.10	1	0.018, <0.01	5.7	---	24	107, 91	<0.025
402	---	---	---	---	---	---	---	---	---	---	---	---	---	---	Dry well	---	---	---	---	---	---	---	---	---
403	---	---	---	---	---	---	---	---	---	---	---	---	---	---	Dry well	---	---	---	---	---	---	---	---	---
404	---	<0.025	0.19	---	---	275	85.8, 106	---	0.002	---	32	<0.025	---	<15	7.4	7.0	<0.10	3	0.035, <0.01	4.8	---	116	390, 330	<0.025
405[f]	---	<0.025	ND	---	---	38	28.8, 36	---	0.026	---	8	<0.025	---	<15	6.8	6.4	<0.10	3	0.013, <0.01	2.3	---	26	87, 78	<0.025
406[f]	---	<0.025	0.017	---	---	315	37.1, 41	---	0.033	---	46	<0.025	---	<15	7.4	7.2	<0.10	4	0.027, <0.01	8.6	---	34	132, 196	<0.025
407[f]	---	<0.025	0.11	---	---	210	59.7, 65	---	0.040	---	21	<0.025	---	<15	7.6	0	<0.10	4	0.026, <0.01	7.0	---	75	198, 140	<0.025
408[f]	---	<0.025	---	---	---	250	44	---	0.077	---	55	<0.025	---	<15	7.8	7.3	<0.10	7	<0.01	10.6	---	56	85	<0.025
409[f]	---	<0.025	---	---	---	26	12	---	0.018	---	13	<0.025	---	64	6.8	6.4	<0.10	6	<0.01	8.1	---	12	64	<0.025
410[f]	---	<0.025	ND	---	---	43	21.9, 22	---	0.001	---	11	<0.025	---	<15	6.8	6.4	<0.10	3	0.020, <0.01	8.0	---	38	126, 136	<0.025
411	---	<0.025	ND	---	---	330	175.0, 135	---	0.033	---	21	<0.025	---	<15	7.4	6.8	0.40	7	0.160, <0.01	8.5	---	680	1590, 960	<0.025
501[f]	---	<0.025	---	---	---	730[g]	2140[g]	---	0.025	---	93	<0.025	---	<15	---	6.9	<0.10	4	<0.01	9.1	---	360[g]	94	<0.025
502[f]	---	<0.025	---	---	---	200	238	---	0.340	---	39	<0.025	---	<15	7.6	7.2	<0.10	3	<0.01	8.1	---	296	315	<0.025
503[f]	---	0.089	---	---	---	92	40	---	0.013	---	18	<0.025	---	<15	---	7.8	<0.10	2	<0.01	7.9	---	40	16	<0.025
5A	---	<0.025	---	---	---	235	82	---	---	---	19	<0.025	---	<15	---	7.0	<0.10	2	<0.01	7.2	---	258	405	<0.025
601[h]	---	---	ND	---	---	---	0.16	---	---	---	---	---	---	---	---	---	---	---	ND	---	---	---	<1.0	---
Creek	---	<0.025	---	---	---	93	96	---	0.012	---	16	0.060	---	<15	8.1	7.6	0.54	5	<0.01	2.7	---	60	132	<0.025
602[h]	---	<0.025	---	---	---	0.7	<1	---	<0.010	---	0.04	<0.025	---	<15	---	---	<0.10	0.02	<0.01	<0.1	---	0.11	<5	<0.025
Standard																								
		0.05[i]		1.0[i]	0.01[i]		250[j]	0.05[i]	0.3[j]	0.05[i]				10.0[i]	6.5 -	8.5[j]			0.01[i]		0.05[i]		250[j]	

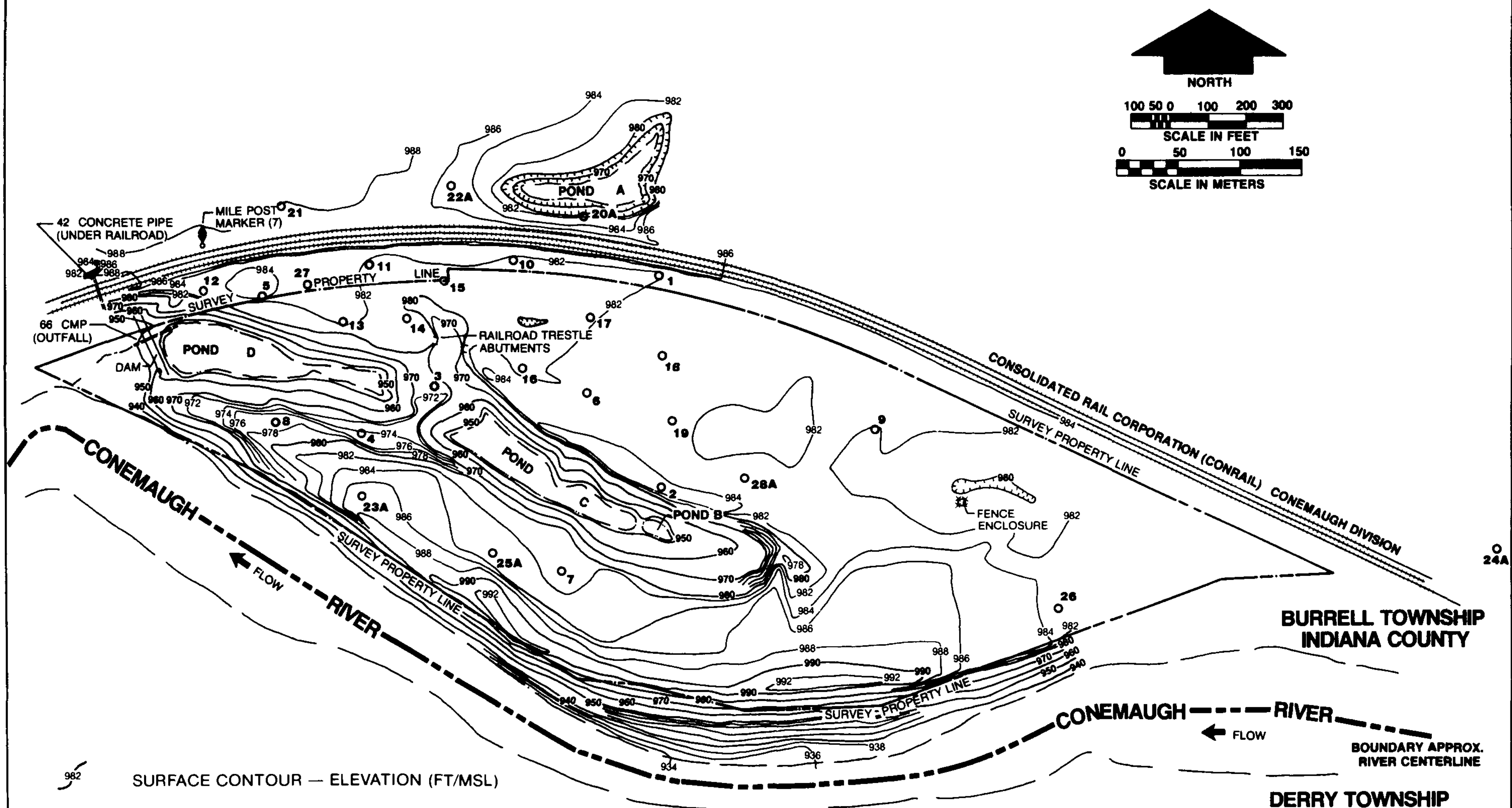
[a]Well locations shown on Figure D.2-2.
[b]"<" indicates a detection limit; actual concentrations may be lower.
[c]--- indicates no analysis was performed.
[d]None detected.
[e]Chartiers Creek adjacent to wells 303S and 303R.
[f]Well is located off the expanded Canonsburg site.
[g]Questionable result.
[h]Field blank.
[i]EPA National Interim Primary Drinking Water standards (40 CFR 141).
[j]EPA National Secondary Drinking Water guidelines (40 CFR 143).

Source: Weston field data (1979-1983).

Table D.2-3. Wells within a 1-mile radius of the Canonsburg site

Address	Use
132 1/2 Latimer Avenue	Wash cars
351 Bluff Street	Abandoned
402 Ridge Avenue	None
32 West Pitt Street	Abandoned
154 E. College Street	Never used
15 Latimer Avenue	None
302 W. Grant Street	Abandoned
202 W. Grant Street	None
213 Reed Street	None
126 W. Pike Street	None
19 Latimer Avenue	Water garden
16 Strabane Avenue	Abandoned

Source: Weston (1979) socioeconomic survey, Chnupa (1983).



982 SURFACE CONTOUR — ELEVATION (FT/MSL)

○18 GROUNDWATER SAMPLING WELL LOCATION/DESIGNATION

25A LETTER A—WELL INTO BEDROCK

NOTE
1 PROPERTY LINE DATA FROM PLAN OF PROPERTY FOR UNION CARBIDE CORP, BY RICHARD G BACH & ASSOC ZELIENOPLE, PA-DATED 11/16/77
2 TOPOGRAPHICAL DETAIL FROM MAP TEST HOLE LOCATIONS FOR ROY F WESTON INC BY KURCH-HOUSLEY & ASSOC PITTSBURGH, PA-DATED 11/6/81 REV 3/2/82
3 ALL ELEVATIONS ARE TO USGS DATUM, BLAIRSVILLE PA ARE SHOWN IN FT/MSL ELEVATION CHECK KURCH-HOUSLEY PITTSBURGH PA-DATED 6/11/82

FIGURE D.2-14
GROUNDWATER SAMPLING WELL LOCATIONS
BURRELL TOWNSHIP SITE

Table D.2-4. Flow-net calculations -- Burrell site

Flow through unit cross-section:

$q = K\Delta h \frac{N_f}{N_d} \cdot \frac{a}{b}$ (Perloff and Baron, 1976)

Where:

K = Hydraulic conductivity.

N_f = Number of flow channels.

a/b = Ratio of spacing of equipotential lines (a) to flow lines (b).

Δh = Change in potential (head) between two equipotential lines (h_1-h_2).

n_d = Equipotential units between h_1 and h_2.

Δh = Drop in head between W19 and W7.

K = 0.16 ft/min.

n_f = 2.

a/b = 0.1.

$q = (0.16 \text{ ft/min.})(942.2' - 937.9') \cdot \frac{2}{4.7} (0.1)$

q = 0.029 ft^3/min.

Total flow across 2000 ft. cross-section Q:

Q = 58 ft^3/min. = 452 gpm (does not discharge to the onsite ponds).

Δh = Drop in head between edge of site and Pond D.

K = 0.16 ft/min.

n_f = 2.

a/b = 0.19.

$q = K \ h \ \frac{n_f}{n_d} \cdot \frac{a}{b}$

$q = (0.16 \text{ ft/min.})(950 - 937) \cdot \frac{2}{9} (0.19)$

q = 0.089 ft/min.

Total flow across 950 ft. cross-section:

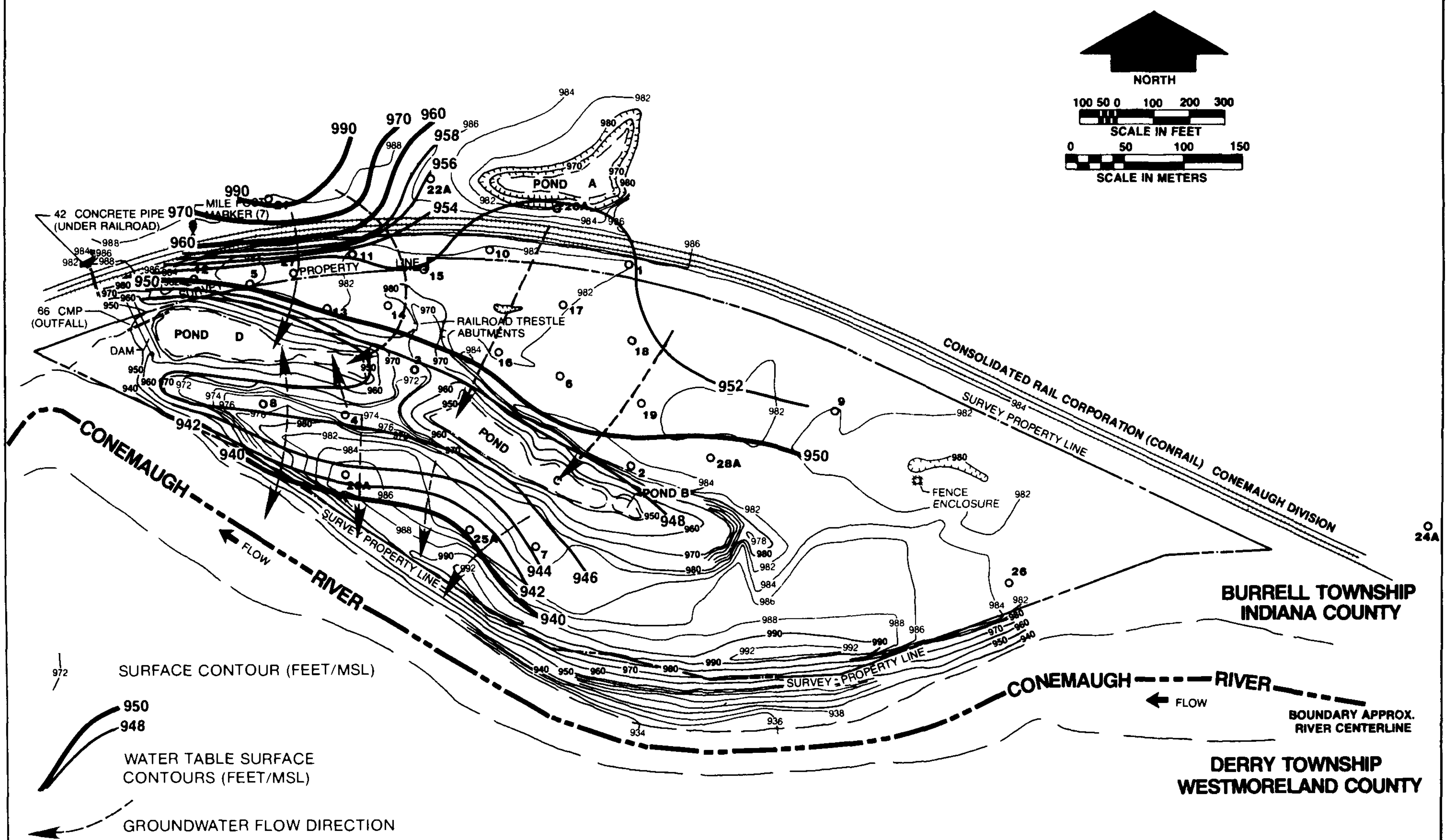
Q = 39.1 ft^3/min. = 305 gpm (discharges to the onsite ponds)

Outflow from Pond D = 200 gpm (field estimate).

305
-200
105 gpm -- direct seepage to river

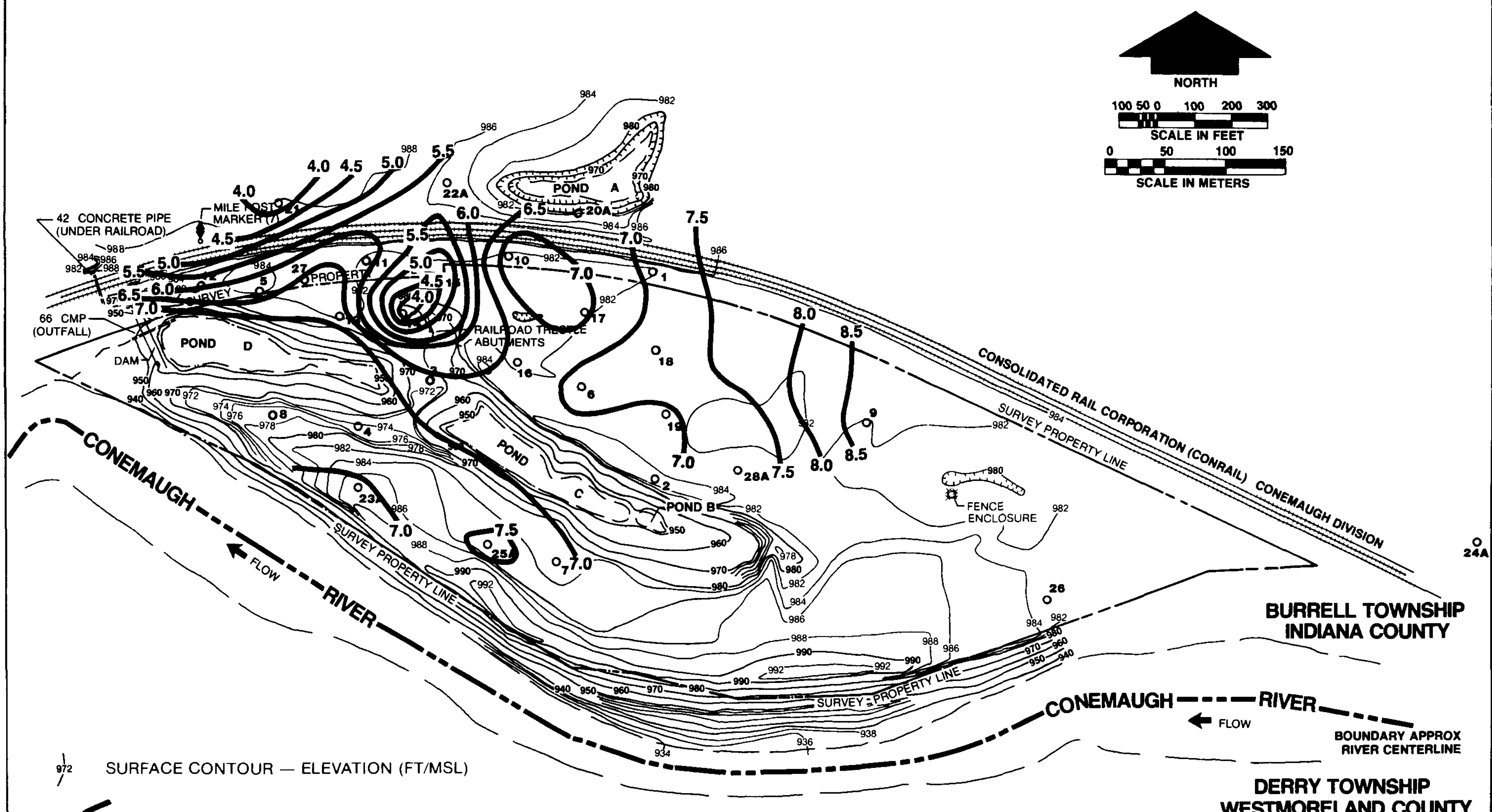
Total direct seepage to river:

452
+105
557 gpm



NOTE
1. PROPERTY LINE DATA FROM PLAN OF PROPERTY FOR UNION CARBIDE CORP BY RICHARD G BACH & ASSOC ZELIENOPLE, PA-DATED 11/16/77
2. TOPOGRAPHICAL DETAIL FROM MAP TEST HOLE LOCATIONS FOR ROY F WESTON INC BY KURCH-HOUSLEY & ASSOC PITTSBURGH PA-DATED 11/6/81 REV 3/2/82
3. ALL ELEVATIONS ARE TO USGS DATUM BLAIRSVILLE ... ND ARE SHOWN IN FT/MSL ELEVATION CHECK ... Y KURCH-HOUSLEY PITTSBURGH PA-DATED 6/11/82

FIGURE D.2-15
WATER TABLE MAP — 19 JANUARY 1982
BURRELL TOWNSHIP SITE

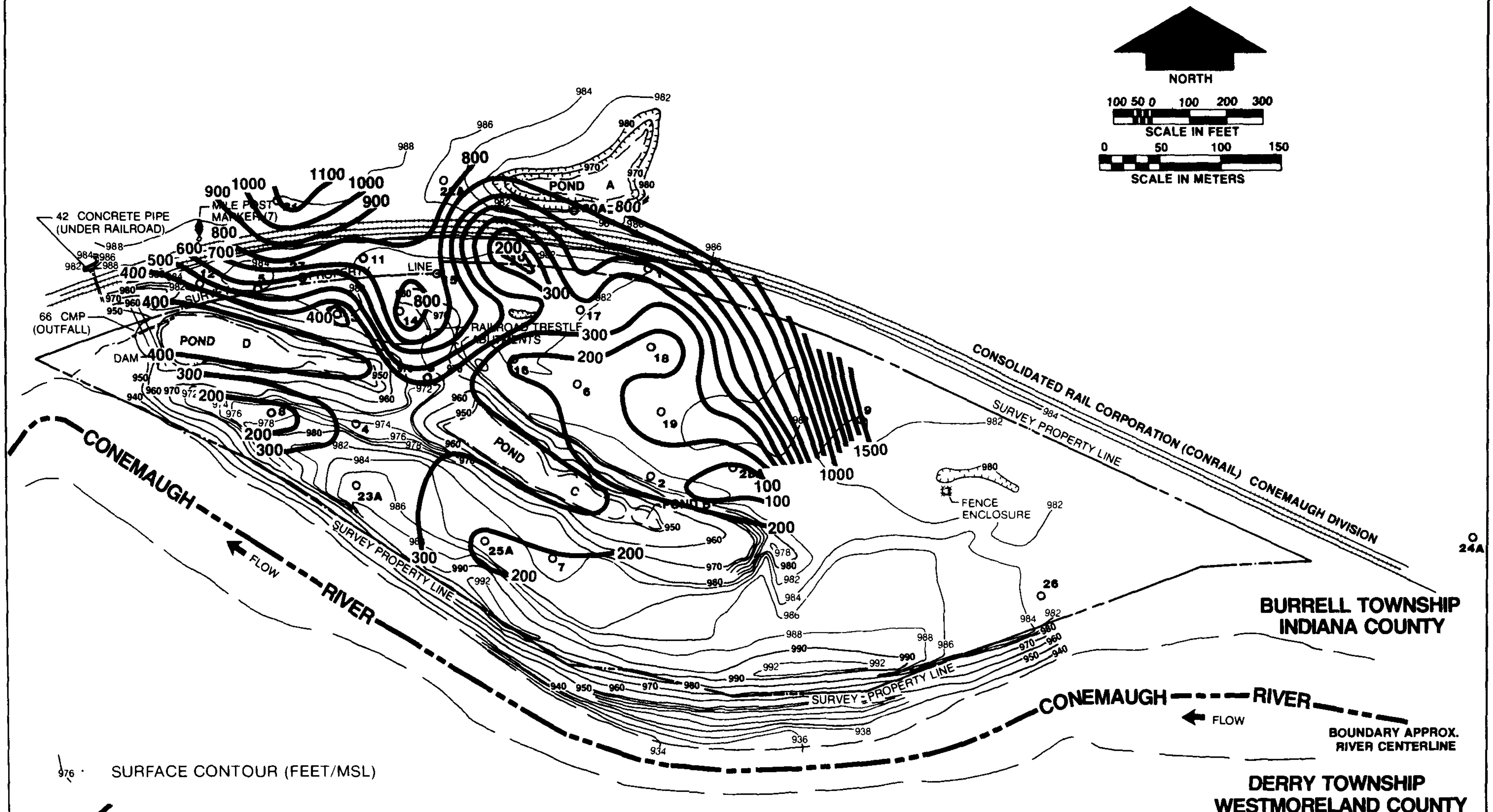


972 SURFACE CONTOUR — ELEVATION (FT/MSL)

7.5 ISOPLETH OF pH (0 5 INTERVAL)

NOTE
1. PROPERTY LINE DATA FROM PLAN OF PROPERTY FOR UNION CARBIDE CORP BY RICHARD G BACH & ASSOC ZELIENOPLE PA-DATED 11/16/77
2. TOPOGRAPHICAL DETAIL FROM MAP TEST HOLE LOCATIONS FOR ROY F WESTON INC BY KURCH-HOUSLEY & ASSOC PITTSBURGH PA-DATED 11/6/81 REV 3/2/82
3. ALL ELEVATIONS ARE TO USGS DATUM BLAIRSVILLE PA AND ARE SHOWN IN FT/MSL ELEVATION CHECK RUN BY KURCH-HOUSLEY PITTSBURGH PA-DATED 6/11/82

FIGURE D.2-16
ISOPLETH MAP OF GROUNDWATER pH
BURRELL TOWNSHIP SITE



976 SURFACE CONTOUR (FEET/MSL)

400 ISOPLETH OF SULFATE CONCENTRATIONS (ppm)

NOTE
1 PROPERTY LINE DATA FROM PLAN OF PROPERTY FOR UNION CARBIDE CORP BY RICHARD G BACH & ASSOC ZELIENOPLE PA-DATED 11/16/77
2 TOPOGRAPHICAL DETAIL FROM MAP TEST HOLE LOCATIONS FOR ROY F WESTON INC BY KURCH-HOUSLEY & ASSOC PITTSBURGH PA-DATED 11/6/81 REV 3/2/82
3 ELEVATIONS ARE TO USGS DATUM BLAIRSVILLE D ARE SHOWN IN FT/MSL ELEVATION CHECK BY KURCH-HOUSLEY PITTSBURGH PA-DATED 6/11/82

FIGURE D.2-17
ISOPLETH MAP OF GROUNDWATER SULFATE CONCENTRATION BURRELL TOWNSHIP SITE

Table D.2-5. Ground-water quality -- Burrell site

Well[a] number	Date sampled	pH	Specific conductance (μhos/cm)	Chloride (mg/l)	Sulfate (mg/l)	Nitrate (mg/l)	Iron (mg/l)	Lead (mg/l)	Barium (mg/l)	Boron (mg/l)
1	Dry									
2	1-29-82	6.8	1100	29.8	91	NF[b]	0.06	NF	0.07	0.63
3	1-29-82	6.9	1175	14	348	NF	0.22	NF	0.02	0.40
4	Dry									
5	Blocked									
6	2-4-82	7.2	1200	35.2	170	NF	0.10	NF	0.11	0.45
7	1-29-82	7.7	1300	59.8	200	NF	NF	NF	0.10	1.13
8	1-29-82	7.4	900	9.3	131	NF	NF	NF	0.04	0.59
9	1-29-82	8.8	4900	106	1590	6.5	142	NF	0.41	1.70
10	2-4-82	7.3	900	21.2	108	NF	0.07	NF	0.02	0.18
11	1-29-82	7.1	2000	795	NF	NF	NF	NF	NF	0.20
12	1-29-82	5.8	750	8.3	720	0.34	3.84	NF	NF	0.27
13	1-29-82	7.2	1975	24.3	300	NF	NF	NF	0.07	0.24
14	1-29-82	3.5	1825	23.4	880	1.62	50.1	0.52	NF	0.07
15	1-29-82	4.6	1250	17.8	680	0.33	0.40	NF	NF	0.06
16	2-4-82	6.7	1550	16.8	198	NF	0.06	NF	NF	0.22
17	2-4-82	6.8	1100	19.1	380	NF	NF	NF	0.02	0.24
18	2-2-82	7.0	570	9.1	112	0.23	1.62	NF	NF	0.17
19	1-29-82	6.9	1500	15.5	266	NF	0.07	NF	NF	0.94
20	2-4-82	6.6	1300	20.4	665	I[c]	NF	NF	0.03	0.07
21	1-29-82	3.7	---	5.6	891	0.32	0.72	NF	NF	NF
	2-2-82	3.3	1850	8.8	1120	0.73	3.7	NF	NF	0.10
22	2-4-82	5.2	1600	18	845	NF	NF	NF	NF	NF
23	2-2-82	6.9	1425	51.8	390	NF	NF	NF	NF	0.43
24	2-2-82	7.8	325	4.2	34.8	NF	0.49	NF	0.10	0.15
25	2-2-82	7.6	1200	24	169	NF	NF	NF	0.09	0.50
26	2-2-82	7.0	700	18.3	79	NF	0.14	NF	0.03	0.16
27	2-4-82	6.6	---	11	895	NF	13	NF	NF	0.12
28	2-4-82	7.5	350	7.0	9.6	NF	NF	NF	0.72	0.08
Pond A	2-4-82	7.0	1250	19.7	420	NF	NF	NF	0.02	0.76
Pond B	2-4-82	6.9	1200	20.2	290	NF	NF	NF	0.03	0.41
Pond C	2-4-82	5.7	12	22.3	440	0.72	NF	NF	NF	0.07
Standard										
		6.5-8.5[d]			250[d]	10[e]	0.3[d]	0.05[e]	1.0[e]	

[a]Well locations shown on Figure D.2-14.

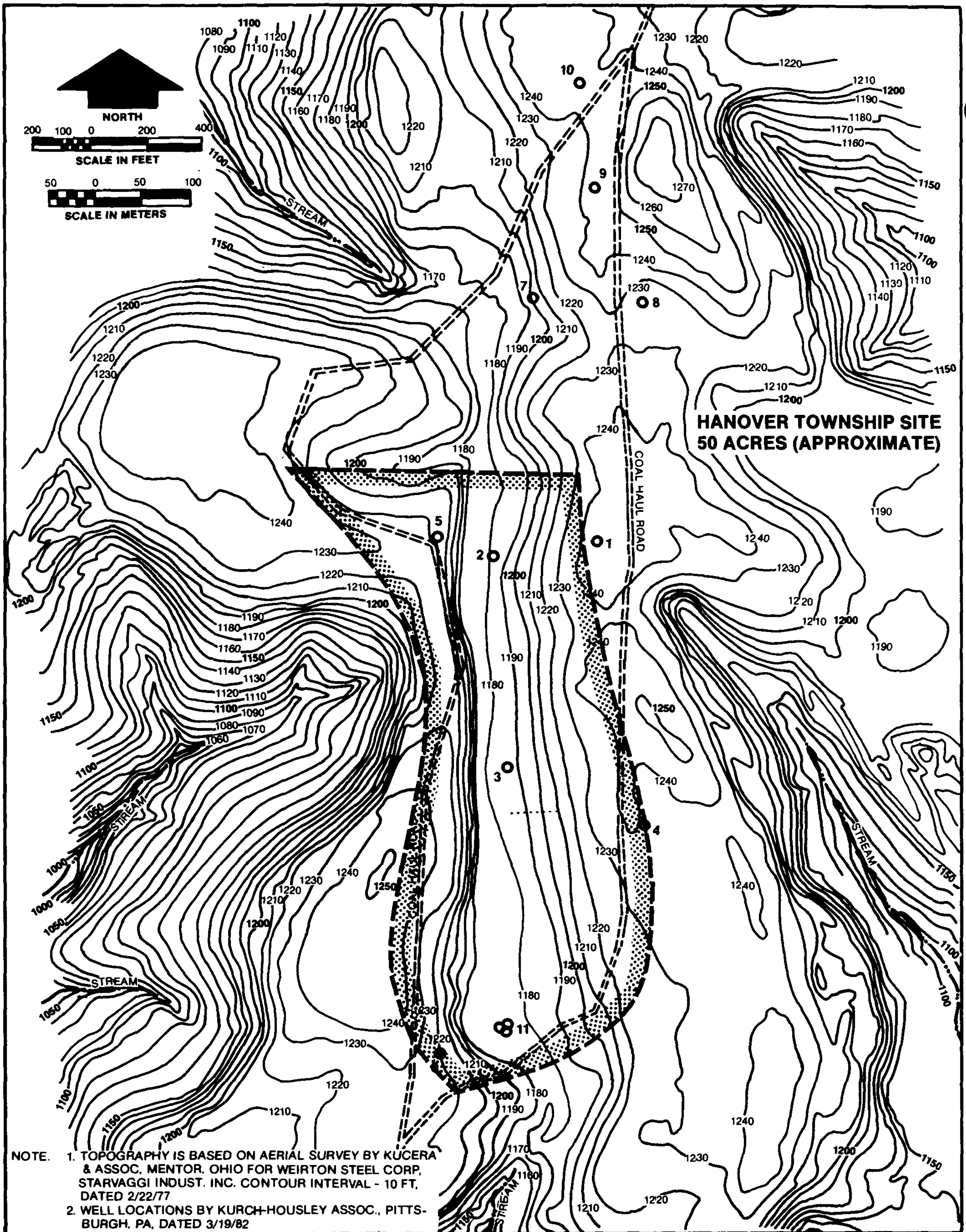
[b]NF = Not found.

[c]I = Interference

[d]EPA National Secondary Drinking Water guidelines (40 CFR 143).

[e]EPA National Interim Primary Drinking Water standards (40 CFR 141).

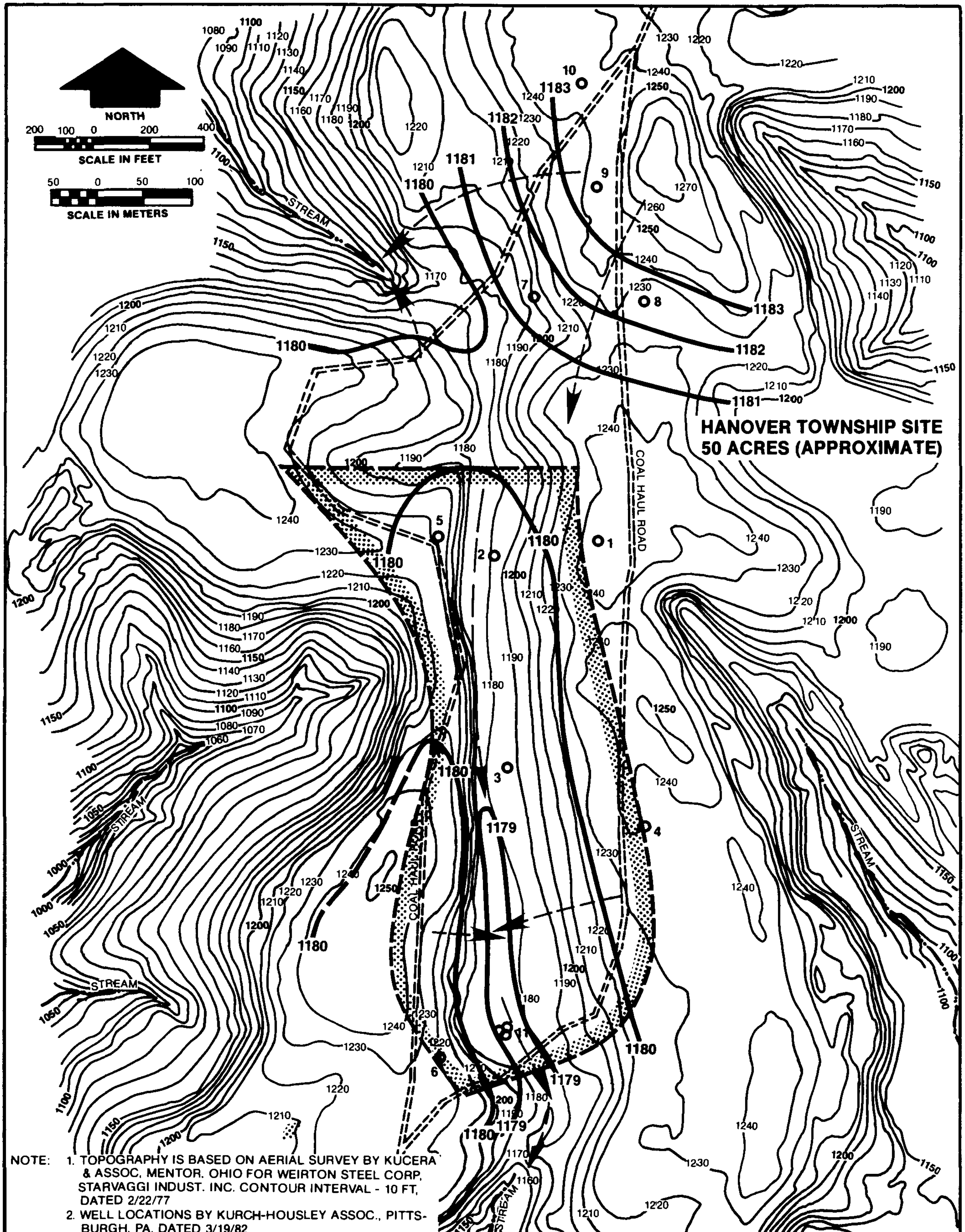
Source: Weston (1982) field data.



3 GROUNDWATER SAMPLING WELL-LOCATION/DESIGNATION

1230 SURFACE CONTOUR — ELEVATION

FIGURE D.2-18
GROUNDWATER SAMPLING WELL LOCATIONS
HANOVER TOWNSHIP SITE

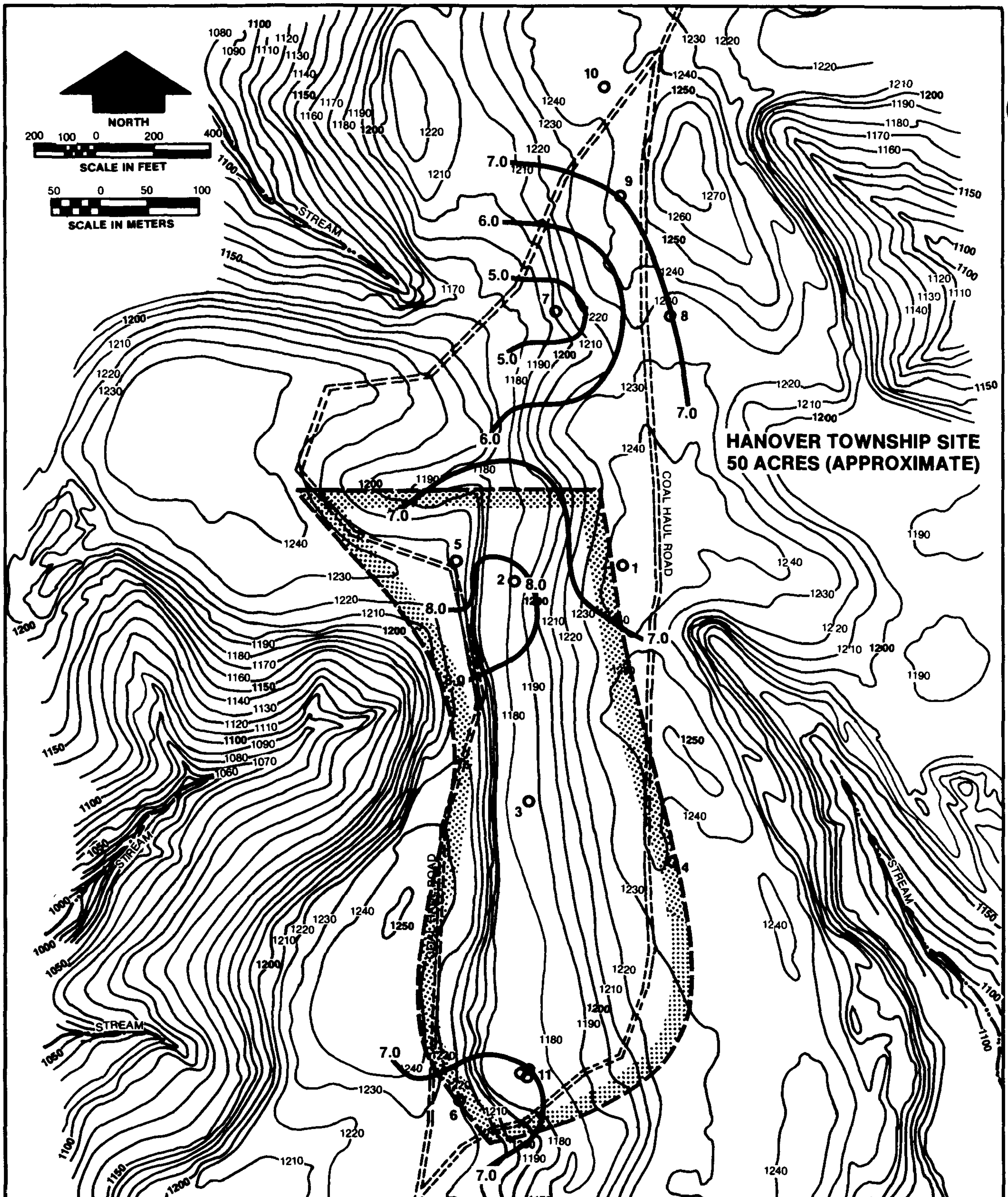


O GROUNDWATER SAMPLING WELL-LOCATION/DESIGNATION

1179 WATERTABLE SURFACE CONTOURS (FT/MSL)

GROUNDWATER FLOW DIRECTION

FIGURE D.2-19
WATER TABLE MAP—12 MARCH 1982
HANOVER TOWNSHIP SITE



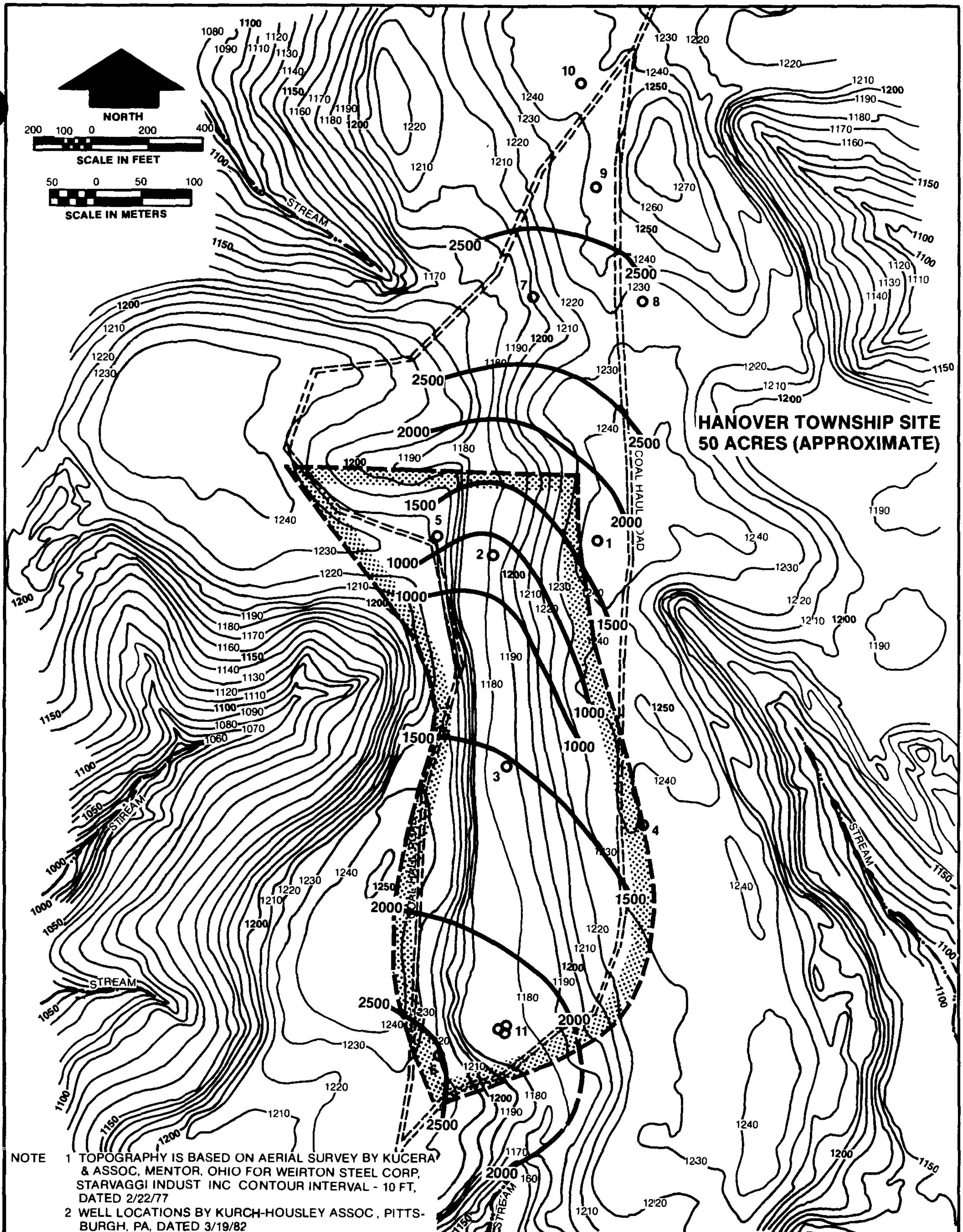
NOTE 1. TOPOGRAPHY IS BASED ON AERIAL SURVEY BY KUCERA & ASSOC, MENTOR, OHIO FOR WEIRTON STEEL CORP, STARVAGGI INDUST. INC. CONTOUR INTERVAL - 10 FT, DATED 2/22/77

2. WELL LOCATIONS BY KURCH-HOUSLEY ASSOC., PITTSBURGH, PA, DATED 3/19/82

O GROUNDWATER SAMPLING WELL-LOCATION/DESIGNATION

6.0 ISOPLETH OF pH (1 UNIT INTERVAL)

FIGURE D.2-20
ISOPLETH MAP OF GROUNDWATER pH
HANOVER TOWNSHIP SITE



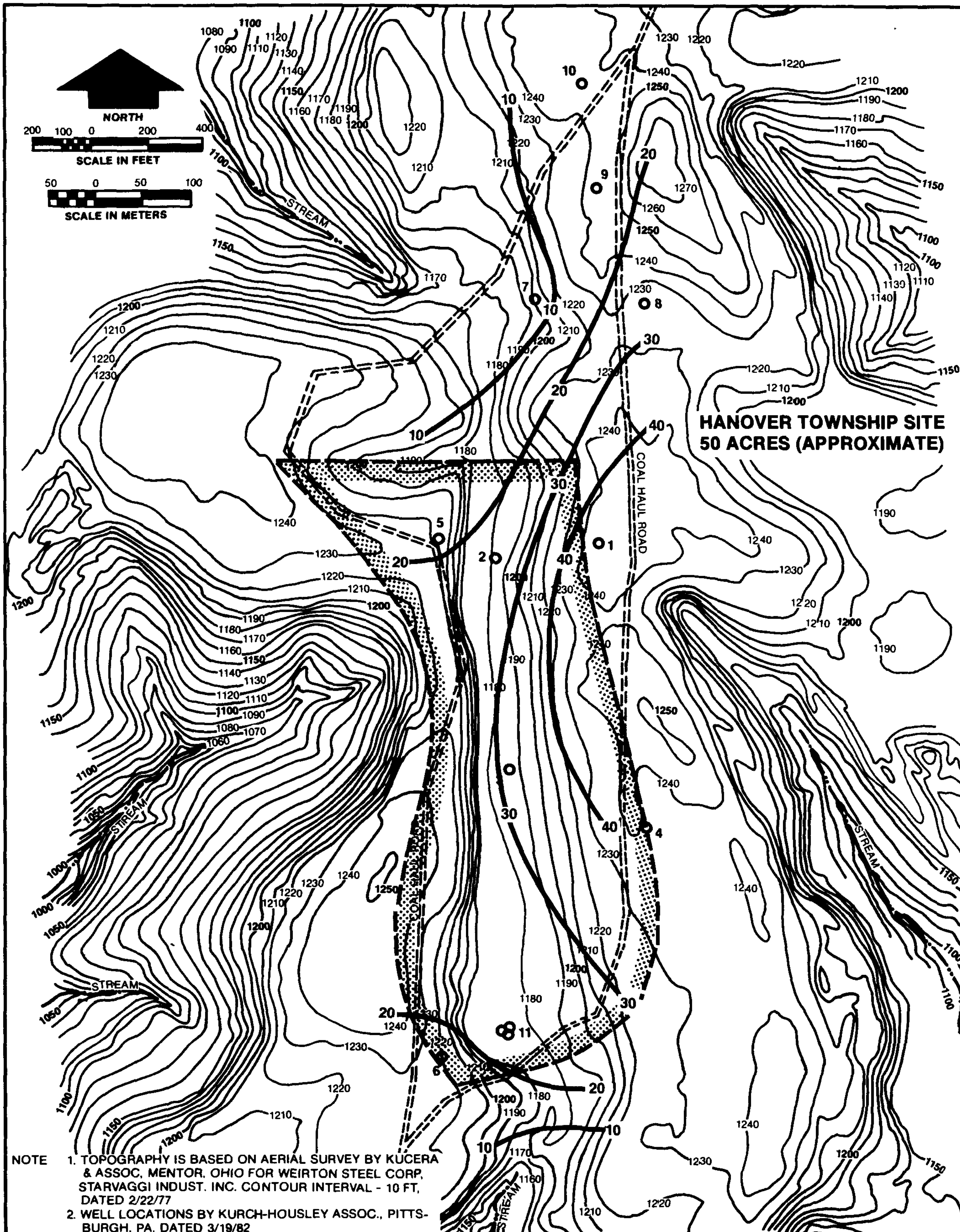
NOTE 1 TOPOGRAPHY IS BASED ON AERIAL SURVEY BY KUCERA & ASSOC, MENTOR, OHIO FOR WEIRTON STEEL CORP, STARVAGGI INDUST INC CONTOUR INTERVAL - 10 FT, DATED 2/22/77

2 WELL LOCATIONS BY KURCH-HOUSLEY ASSOC, PITTSBURGH, PA, DATED 3/19/82

O GROUNDWATER SAMPLING WELL-LOCATION/DESIGNATION

1500 ISOPLETH OF SULFATE CONCENTRATIONS (ppm)

FIGURE D.2-21
ISOPLETH MAP OF GROUNDWATER SULFATE CONCENTRATIONS HANOVER TOWNSHIP SITE



GROUNDWATER SAMPLING WELL-LOCATION/DESIGNATION

30 ISOPLETH OF TOTAL ORGANIC CARBON CONCENTRATIONS (mg/l)

FIGURE D.2-22
ISOPLETH MAP OF GROUNDWATER TOTAL ORGANIC CARBON CONCENTRATIONS HANOVER TOWNSHIP SITE

Table D.2-6. Ground-water quality -- Hanover site

Well number[a,b]	Iron (mg/l)	Lead (mg/l)	Nitrate (mg/l)	Sulfate (mg/l)	Total cyanide (mg/l)	Total organic carbon (mg/l)	Specific conductance (mmhos)	pH	Total dissolved solids (mg/l)
1	ND	ND	0.94	1660	0.03	50.5	3100	6.3	4792
2	ND	ND	0.2	910	0.02	26.0	2200	8.2	1706
5	ND	ND	0.2	1250	0.03	16.0	1500	7.7	2004
6	0.07	ND	3.75	2500	0.03	11.0	2300	6.8	3918
7	0.27	ND	0.33	3030	0.03	6.5	3000	4.4	4884
8	ND	ND	0.2	2840	0.03	22.5	2200	6.9	4724
9	ND	ND	0.2	2240	0.03	16.5	2400	7.0	2874
11	0.14	ND	0.2	2320	0.03	5.5	2300	7.3	3196
"A"	ND	ND	0.64	1910	0.03	5.5	2500	7.3	3196
"B"	0.06	ND	0.2	1860	0.03	6.0	2700	7.0	3230
Creek	ND	ND	0.21	1550	0.02	1.5	2100	6.3	2690
Standards									
		0.05[c]	10[c]	250[d]				6.5-8.5[d]	

ND - Not detectable.

[a]Well locations are shown on Figure D.2-18.
[b]Wells 3, 4, and 10 did not contain sufficient water for sampling.
[c]EPA National Interim Primary Drinking Water standards (40 CFR 141).
[d]EPA National Secondary Drinking Water guidelines (40 CFR 143).

Source: Weston (1982) field data.

Table D.2-7. Wells within a 1-mile radius of the Hanover site

Location	Type
Goodwill Hill Fishing and Hunting Club	Spring
Dr. Glen Roberts property	Two wells, each approximately 100 feet deep
John Smith property	Drilled well
Dr. Glen Roberts property	Three wells drilled by Smith Township Water Company (presently capped and not in use)

Source: Chnupa (1983).

REFERENCES FOR APPENDIX D

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Appendix E

BIOLOGICAL INFORMATION

Appendix E.1

TERRESTRIAL ECOLOGY STUDIES

Appendix E.1

TERRESTRIAL ECOLOGY SURVEYS

E.1.1 Overview

The purpose of the terrestrial ecology surveys conducted at the Canonsburg, Burrell, and Hanover sites was to perform qualitative observations for use in developing a general description of their ecological resources. Observations were to be made for the following reasons:

1. To determine the site habitats and their associated wildlife.

2. To identify any unusual ecological features of the site (as a whole, or in part) with respect to the surrounding area.

3. To provide input to determining the need for further quantitative ecological studies.

Because of its small size, the entire Canonsburg site was traversed during the survey. The Burrell and Hanover sites, being larger (about 50 acres each), were surveyed by selecting key areas and representative zones for study.

An overview of the Burrell site and its surrounding area was made from a chartered airplane on February 11, 1980. This reconnaissance provided an overall comparison between the site and its surroundings. It was also used to delineate major vegetation zones on the Burrell site, and to choose areas for ground-level investigation. The 1980 ground survey was performed by walking through representative transects of the site. A segment of the river bank and the complete pond perimeters were also traversed.

The Hanover site is an open property lacking the variation in features of the other sites. Therefore, the ecological survey was based on a walk-through of random sectors.

These surveys concentrated on the following activities:

1. Identifying tree species.

2. Identifying the major herbaceous and brush species.

3. Estimating the vegetative zones over the site--their relative size and location.

4. Identifying any unique or unusual vegetation with respect to the general area.

5. Determining the habitat types on the site and identifying the animals associated with them.

All of the major vegetation types encountered during the walk-throughs were identified in the field, and their relative abundance and location were noted. (Numerous photographs were also taken to document site conditions.) In addition, physical conditions were noted which might affect the site's ecology.

Wildlife information was also obtained through careful site observation. The major impetus was placed on noting the indirect signs of habitation (e.g., tracks, droppings, burrows, nests, trails, runways, etc.). During the checks of the Canonsburg and Burrell sites, key areas were traversed to verify the earlier observations and note any changes.

E.1.2 Observations

E.1.2.1 Canonsburg site

Mature woodland trees line the bank of Chartiers Creek along Areas B and C and occur in the area between the rail line and George Street. These strip woodlands consist mainly of elm, box elder, cherry, hickory, and occasional willows. Common colonizing or early successional tree species such as quaking aspen, black locust, sumac, and cherry are found along the edge of these woodlands and along fences, with scattered individuals within the Canonsburg site.

Grasses and mosses are the dominant ground covers in Areas A, B, and C. Within the fenced section of Area A, broomsedge sparsely covers the tile field (to the north of Building 18), and another thick bunch grass is found along the fence. Outside the fence is a mowed lawn of crabgrass and native fescue.

The flat central potion of Area B (the dredge fill) is sparsely covered with various tall grasses and dense patches of clover, while its slopes are thickly covered with bunchgrass. (Bulrush also occurs in water lenses on top of the dredge fill area and seeps on the side slopes.) Runoff ditches along the roadways (mainly along the perimeters of Areas A and B) are choked with cattail and bulrush, where water stands and sediment from the building area is accumulating.

The ballfield, Area C, has a sparse cover of grasses, asters, and goldenrod. The availability of soil moisture appears to be very low in the foot-deep surface layer of red dog which covers the entire ballfield. An examination of soil test pits in the area indicate that grass roots do not penetrate this red-dog layer. Premature wilting and burning was observed throughout the field, particularly in the old "infield" in early summer (possibly from a moisture deficit). A pervasive layer of mosses may provide the major moisture retention in this area.

Although the ballfield (in Area C) has been inactive for some time, definite patterns remain in the ground cover. Round bare areas of red dog occur in the infield and a distinct area of short grasses extends from the fence gate opening into the field and curves toward left field. A bare strip of red dog nearly devoid of vegetation extends from home plate along the third base line into left field. This strip, from 3 to 8 feet wide, has radioactivity levels consistently above background, with one of the highest surface levels of activity within the study area (15,000 counts per second) occurring on third base. The vegetation patterns may well be a result of various species' success on variable depths and consistencies of the red-dog fill. These patterns may also be remnants of fill placement, research investigations, or ballfield maintenance activities. (A map of the Canonsburg site's vegetation zones is shown on Figure E.1-1. Table E.1-1 gives a listing of the plant species growing on the Canonsburg site.)

Although Areas A, B, and C all have relatively sparse vegetative cover because of poor growth on cinders, dredge spoils, and red dog, each area is ringed by a less-disturbed fringe area of good vegetative cover along fence lines, ditches, and spoil area slopes. Overall these areas provide suitable habitat for significant small mammal populations. Runways were observed in all areas, particularly along fringe sectors. Kestrels were observed successfully hunting in all three areas.

More heavily vegetated fringe or edge areas surrounding the field areas provide habitat for rabbits and groundhogs whose burrows were only observed along the relatively undisturbed slopes of the creek, the intermittent stream (B4), and the fence line of Area A. Rabbit trails and feeding areas were common throughout all areas.

Edge areas and woodlands provide suitable habitat for a variety of passerine birds. In addition to kestrels already mentioned, screech owls and redtail hawks probably hunt in the Canonsburg site area at times. A few old trees along the creek may even be used for nesting, as well as for raccoon and squirrel dens.

According to the local game warden, muskrats are commonly associated with Chartiers Creek and its tributaries. Migrating waterfowl utilize Chartiers Creek to a minor extent during spring and fall. Mallards and wood ducks were observed on the creek immediately upstream of the site in the fall. Green herons were occasionally observed along the creek in the area, and it is likely that great blue herons also use the creek near the site.

A general list of wildlife common to the Canonsburg site region is given in Table E.1-2.

All areas of natural vegetation have some value as wildlife habitat. Chartiers Creek and its riparian woodlands have the greatest value for wildlife of the Canonsburg site's habitats, mainly due to their unique nature in an urban setting. Although every small habitat area which contributes to the support of wildlife has some value, perhaps the greatest value of Canonsburg site habitats may be seen in their use as undeveloped or potential urban parkland. If the well-worn trails along Chartiers Creek and through field areas are any indication, the area is heavily visited by local residents. However, no organized hunting or other recreational activity is known to occur in or near the Canonsburg site area.

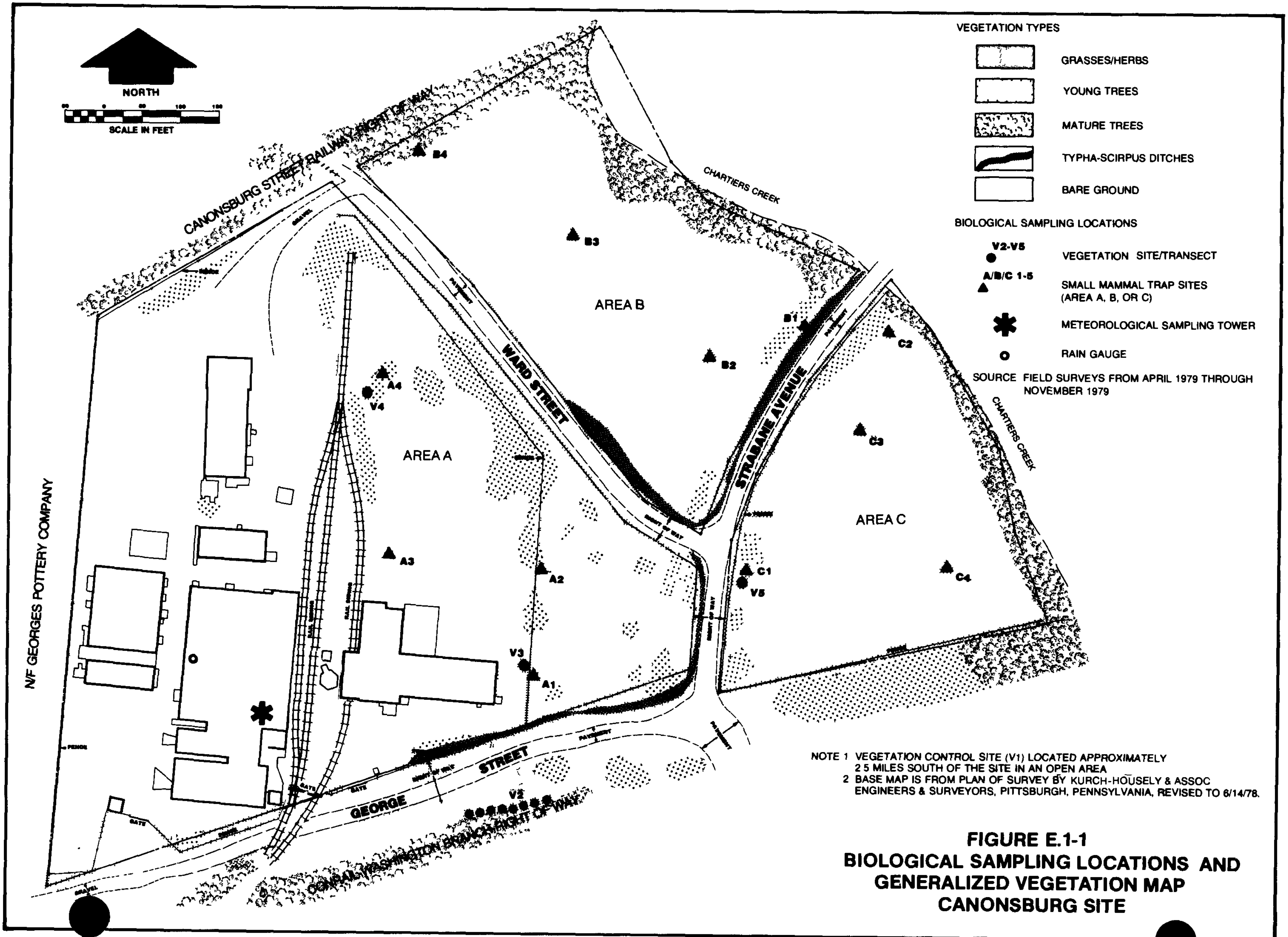


FIGURE E.1-1
BIOLOGICAL SAMPLING LOCATIONS AND GENERALIZED VEGETATION MAP CANONSBURG SITE

Table E.1-1. Plants of the three project sites

Scientific Name	Common name
Canonsburg site	
Ulmus americana	American elm
Prunus sp	Cherry
Acer negundo	Box elder
Carya sp	Hickory
Salix sp	Willow
Populus tremuloides	Quaking aspen
Robina pseudoacacia	Black locust
Rhus sp	Sumac
Typha latifolia	Cattail
Scirpus validus	Bulrush
Andropogon virginicus	Broomsedge
Trifolium sp	Clover
Aster sp	Aster
Solidago sp	Goldenrod
Dipsacus sylvestris	Teasel
Gramineae	Grasses
Burrell site	
Platanus occidentalis	Sycamore
Populus tremuloides	Quaking aspen
Betula sp	Birches
Robina pseudoacacia	Black locust
Crataegus	Hawthorne
Quercus sp	Oaks
Carya sp	Hickory
Rhus sp	Sumac
Dipsacus sylvestris	Teasel
Arctium minus	Burdock
Verbascum thapsus	Common mullein
Phragmites communis	Reed grass
Daucus carota	Queen Anne's lace
Gramineae	Grasses
Hanover site	
Trifolium sp	Clover
Gramineae	Grasses
(Near the site)	
Quercus sp	Oaks
Coniferae	Conifers
Populus sp	Aspen
Carya sp	Hickory
Acer sp	Maple
Rhus sp	Sumac
Betula sp	Birch

Table E.1-2. Wildlife common to the region of the three sites

Scientific Name	Common name
Mammals	
Didelphis marsupialis	Opossum
Blarina brevicauda	Shorttail shrew
Scalopus aquaticus	Eastern mole
Peromyscus leucopus	White-footed mouse
Microtus Pennsylvanicus	Meadow vole
Procyon lotor	Raccoon
Mustela rixosa	Least weasel
Mustela frenata	Longtail weasel
Mustela vison	Mink
Mephitis mephitis	Striped skunk
Vulpes fulva	Red fox
Urocyon cinereoargenteus	Gray fox
Marmota monax	Woodchuck
Tamias striatus	Chipmunk
Sciurus carolinensis	Eastern gray squirrel
Sciurus niger	Eastern fox squirrel
Ondatra zibethica	Muskrat
Sylvilagus floridanus	Eastern cottontail
Odocoileus virginianus	Whitetail deer
Waterfowl	
Gavia immer	Common loon
Podilymbus podiceps	Pied-billed grebe
Olor columbianus	Whistling swan
Branta canadensis	Canada goose
Anas platyrhynchos	Mallard
Aix sponsa	Wood duck
Lophodytes cucullatus	Hooded merganser
Ardea herodias	Great blue heron
Butorides striatus	Green heron
Raptors	
Accipiter gentilis	Goshawk
Accipiter cooperii	Cooper's hawk
Buteo jamaicensis	Red-tailed hawk
Falco sparverius	American kestrel
Otus asio	Screech owl
Bubo virginianus	Great horned owl
Tyto alba	Barn owl

E.1.2.2 Burrell site

From the air the Burrell site appeared to be a flat, grassy plateau with a thin fringe of intermediate-sized trees along its perimeters. The river bend containing the Burrell site resembled the other river bends in the area, and was distinguishable only by the presence of the steep-banked ponds in its western region.

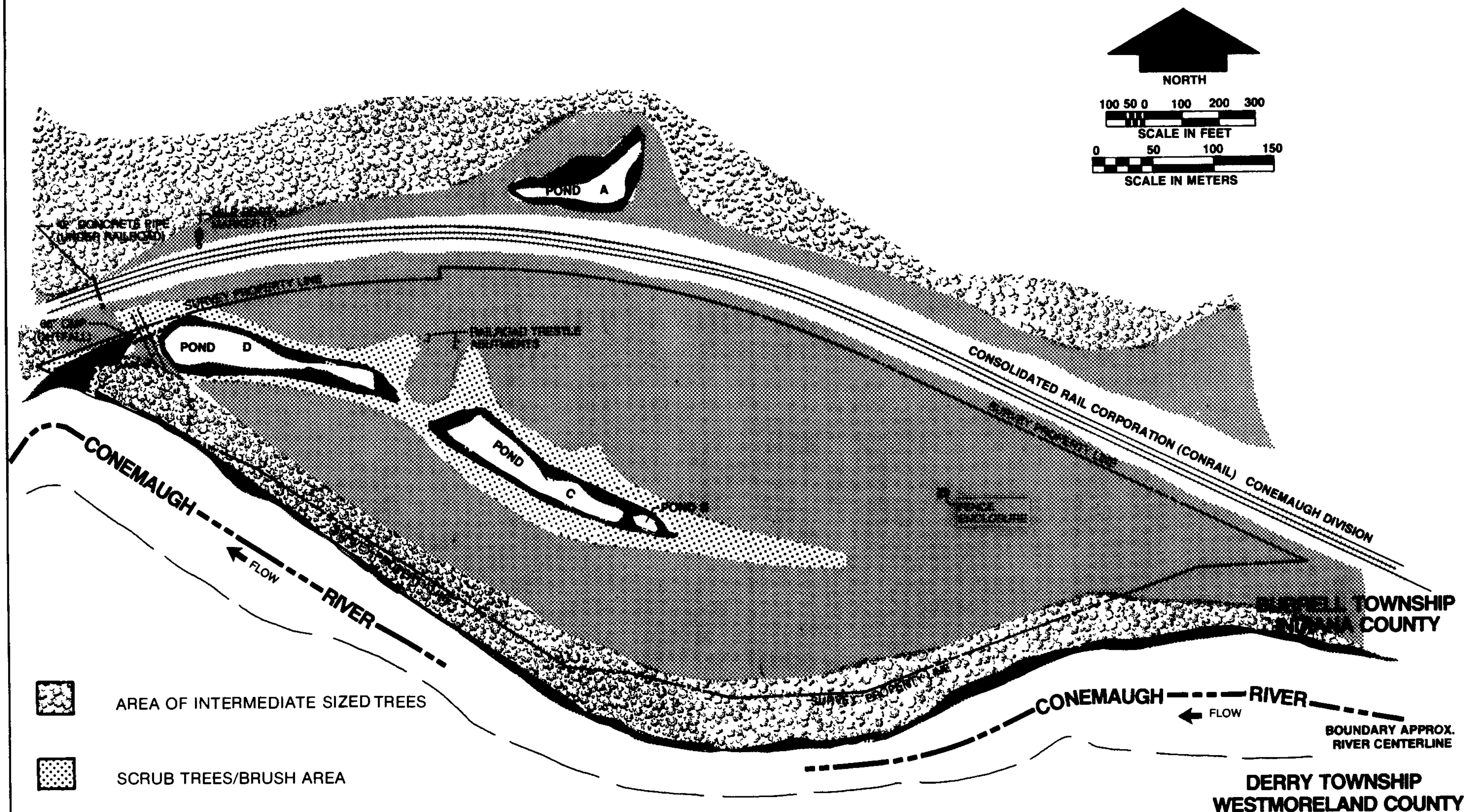
At ground-level, the Burrell site's substrate is clearly its most outstanding feature. Apparently the entire Burrell site is a plateau of railroad ties. The presence of exposed ties along the steep river and pond banks suggests that they may be present to a considerable depth. Many stretches of the Burrell site consist solely of ties with little to no soil material present. There are also small irregular subsidence areas where the ties appear to have settled.

Except for the rail corridor running along its northern perimeter, the entire Burrell site is vegetated (see Figure E.1-2). The majority of its cover consists of grasses and other herbaceous plants, such as: teasel, burdock, goldenrod, common mullein, multiflora, raspberry, and Queen Anne's lace (Table E.1-1). Trees present on the Burrell site are generally early-successional types: sycamore, hawthorn, birches, maples, quaking aspen, locust, and sumacs. The only stands of trees occur along the river bank and along the bluff to the north of the raillines, forming a fringe along the perimeters. Taller trees in the bluff area also include some oaks and hickories.

The steep-banked pond areas contain often dense patches of brushy vegetation (mainly sumacs and multiflora and hawthorn); however, it is questionable whether the bank area could support significant tree growth because of its loose railroad tie composition. Individual trees, roughly 15 years old, occur irregularly throughout the Burrell site. The age of these trees, and the fact that they are early colonizing species that typically grow in stands, suggests that vegetative succession is being inhibited at the Burrell site. It may be that tree growth over the majority of the Burrell site area is being limited by the presence of the railroad ties and the subsequent lack of a stable soil substrate. Wet areas in the vicinity of the ponds and along the river bank also contain stands of reed grass.

The overall Burrell site is best characterized as an old field habitat. It is too open, even along the river bank, to support true forest dwellers. The dominant wildlife supported at the Burrell site appears to be burrowing and den-dwelling animals. The irregularity of the landfill material is well suited for this use, as evidenced by many den openings and well-worn runs and paths traversing the site. Signs (droppings and tracks) of rabbits, opossum, mice, voles, shrews, and woodchucks were observed during the surveys. The carcass of a red fox was also encountered in February 1980.

Areas of loose landfill material (especially piles of railroad ties, rocks, and scrap metal) also provide suitable habitat for snakes. Black rat snakes and several types of garter snakes were observed at the Burrell site.



AREA OF INTERMEDIATE SIZED TREES

SCRUB TREES/BRUSH AREA

AREA OF HERBACEOUS COVER WITH INTERSPERSED TREES

WET VEGETATION AREA

SOURCE: FIELD SURVEY 2/21/80 AND AERIAL PHOTOGRAPHS

NOTE 1 PROPERTY LINE DATA FROM PLAN OF PROPERTY FOR ... CARBIDE CORP, BY RICHARD G BACH & ASSOC, ...OPLE, PA-DATED 11/16/77

FIGURE E.1-2
GENERALIZED VEGETATION TYPE MAP
BURRELL TOWNSHIP SITE

The Burrell site serves as a hunting area for a variety of carnivorous animals such as foxes and kestrels, which have been observed at the site.

Although the Burrell site's trees do not appear to be well-suited for nesting raptors, many are used as nest sites for a variety of passerines typical of old-field habitats. Sparrows, finches, blackbirds, cardinals, and woodpeckers were observed at the site during the surveys. During the February survey, the presence of a large number of their nests was noted.

Although the Burrell site does not support forest dwellers, there is evidence, in the form of droppings and worn paths, that deer regularly pass through the Burrell site.

The only standing water occurs in the three steep-banked ponds. These were not sampled during any of the ecology surveys. The pond north of the raillines contains a large amount of roofing shingles and automobile tires, and the western-most pond is covered with an oily sheen and contains red staining on the bottom. Based on the observed conditions of these ponds, their value as aquatic habitat is questionable.

The river valley in this area is in open use, much of it being wooded. The Burrell site's open condition is not unusual for the area, and its plant and animal species are common to the area. No unusual species or habitats were encountered that would necessitate further quantitative study. The Burrell site region supports the same type of animal species as the Canonsburg site (Table E.1-2).

E.1.2.3 Hanover site

The most outstanding feature of the Hanover site is its rocky substrate. This appears to have limited vegetative growth over the entire Hanover site area, while some of the steeper slopes have bare rocky areas. Outside the Hanover site there are steep hill areas that have not been strip-mined like the site. These areas contain wooded growth that includes oaks, conifers, hickories, maples, and aspen, with sumacs and birches along their perimeters (Table E.1-1). The Hanover site does not contain any trees. Its major vegetation consists of clover and bunch grasses. Dense stands of cattails grow within the wet drainage areas.

The Hanover site represents an old field habitat. It supports a variety of small mammals, such as mice, voles, shrews, and rabbits. Since there are no trees on the Hanover site, den- or tree-nesting animals were not observed at the site. The Hanover site is included in the range of larger, woodland-dwelling animals. Deer were observed on the Hanover site and it is likely that raptors and other carnivores hunt on the site. The Hanover site is contained within the same regional area as the Canonsburg site. Therefore, the general area contains similar animal species.

Appendix E.2

AQUATIC BIOLOGY SURVEY OF CHARTIERS CREEK

Appendix E.2

AQUATIC BIOLOGY SURVEY OF CHARTIERS CREEK

E.2.1 Purpose

Two surveys were conducted to assess the general condition of the biota in Chartiers Creek near the expanded Canonsburg site. The purpose of the surveys was to describe the biota of the creek in order to predict what effects remedial actions at the Canonsburg site would have on stream life. The first survey was conducted on April 3, 1979, and the second on July 25, 1979.

E.2.2 Methods

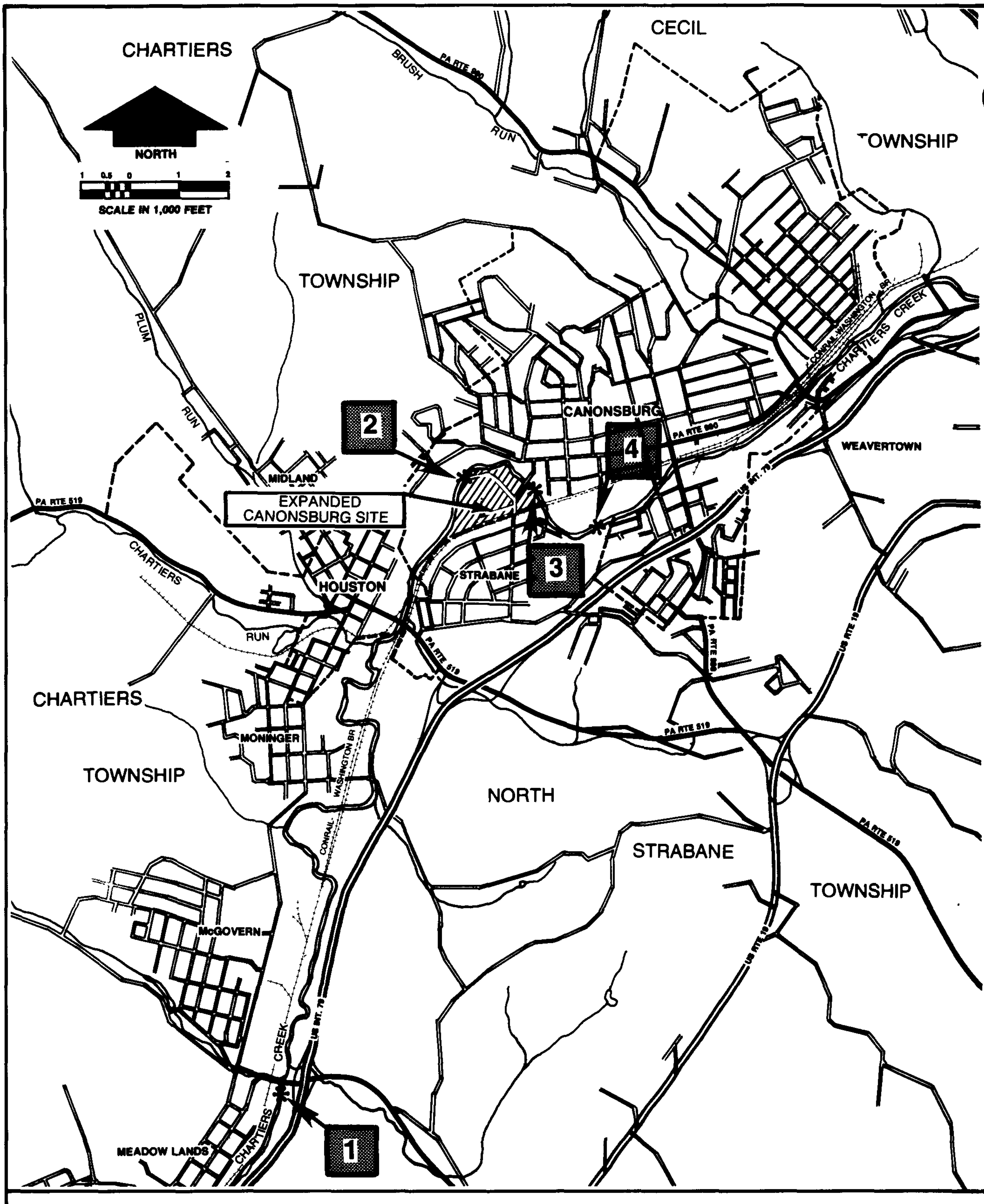
Four sampling stations were established (Figure E.2-1) in Chartiers Creek. Station 1 was located well upstream of the expanded Canonsburg site, and was designed to serve as a reference. Stations 2 and 3 were located along the expanded Canonsburg site, above and below the small ditch draining the expanded Canonsburg site. This ditch empties into Chartiers Creek at the Strabane Avenue bridge. Station 4 was located in the channelized portion of Chartiers Creek, approximately 400 meters downstream from the railroad bridge.

A Smith-Root Type VII backpack electroshocker, and a beach seine were used for fish sampling, while macrofauna were sampled by kicknet. The suitability of the electroshocker for stream conditions was determined by performing preliminary water-quality measurements. These water conditions are given in Table E.2-1. The conductivities measured in April were 420 to 440 micromhos, using the equipment's optimum range (20 to 1000 micromhos). The measurements in July (1080-1200 micromhos), although high, can still be expected to provide accurate results.

E.2.3 Physical conditions

Table E.2-2 presents a description of the physical nature of each station. In general, Chartiers Creek flows over shale bedrock overlain by a thin layer of rubble and silt, and is characterized by a steep gradient. This gradient results in swift currents and numerous riffles. Undercut banks and snags are common. The banks tend to be muddy, but the mud extends less than 1 meter into the stream, where it is replaced by the rocky substratum.

Station 1 yielded large numbers of oligochaetes and chironomids in April, but no other species. In July, the kicknet samples contained numerous oligochaetes and nematodes, as well as a snail. Few chironomids were noted, probably reflecting adult emergence between April and July. Extensive growths



AQUATIC BIOLOGY—SAMPLING SITES —APRIL AND JULY 1979

FIGURE E.2-1
LOCATION OF THE AQUATIC BIOLOGY SURVEY SAMPLING SITES ON CHARTIERS CREEK IN THE VICINITY OF THE EXPANDED CANONSBURG SITE

Table E.2-1. Water-quality parameters in Chartiers Creek associated with the biological sampling efforts (1979)

Station	Temperature (°C)		Specific conductance (micromhos)		pH (units)		Dissolved oxygen (mg/l)	
	April	July	April	July	April	July	April	July
1	4.7	21.8	420	1200	7.6	---	---	3.9
2	4.6	22.7	420	1080	7.8	---	---	4.5
3	4.7	22.8	420	1100	7.8	---	---	4.6
4	4.9	23.5	440	1160	7.5	---	---	7.4

Source: Weston (1979) field data.

of aquatic vegetation contained large numbers of snails. No fish were captured by either seining or electrofishing, although local inhabitants claimed that carp are occasionally caught near Station 1.

Station 2 was dominated by oligochaetes and chironomids in April, with a few leeches. In July, the chironomids were uncommon, leeches and snails were dominant, and oligochaetes were subdominant. The kicknet samples in July also contained a small dead crayfish, a dead isopod, and a water beetle. Numerous crayfish holes were present in the bank. No fish were captured in an electrofishing effort, which extended from Station 2 to the waterfall at the railroad bridge.

Station 3 was characterized by numerous leeches and chironomids in April. Oligochaetes were rare. One physid snail and one juvenile crayfish were noted. In July, oligochaetes were common, as were leeches and snails. Chironomid larvae were rarely observed, but pupae were observed. One crayfish (2.5 cm long) was captured.

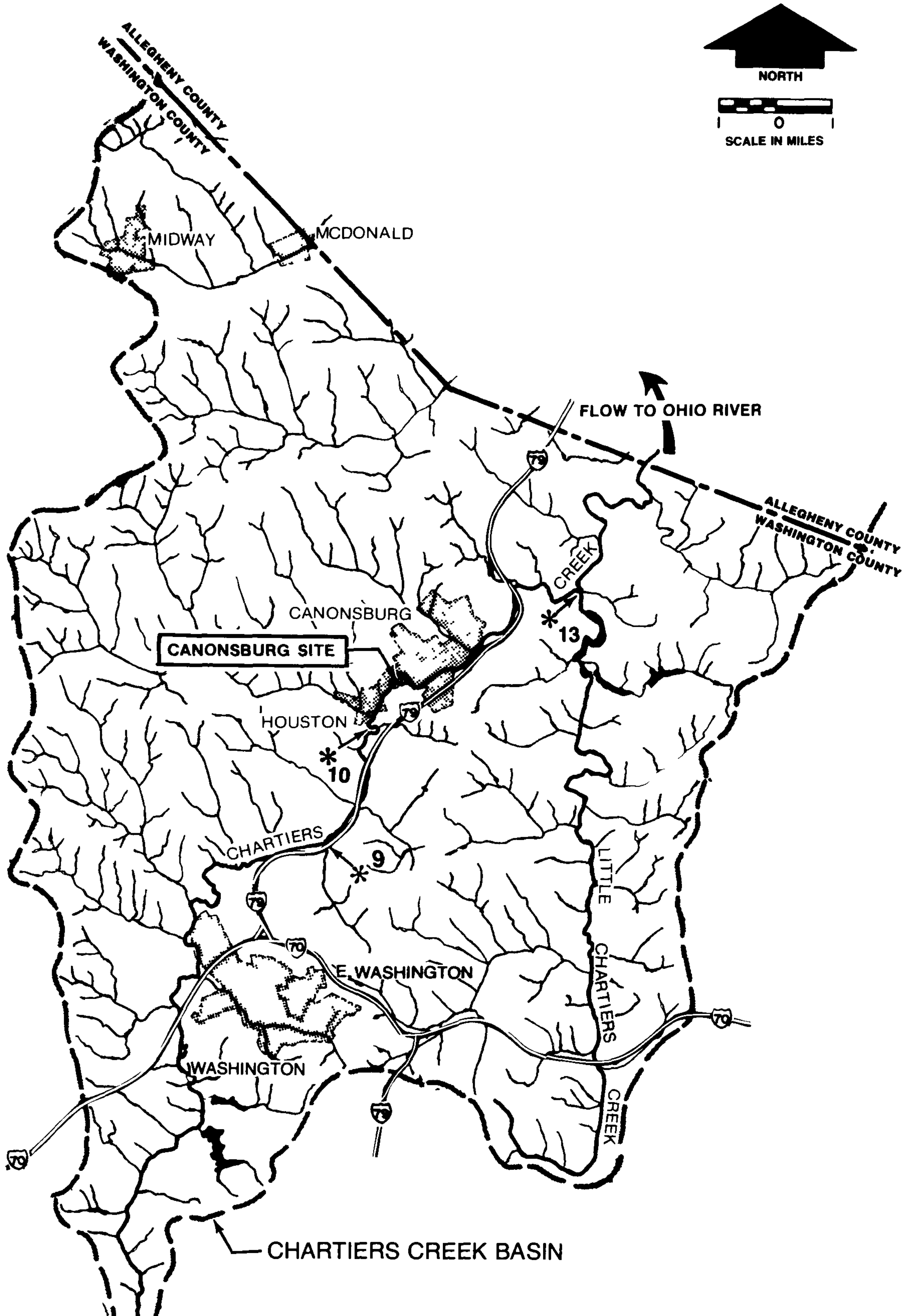
In April, the fauna at Station 4 consisted of chironomids and oligochaetes with occasional leeches, and appeared to be sparse in numbers. In July, however, the samples contained numerous snails, oligochaetes and chironomid larvae and pupae. Leeches and an isopod were also present, as well as a dead crayfish.

These results suggest that the stream reach under study is in a zone of recovery from the input of sewage. Dissolved oxygen and species diversity both increase in a downstream direction, indicating a gradual improvement in conditions. Although no fish were captured during this study, their presence was evident, and local fishermen are known to have caught carp in the study reach. The physical nature of the habitat is good; it is likely that the very poor water quality is the principal limiting factor to fish.

E.2.4 Additional aquatic information

As an additional source of aquatic information on Chartiers Creek, Weston drew upon a field study performed by Gary Kreamer (1978).

"Between sites 9 and 10 (Figure E.2-2), Chartiers Creek flows through light residential and commercial areas and receives iodide compounds, oil, fluoride, and acid rinse water in effluents from local industries. Oily films, milky-colored films, and brownish scums are extensive on the water surface. A wide, rapid riffle, bottomed with boulders, and rubble, grades upstream to a shallower riffle of moderate current and a rubble-gravel substrate. Above the riffles, a long pool section of mostly bedrock overlain with some rubble, gravel and silt (especially at the sides), follows a short pool section of silted flat rubble and gravel. Pools are mostly of moderate flow, and uniform in depth with some small eddies, and shelter in the form of debris and overhanging vegetation. The shade is fair in the riffles, which



MAJOR STREAM AND/OR BRANCH

TRIBUTARY STREAM

* FISH SAMPLING SITE/NUMBER

SOURCE KREAMER 1973

FIGURE E.2-2
LOCATION OF FISH SAMPLING SITES
CHARTIERS CREEK BASIN
WASHINGTON COUNTY, PENNSYLVANIA

Table E.2-2. Physical conditions at aquatic sampling stations (April and July 1979)

Station	Substratum	Banks	Shade	Aquatic vegetation
1	Shale bedrock covered with periphyton and cobbles; silt in the interstices.	Muddy and low.	None--banks covered with grass and bushes.	Numerous attached green algae and *Sphaerotilus* in April; abundant algae in July.
2	Boulders and cobbles covered with periphyton; silt in interstices.	Steep, undercut; trash dumped along banks.	Moderately shaded by trees.	Sparse attached green algae and *Sphaerotilus* in April; abundant algae in July.
3	Shale bedrock covered with cobbles; periphyton abundant; silt in interstices.	Steep, undercut.	Well shaded by trees.	Sparse attached green algae in April; moderately-abundant in July.
4	Shale bedrock; areas of cobbles and gravel; periphyton abundant.	Steep, riprapped.	None.	Very sparse--attached green algae in April; abundant algae in July.

Source: Weston (1979) field data.

Table E.2-3. Fish collected at sites on Chartiers Creek

Scientific name	Common name	Stream order 4 / Site number 10	Stream order 4 / Site number 13
Semotilus atromaculatus	Creek chub	0	1
Catostomus commersoni	White sucker	0	17
Notropis chrysocephalus	Striped shiner	0	
Cyprinus carpio	Carp	0	6
Total individuals		0	24
Total species		0	3
Diversity		0	1.04

Source: Kreamer (1978).

are banked by fairly steep, wooded hills. The pool areas sampled (except below a bridge), were more exposed to the sun with low and grassy banks. No fish were collected at site 10 (Table E.2-3).

"Site 13 is the farthest downstream on Chartiers Creek. Between sites 10 and 13 the waters of Chartiers Creek have been greatly altered by channelization as the stream passes through the highly developed towns of Houston and Canonsburg. Within this section, Chartiers Creek receives substantial amounts of mine drainage, particularly from Chartiers Run, and a large outflow from an inactive deep mine near the Fort Pitt Bridge Works in Canonsburg (Table E.2-4). Numerous industrial discharges also enter the stream in this area, containing crude oil, brine, cooling water, clays, silage wastes, and potato wastes (WCPC, 1973). Within the 7-mile reach separating sites 10 and 13, the waters of Chartiers Creek become very turbid, in addition to increasing substantially in flow.

"Site 13 is located about 100-yards downstream from the Hahn Portal of Montour Mine No. 4, and about a half-mile downstream from a primary sewage treatment plant that services the Canonsburg area. Decomposing organic matter is quite evident on the surface of the extemely turbid water. The stream is mostly moderately flowing, with wide (65 feet) pools of fairly uniform depth (16 to 34 inches). Substratum in the pools is mostly rubble and gravel with some exposed bedrock. Still eddies to the sides of the pool areas, laden with organic-rich sediments, reach a depth of 2 feet and contain some logs and debris. Shelter, however, is generally poor, and deep lurking areas are scarce. A wide riffle flows rapidly over bedrock, boulders, and rubble within the study area. Stream banks are well vegetated with deciduous trees and brush. Fish were collected in the waters of Chartiers Creek at site 13, including several large carp in the moderate pools and young white suckers and creek chubs that inhabited only the still organic-rich eddies at the pool margins."

Table E.2-4. Physical/chemical data for sites on Chartiers Creek

Parameter	Site number 10	13
Nitrates (ppm)	53	48
Sulfates (ppm)	195	260
Iron (ppm)	0.8	4.0
Chlorides (ppm)	87	81
Specific conductance (μmhos/cm)	835	750
pH	7.6	7.4
M.O. (alkalinity) (ppm)	171	188
Hardness (ppm)	325	325
Flow volume (cfs)	78	137
Stream gradient (feet/mile)	13	6
Substrate composition (%)		
Bedrock	40	5
Boulders	10	15
Rubble	25	45
Gravel	15	15
Sand	0	5
Silt	10	10
Clay	0	0
Muck	0	0
Pool-riffle ratio	3	2
Riffle habitats		
Maximum width (ft)	55	65
Average depth (in.)	9	14
Maximum depth (in.)	14	20
Maximum length (ft)	60	80
Siltation	1	1
Pool habitats		
Maximum width (ft)	50	65
Average depth (in.)	20	18
Maximum depth (in.)	33	34
Maximum length (ft)	100	100
Siltation	2	2
Flow rate (%)		
Rapid	25	20
Moderate--riffle	20	30
Moderate-- pool	50	40
Sluggish	5	10

Source: Kreamer (1978).

Appendix E.3

CORRESPONDENCE ON THREATENED OR ENDANGERED SPECIES

Appendix E.3

ENDANGERED SPECIES

Both state and Federal agencies were asked to review the three site areas for the presence of endangered or threatened species, unusual habitats or areas of special concern. In each case, none of these species or habitats were discovered. The accompanying letters document the agencies' findings.

COMMONWEALTH OF PENNSYLVANIA

PENNSYLVANIA GAME COMMISSION

P. O. BOX 1567
HARRISBURG, PENNSYLVANIA 17120

ADMINISTRATIVE DIVISIONS

ACCOUNTING	787 - 4492
ADMINISTRATION	787 - 5670
LICENSE SECTION	- 2084
PERSONNEL	7836
GAME MANAGEMENT	- 5529
	787 - 6711
INFORMATION & EDUCATION	787 - 6286
LAW ENFORCEMENT	787 - 5743
LAND MANAGEMENT	787 - 6818
REAL ESTATE	787 - 6568

August 11, 1982

Mr. Michael V. Mellinger, PhD
Project Manager
Weston Consultants
Weston Way
West Chester, PA 19380

In re: Borough of Canonsburg,
Cleanup of Landfill Site

Dear Mr. Mellinger:

Thank you for forwarding the above referenced information to our office for review and comment.

We have made a determination that this project will not affect the habitat of any Federally listed threatened or endangered wildlife species under our jurisdiction.

We appreciate the opportunity to comment on proposed projects during the developmental stages, and to provide technical assistance as available.

If we can be of further assistance, please contact this office.

Very truly yours,

Jacob I. Sitlinger, Chief
Division of Land Management

COMMONWEALTH OF PENNSYLVANIA

PENNSYLVANIA GAME COMMISSION

P. O. BOX 1567
HARRISBURG, PENNSYLVANIA 17120

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	787 6711
INFORMATION & EDUCATION	787 6286
LAW ENFORCEMENT	787 5743
LAND MANAGEMENT	787 6818
REAL ESTATE	787 6568

July 21, 1982

Mr. Michael V. Mellinger, PhD
Project Manager
Weston Consultants
Weston Way
West Chester, PA 19380

In re: Proposed Sites - Hanover Township, Washington County, Burrell Township, Indiana County

Dear Mr. Mellinger:

This is in response to your above referenced requests for information.

A field assessment team from our Southwest Division office has recently reviewed this project and made a determination that the proposed project would not affect any Federally listed, endangered or threatened wildlife species under our jurisdiction. A determination was also made that this project would not affect any critical or unique habitat of special concern to the Pennsylvania Game Commission.

If you have any further questions, please contact this office.

Very truly yours,

Jacob I. Sitlinger, Chief
Division of Land Management

814-359-2754

COMMONWEALTH OF PENNSYLVANIA
PENNSYLVANIA FISH COMMISSION
Bureau of Fisheries and Engineering
Robinson Lane
Bellefonte, PA 16823

August 10, 1982

Mr. Michael V. Mellinger
Roy F. Weston, Inc.
Weston Way
West Chester, PA 19380

Dear Mr. Mellinger:

I have examined the maps depicting the uranium mill tailings site in Canonsburg, Washington County, and the two proposed disposal sites in Hanover Township, Washington County, and Burrell Township, Indiana County.

None of the fishes, amphibians or reptiles listed by us as endangered or threatened are presently known to occur at or in the vicinity of these sites. The only federally listed fish, amphibian or reptile species recorded from Pennsylvania are the shortnose sturgeon (Delaware River only), blue pike, and longjaw cisco. The latter two species were listed for the Great Lakes only, and have been proposed for deregulation by the Fish and Wildlife Service due to probable extinction (F.R. Vol 47, No. 101, May 25, 1982).

If you require additional information about endangered or threatened species under our jurisdiction, please do not hesitate to contact this office.

Sincerely,

Clark N. Shiffer

Clark N. Shiffer
Herpetology and Endangered
Species Coordinator

jb
Enclosure
cc: R. Snyder

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
Post Office Box 1467
Harrisburg, Pennsylvania 17120
August 25, 1982

(717) 787-3444

In reply refer to
RM-F FAS
Bureau of Forestry

Michael V. Mellinger, Ph.D.
Project Manager
Weston Consultants
Weston Way
West Chester, PA 19380

Dear Dr. Mellinger:

The Bureau of Forestry knows of no endangered plant species at, or near, the proposed disposal areas at Canonsburg, Hanover Township and Burrell Township. There is no State Forest Land near these areas.

You should contact the Pennsylvania Game Commission concerning endangered mammals and birds and the proximity of State Game Lands to these sites. Contact the Pennsylvania Fish Commission concerning endangered fish where the site is near water.

Sincerely,

Malcolm D. Waskiewicz

MALCOLM D. WASKIEWICZ
Assistant forest Resource Planner

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Suite 322
315 South Allen Street
State College, PA 16801

October 20, 1982

Mr. David Lechel
Manager, Environmental Services
Jacobs Engineering Group Inc.
5301 Central Avenue N.E.
Suite 1700
Albuquerque, NM 87108

Dear Mr. Lechel:

This is in response to your letter of October 4, 1982, requesting information on the presence of federally listed or proposed endangered and threatened species, within the impact area of the Department of Energy Uranium Mill Tailings Remedial Action Project at the former processing site in the borough of Cannonsburg, Washington County; the former disposal site in Burrell Township, Indiana County; and a potential disposal site in Hanover Township, Washington County, Pennsylvania.

Except for occasional transient species, no federally listed or proposed threatened or endangered species under our jurisdiction are known to exist in the impact area of the proposed projects. Therefore, no Biological Assessment or further Section 7 consultation under the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.) is required with the Fish and Wildlife Service (FWS). Should project plans change, or if additional information on listed or proposed species becomes available, this determination may be reconsidered. A compilation of federally listed endangered and threatened species in Pennsylvania is enclosed for your information.

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.

Sincerely,

Edward Perry

Edward W. Perry
Acting Field Supervisor

Enclosure

FEDERALLY LISTED ENDANGERED AND THREATENED SPECIES IN PENNSYLVANIA

Common Name	Scientific Name	Status	Distribution
FISHES:			
Cisco longjaw	*Coregonus alpenae*	E	Lake Erie - probably extinct
Pike, blue	*Stizostedion vitreum glaucum*	E	Deep water of Lake Erie - probably extinct
Sturgeon, shortnose*	*Acipenser brevirostrum*	E	Delaware River and other Atlantic coastal rivers
REPTILES:			
NONE			
BIRDS:			
Eagle, bald	*Haliaeetus leucocephalus*	E	Entire state
Falcon, American peregrine	*Falco peregrinus anatum*	E	Entire state - re-establishment to former breeding range in progress
Falcon, Arctic peregrine	*Falco peregrinus tundrius*	E	Entire state migratory - no nesting
Warbler, Kirtland's	*Dendroica kirtlandii*	E	Entire state - occasional migrant
MAMMALS:			
Bat, Indiana	*Myotis sodalis*	E	Entire state
Cougar, eastern	*Felis concolor cougar*	E	Entire state - probably extinct
MOLLUSKS:			
NONE			
PLANTS:			
NONE			

* Principal responsibility for this species is vested with the National Marine Fisheries Service.

REFERENCES FOR APPENDIX E

Kreamer, G., 1978. "Factors Influencing the Distribution, Abundance, and Composition of Fishes in Several Small, Upland Streams of the Appalachian Plateau, Southwestern Pennsylvania," Master's thesis, Washington and Jefferson College, Washington, Pennsylvania.

Appendix F

RADIOLOGICAL INFORMATION

Appendix F.1

BASELINE RADIOLOGICAL INFORMATION

Table F.1-1. Comparison of radiological observations at the Canonsburg and Burrell sites with pertinent regulatory guidelines and standards

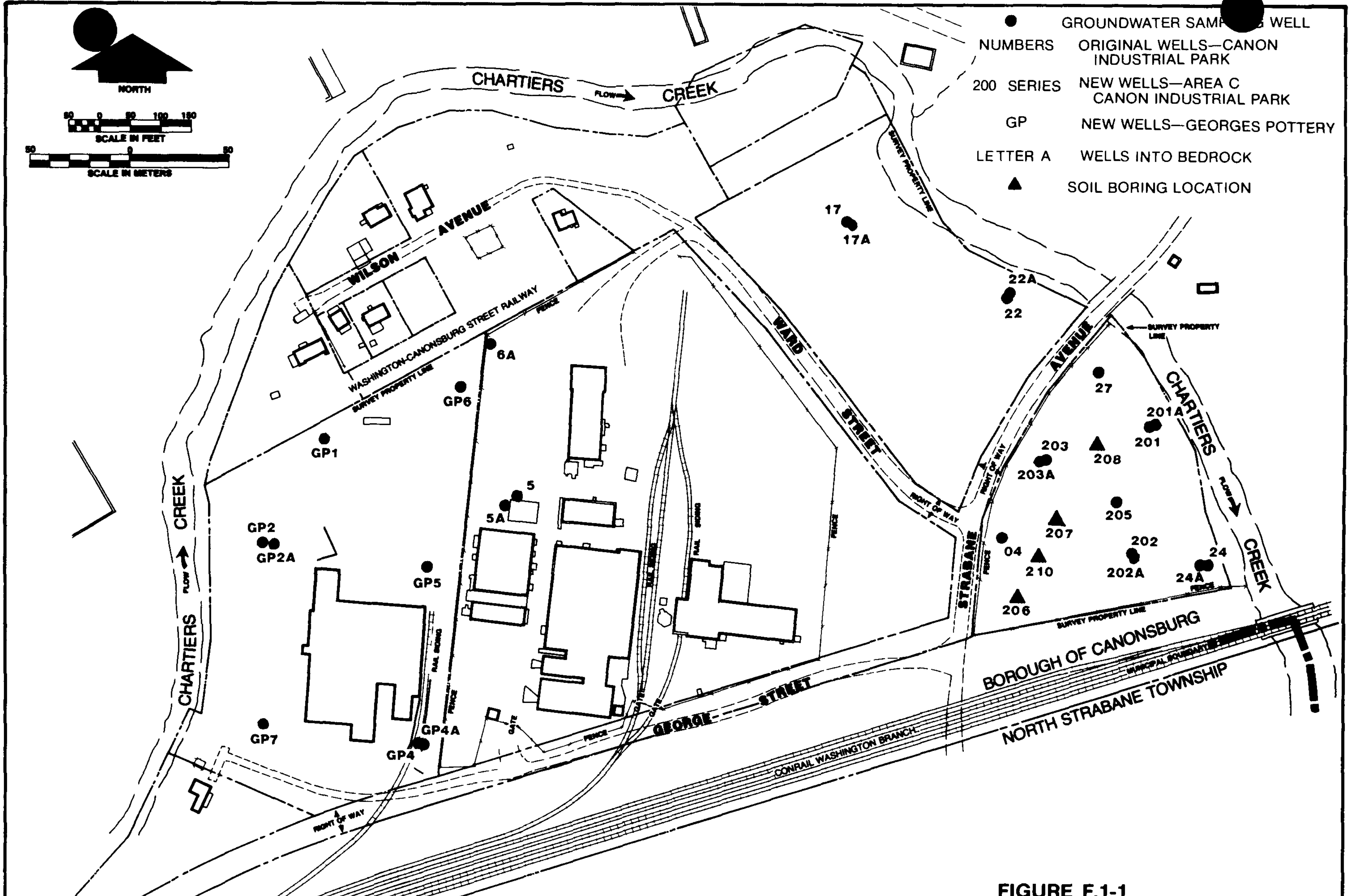
Pathway	Medium	Type of contamination	Standard or guideline	Source	Limit	Maximum value found at Canonsburg	Maximum value found at Burrell
Surface contamination	Building material	Gross alpha (from Ra-226)	Regulatory Guide 1.86, "Decontamination Guidelines for Facilities and Equipment"	USNRC, 1976	300 dpm/100 sq cm	40,000 dpm/100 sq cm	Not applicable
		Removable gross alpha (from Ra-226)			20 dpm/100 sq cm	400 dpm/100 sq cm	Not applicable
		Gross beta			0.2 mrad/hour at 1 cm	8.5 mrad/hour at 1 cm	Not applicable
External radiation	Not applicable	Not applicable	"Dose Limits to Public Individuals"	ICRP, 1971	500 mrem/year	4,000 mrem/year	1,260 mrem/year
			"Clean-up Criteria for Uranium Mill Sites"	USNRC, 1978	140 mrem/year		
			Regulatory Guide 1.86, "Decontamination Guidelines for Facilities and Equipment"	USNRC, 1976	0.2 mrad/hour	25 mrad/hour	5.4 mrad/hour
Air	Concentration within buildings	Rn-222	DOE 5480.1[a]	USDOE, 1981	3 pCi/l	300 pCi/l	2.65 pCi/l
		Pb-210			4×10^{-3} pCi/l	1.3×10^{-4} pCi/l	No data
		Ra-226			3×10^{-3} pCi/l	8.1×10^{-5} pCi/l	No data
		Th-230			8×10^{-5} pCi/l	2.1×10^{-4} pCi/l	No data
		U-238			3×10^{-3} pCi/l	3.5×10^{-4} pCi/l	No data
		Rn-222 + daughters	10 CFR 20	USNRC, 1960	0.033 WL	0.51 WL	0.001 WL
			40 CFR 192	USEPA, 1983	0.030 WL		

[a]Also 10 CFR 20, except for U-238.

Table F.1-1. Comparison of radiological observations at the Canonsburg and Burrell sites with pertinent regulatory guidelines and standards (continued)

Pathway	Medium	Type of contamination	Standard or guideline	Source	Limit	Maximum value found at Canonsburg	Maximum value found at Burrell
Ground water	Onsite	Ra-226 U-238	10 CFR 20	USNRC, 1960	30 pCi/l 40,000 pCi/l	4,500 pCi/l 14,380 pCi/l (U-235 + U-238)	
Soil	Floor drain sediments	U-238 Ra-226	10 CFR 40	USNRC, 1961	172 pCi/g	270 pCi/g 310 pCi/g	Not applicable Not applicable
	Surface onsite	U-238	46 FR 52061-52063 (October 23, 1981)	USNRC, 1981	200 pCi/g[a]	51,000 pCi/g	360 pCi/g
		Ra-226	40 CFR 192	USEPA, 1983	5 pCi/g	4,200 pCi/g	5,000 pCi/g
	Surface offsite	U-238	46 FR 52061-52063 (October 23, 1981)	USNRC, 1981	10 pCi/g	10 pCi/g	No data
		Ra-226	40 CFR 192	USEPA, 1983	5 pCi/g	3,100 pCi/g	No data

[a]Above this level, the site is to have access restricted.



NOTE THIS MAP IS BASED ON A SURVEY AND TOPOGRAPHY BY KURCH HOUSLEY & ASSOC PITTSBURGH PA DATED MARCH 1983 AND ON MAPS OF THE CHARTIERS CREEK BASIN PA BY THE US ARMY CORPS OF ENGINEERS PITTSBURGH PA DATED 6/3/73

FIGURE F.1-1
GROUNDWATER AND SUBSURFACE SOIL SAMPLING LOCATIONS USED FOR RADIOLOGICAL SURVEY EXPANDED CANONSBURG SITE

Table F.1-2. Radiological analysis of subsurface soil samples taken from the Canonsburg site

Sample location and depth (feet)	Sample (results in picocuries per gram (pCi/g)) Ra-226	U-234	U-235	U-238
203				
2-3	3,400	3,020	5.0	35.3
3.5-3.8	10,900	464	12	307
5.6-6.8	18,400	4,240	188	1,960
8.5-9.5	130	38.1	1.2	30.3
204				
5-6	2,260	1,090	19.5	267
11-12	21.4	4.8	0.13	3.91
13-14	38.7	10.3	0.33	10.3
205				
3.5-4	10,000	128	3.2	73.8
4.5	21,800	961	33	395
6	18,500	950	32	325
206				
4-6	8,480	186	5.1	119
6-7	3,790	406	7.9	3.37
16-17	39.6	8.79	0.33	8.66
207				
0-2	18,900	81.7	1.9	17.1
2-4	785	26.6	1.6	25.8
8-10	5,930	1,630	31	424
208				
2-4	12,000	628	19	470
4-6	7,850	125	3.6	91
6-8	7,220	282	3.3	209
210				
0-3	2,000	400	13.5	218
3.5-5.5	548	54	2.4	50.8
5.5-7.5	6,490	4,590	48	329
11.5-13.5	2,110	1,280	3.43	639

[a]Locations are shown on Figure F.1-1.
Source: Weston (1982) field data.

Table F.1-3. Radiological analysis of sediment samples taken from Chartiers Creek near the expanded Canonsburg site

Location	Nuclide (results in picocuries per gram-dry (pCi/g))								
	Th-230	U-235	U-238	Ra-226	Ac-228	Bi-214	Th-232	Cs-137	K-40
Upstream of site near railroad track	6.5	<0.26	<10	2.0	1.2	0.86	0.52	0.12	12
North of Wilson Avenue	8.3	<0.39	<5.9	1.9	0.98	0.76	0.17	0.11	11
Northeast corner of site	1.5	<0.37	<6.7	2.8	1.2	0.82	0.27	0.30	13

Source: Weston (1979) field data.

Table F.1-4. Concentrations of nuclides in ground-water samples taken from the expanded Canonsburg site and adjacent offsite properties

Nuclide (picocuries per liter (pCi/l))

Well location[a]	U-234 I[b]	U-234 II[c]	U-234 III[d]	U 235 (soluble) I	U 235 (soluble) II	U 235 (soluble) III	U 238 (soluble) I	U 238 (soluble) II	U 238 (soluble) III	Total uranium I	Total uranium II	Total uranium III	Ra 226 (soluble) I	Ra 226 (soluble) II	Ra 226 (soluble) III
5	[e]	--	--	380	--		8 161						4 500		
5A	--	7 5[f]	8 0	<25	--		11 3		8 3			16 2	66	<1[f]	1 0
6A	--	--	--	<13			8 8						37		
17	--		--	<28			450						75		
17A		--	--	<13			19 6						61		
22		--	--	<23			127 8					--	81		
22A	--		--	<11			9 1	--					34		
24	--			<12	--		440						39		
24A	--	--	--	<29		--	14 8		--				81		
27			--	<28			259 7						190		
201	117	--	--	4 2			119						1		
201A	5 5		4 2	0 15			2 54		1 9			6 1	2		2 4
202	146	--	--	5 8			142	--					54 9		
202A	5 13		3 3	0 18			4 11		3 7			7 0	25		25
203	2 66	--		0 13		--	2 87						178	--	
203A	4 21			0 20			3 30						3 77		
204	3 310	--	--	74			3 270	--					87 2		
205	3 780		4 240	97	--		3 950		4 300			8 540	518		670
301S	--	--	220						200			420			1 6
301R		3 66	1 9		<0 1			2 51	2 8			4 7		<1	10
302S		32 6	30 1		0 52			34	31 9			62		<1	2 2
302R	--	0 77	1 5		<0 02			0 41	1 2			2 7		<1	4 9
303S		6 5[f]	2 4		<0 1			3 34	2 2			4 6		<1[f]	4 0
303R		1 6[f]	6 6		<0 2			7 57	6 0			12 6		<1[f]	5 4
304S		162	253		45			161	242			495		<1	2 6
304R		1 43	31 2		0 05			1 22	31 2			62 4		<1	4 3
305S	--	--	--					--							
305R		4 8	6 6		0 13			5 08	7 4			14 0		<1	1 0
306S		119	95 9		3 2			128	103			199		<1	1 7
306R	--	303	305		110			262	305		--	610	--	3 45[f]	3 7
401[g]	--	1 53	0 6		<0 02			1 01	0 6			<2		<1	1 9
402	--	--	--					--							--
403	--														
404		84 9	79		2 6			79 7	79			158		<1	2 4
405[g]	--	0 75	0 4		<0 02			0 71	0 5			<2		<1	1 0
406[g]		1 69	2 8		<0 02			1 45	2 1			4 9	--	<1	1 8
407[g]	--	1 6	3 3		0 15			1 38	3 1			6 4		<1	2 0
408[g]			0 8						0 8			<2			1 4
409[g]	--		0 1		--				0 2			<2			1 1
410[g]	--	110	0 7	--	<0 2			9 51	0 7	--		<2		<1	2 2
411		1 110[f]	1 100		159			574	1 100			2 200		<1[f]	0 72
501[g]			0 7						0 8			<2			1 4
502[g]	--		1 9	--					9			3 8			3 8
503[g]			0 7	--					0 4			<2			1 6
601[h]		0 12			<0 01			0 33						<1	
602[h]			0 5	--					0 6			<2			0 85
Creek		--	0 6		--				0 8			<2			0 16
GP-1	--		--	--	--					93 5			0 167		
GP-2	--	--	--		--					8 42			0 594	--	
GP 2A	--				--					3 11			0 316		
GP-4	--	--	--	--						4 570			18 3		
GP-4A		--			--					291			1 65		
GP-5	--		--	--						375			0 46		
GP-6										4 96			0 279		
GP-7										139			0 213		
NRC standard (10 CFR 20)	30 000			30 000			40 000			30 000[i]			30		

Well location[a]	Ra 228 (soluble) I	Ra 228 (soluble) II	Ra 228 (soluble) III	Gross alpha I	Gross alpha II	Gross alpha III	Gross beta I	Gross beta II	Gross beta III	Ac 227 I	Ac 227 II	Ac 227 III
5					<5[f]	150		<9[f]	<75	378		
5A			<2						--	2 6		
6A										1 3		
17												
17A										3 9		
22									--	1		
22A										6 6		
24												
24A										3 2		
27										15		
201				720			460					
201A				16		<200	17		<50			
202				1 800			1 100					
202A				35		<200	30	--	<50			
203				1 100			640				--	
203A				53			34					
204				6 900			1 700					
205				15 000		7 900	5 700		4 700			
301S						220			150			
301R				<3		<125		<2	<50			
302S				14		65		11	70			
302R				<3		<200		5 5	<50			
303S				<8[f]		<250		14[f]	<50			
303R			<2	31[f]		<250		25[f]	<200			
304S				99		500		51	460			
304R				<3		60		3 5	50			
305S												
305R			<2	3		<75		3 6	<50			
306S			<2	81		204		36	83			
306R	--		<2		300	340		210	240			
401[g]			<2		<3	<50		<2	<50			
402												
403												
404			<2		22	190		20	154			
405[g]					1 4	<50		7 2	<50			
406[g]			<2		<5	<125		6 1	<100			
407[g]			<2		<5	<100		7 2	<50	--		
408[g]						<100			<50			
409[g]						<50			<50			
410[g]					<2	<50		5 6	<50			
411			<2		960[f]	2 170		740[f]	1 310			
501[g]						<500		--	<50			
502[g]						<150			<50			
503[g]						<50		--	<50			
601[h]					<0 4			<1				
602[h]						<5		--	<50			
Creek						<75			<50			
GP-1										0 725		
GP-2										0 764		
GP 2A										1 01		
GP-4										1 16		
GP-4A										1 10		
GP-5										0 752		
GP-6									--	0 144		
GP-7										0 777		
NRC standard (10 CFR 20)				30[j]			3 000[k]			2 000		

Well location[a]	Ac 228 I	Ac 228 II	Ac 228 III	Th 230 I	Th 230 II	Th 230 III	Th 232 I	Th 232 II	Th 232 III	Pb 210 I	Pb 210 II	Pb 210 III	Bi 214 I	Bi 214 II	Bi 214 III
5	31			13 823			40 6			2 2			4 400		
5A	14		--	48 1			3 6			1 8			<4 9		
6A	8			16 3			0 24			2 0			<4 3		
17	13			4 48		--	4 59			1 4			65 5		
17A	6 9			308 4			3 2			1 5			13		
22	11			164 8		--	3 3			1 6			14		
22A				207 7			2 8			1 6					
24	7 5			2 27			1 42			1 7			70		
24A	11			158 6			0 9			1 8			130		
27	15		--	875	--	--	9			2			69		
201					--										
202A		--					--								
203					--										
203A						--	--								
301R							--								
305R								--							
403					--	--	--								
501[g]						--									
503[g]		--													
GP-1				0 725		--	0 418								
GP-2				2 88			0 541								
GP 2A				1 11		--	1 01								
GP-4				3 98			1 04								
GP-4A				1 27			0 899								
GP-5				0 921	--		1 06								
GP-6				1 28			0 642								
GP-7				1 10			0 550								
NRC standard (10 CFR 20)	90 000			2 000			2 000			100			3 000		

[a] Well locations are shown on Figure D 2 2

[b] I = Analyses conducted by Radiation Management Corporation (1979-1982)

[c] II = Analyses conducted by Teledyne (March 1983)

[d] III = Analyses conducted by Bendix Corporation (April 1983)

[e] Dashes indicate no analysis was performed

[f] Analyses conducted by Teledyne (April 1983)

[g] Well is located off the expanded Canonsburg site

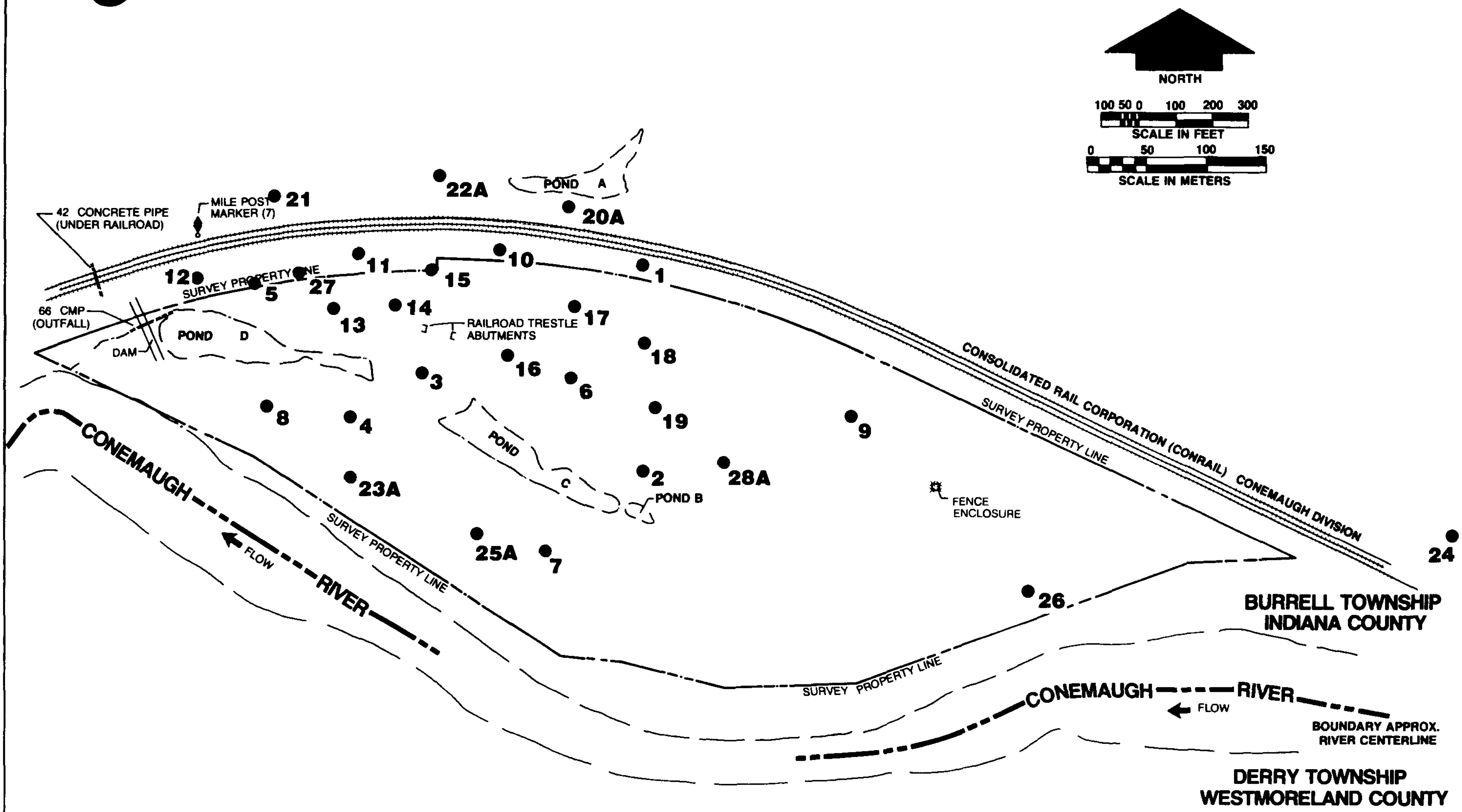
[h] Field blank

[i] This limit is for natural uranium

[j] This limit is for an unknown radionuclide(s) that decays by alpha emission or spontaneous fission

[k] This limit is for an unknown radionuclide(s) that decays by other than alpha emission or spontaneous fission with a half life greater than 2 hours

Source Weston field data (1979 1983)



● GROUNDWATER SAMPLING WELL— LOCATION/DESIGNATION
LETTER A — WELL INTO BEDROCK

NOTE 1 PROPERTY LINE DATA FROM PLAN OF PROPERTY FOR UNION CARBIDE CORP BY RICHARD G BACH & ASSOC ZELIENOPLE PA-DATED 11/16/77
2 TOPOGRAPHICAL DETAIL FROM MAP TEST HOLE LOCATIONS FOR ROY F WESTON INC BY KURCH HOUSLEY & ASSOC PITTSBURGH PA-DATED 11/6/81 REV 3/2/82

FIGURE F.1-2
LOCATION OF GROUNDWATER SAMPLING WELLS USED FOR RADIOLOGICAL SURVEY BURRELL TOWNSHIP SITE

Table F.1-5. Radiological analysis of ground-water samples from the Burrell site

Well number[a]	Ra-226	U-234	U-235	U-238	Gross alpha	Gross beta
	Nuclide (results in picocuries per liter (pCi/l))					
Sample dates July 27-30, 1981						
2	2.02	0.54	<0.05	0.52	< 5	17
3	<1.0	1.81	<0.10	1.63	<10	17
5	<1.0	3.56	0.12	3.28	<40	<40
6	<1.0	2.78	0.13	2.37	<10	15
7	<1.0	1.17	<0.05	0.93	< 5	25
8	<1.0	0.60	<0.05	0.52	<10	18
9	1.28	6.57	0.22	5.34	<40	66
10	<1.0	0.30	<0.05	0.21	< 5	3.5
11	<1.0	3.74	0.13	3.81	<10	< 4
12	1.37	0.56	<0.05	0.52	6	6.1
13	<1.0	5.87	0.40	5.73	16	21
14	<1.0	3.51	0.16	2.86	<10	5.2
15	<1.0	0.13	<0.05	<0.10	< 4	4.0
16	<1.0	1.7	<0.10	1.62	< 4	4.3
17	<1.0	0.47	<0.05	0.42	< 4	3.7
18	1.34	0.10	<0.05	<0.10	4.0	5.8
19	<1.0	1.30	<0.05	1.27	<10	21
20	1.00	0.74	<0.05	0.77	< 4	4.4
21	<1.0	<0.10	<0.05	<0.10	<30	<40
22	<1.0	0.85	<0.05	<0.10	< 7	13
23	<1.0	<0.10	<0.05	0.67	< 9	16
24	---[b]	---	---	---	---	---
25	---	---	---	---	---	---
26	---	---	---	---	---	---
27	---	---	---	---	---	---
28	---	---	---	---	---	---

[a]Location of wells is shown on Figure F.1-2.
[b]Dashes indicate no sample was taken.
Source: Weston (1982) field data.

Table F.1-5. Radiological analysis of ground-water samples from the Burrell site (continued)

Well number[a]	Ra-226	U-234	U-235	U-238	Gross alpha	Gross beta
	Nuclide (results in picocuries per liter (pCi/l))					
Sample dates January 21 - February 11, 1982						
2	---[b]	---	---	---	---[b]	---
3	---	---	---	---	---	---
5	---	---	---	---	---	---
6	<1.0	1.33	<0.04	1.12	< 2	15
7	---	---	---	---	---	---
8	---	---	---	---	---	---
9	<1.0	4.38	0.16	3.44	51	110
10	---	---	---	---	---	---
11	<1.0	0.75	<0.02	0.70	< 4	5.7
12	---	---	---	---	---	---
13	<1.0	0.97	<0.02	0.74	< 3	16
14	<1.0	0.88	<0.03	0.92	< 3	4.3
15	---	---	---	---	---	---
16	---	---	---	---	---	---
17	---	---	---	---	---	---
18	---	---	---	---	---	---
19	---	---	---	---	---	---
20	---	---	---	---	---	---
21	---	---	---	---	---	---
22	---	---	---	---	---	---
23	---	---	---	---	---	---
24	<1.0	0.30	<0.03	0.18	< 5	3.7
25	<1.0	0.21	<0.02	0.13	< 2	4.0
26	<1.0	1.3	<0.10	0.95	< 2	8.1
27	<1.0	0.22	<0.02	0.16	< 3	3.8
28	<1.0	0.55	0.068	0.16	< 4	<2

Appendix F.2

DESCRIPTION OF THE MILDOS COMPUTER CODE AND THE INPUTS USED

Appendix F.2

DESCRIPTION OF THE MILDOS COMPUTER CODE AND THE INPUTS USED

F.2.1 Introduction

The MILDOS computer code (U.S. NRC, 1980) was developed by the NRC to serve as the primary licensing evaluation tool for assessment of radiological impacts resulting from uranium-milling operations. The code can be used to evaluate compliance with the EPA's uranium fuel cycle radiation protection standard (40 CFR 190), compliance with the EPA's remedial-action standards for inactive uranium-processing sites (40 CFR 192), and the maximum air-concentration limits and radiation doses embodied in the NRC's standards for protection against radiation (10 CFR 20). MILDOS uses the calculational models and data, as described in the NRC Regulatory Guide 3.51, "Calculational Models for Estimating Radiation Doses to Man from Airborne Radioactive Materials Resulting from Uranium Milling Operations," except the inhalation dose factors have been modified to reflect new information on radionuclide dosimetry.

F.2.2 Calculational regime

The MILDOS code calculates radiation doses to people resulting from releases of solid particulates and gases from uranium-mill operations, including releases from tailings piles. The code allows for area sources that change with time. As used for tailings it assumes 30 percent fines and 70 percent coarse material (mean diameters of 5 and 35 micrometers, respectively, of density 2.4). Also input to the code are the distribution of the population around the source and the joint frequency distribution of winds averaged throughout the year. The code takes into account resuspension, atmospheric dispersion, and deposition on the ground. The code calculates resultant doses by radionuclide (uranium-238, thorium-230, radium-226, radon-222, and lead-210), by organ (whole body, bone, lung, liver, kidneys, and bronchial epithelium), and by pathway (inhalation, external irradiation, and ingestion). The outputs of the code are expressed as population doses in each population distribution segment (actually committed dose equivalents in man-rems per year of exposure) and as individual doses at specified points in the vicinity (in rems per year of exposure). The commitments are 100 years for the population doses and 50 years for the individual doses. The conversion of these doses to health effects in Chapter 5 were made by the factors given in subsection F.3.2.

The translocation and airborne concentrations of radon gas and radioactive particulates removed from a contaminated area, such as buried or above-ground uranium-mill tailings, are estimated from theoretical and empirical wind-erosion equations according to wind speed and direction, particle size distribution, surface roughness, and atmospheric stability class, and the mill tailings' radionuclide concentrations. A dispersion-deposition-resuspension model is used. This Gaussian plume model allows for source depletion as a result of deposition, radioactive decay, and in-growth of radon-daughter products. The average air concentration is calculated to be constant during each annual release period because of the use of annual average meteorological data and average radionuclide concentrations in the tailings. Surface contamination is estimated by including buildup from deposition, in-growth of radioactive daughters, and removal by radioactive decay, weathering, and other environmental processes. The deposition velocity is estimated on the basis of particle size, density, and physical and chemical environmental conditions that influence the behavior of the smaller particles.

The calculation of the individual organ doses and dose rates to populations and individuals is based on the International Commission on the Radiological Protection (ICRP) Task Group Model (ICRP, 1966). Estimates of the dose to the bronchial epithelium of the lung from inhalation of radon and its short-lived daughters are calculated based on a dose-conversion factor, which Weston modified to reflect the most recent accepted value (Harley and Pasternack, 1982). External radiation exposure includes radiation from airborne radionuclides, and exposure to radiation from contaminated ground. Individual dose commitments, population dose commitments, and environmental dose commitments can then be computed.

F.2.3 MILDOS inputs

The data inputs to MILDOS consist of the following:

1. Meteorological data concerning annual average wind speed and direction by atmospheric stability class for each site (refer to Section 4.3 and Appendix B.1).

2. The population distribution around each site for each ordinal direction in 0.5-kilometer (0.31 mile) increments out to a distance of 2 kilometers (1.24 miles) from the Burrell and Hanover sites and within 0.05, 0.5 to 1.0, 1.0 to 1.5, 1.5 to 2.0, and 2.0 to 3.0, etc. to 9.0 to 10.0 kilometers from the Canonsburg site (refer to Section 4.12, Figures G-6 and G-7, and Tables G-5, G-9, and G-11).

3. The average radionuclide release rates for the time periods of interest and the average radionuclide concentrations at each site in excess of the natural background.

Data required for conducting the radiological impact analysis by using the MILDOS computer program were collected in March 1983. The data collection task addressed population distribution, dairy farming, and agricultural activities within a 10-kilometer radius of the Canonsburg site. Specific information was obtained through letters, phone calls, and visits to municipal, county, and regional agencies.

The task began with the identification of those municipalities within a 10-kilometer radius of the Canonsburg site. This was done on official highway maps of Washington and Allegheny Counties. After identification of these municipalities, specific population and agricultural information was assembled for each of them. This information was placed on maps of the 10-kilometer radius area. The population data were located according to specific sector (1 of 16) and distance from the site. The dairy farms were identified according to coordinates from the Canonsburg site.

Specific sources of information used in this task were the following:

1. U.S. Bureau of Census Library, Philadelphia -- 1980 census data for the area municipalities.

2. Washington County Planning Commission -- detailed census tract maps of the Pittsburgh Standard Metropolitan Statistical Area.

3. Washington and Allegheny County Offices -- information on major land use activities including: number, size (acreage), and location of farms within each municipality.

4. U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service (ASCS) and the U.S. Soil Conservation Service -- comprehensive data on agricultural and dairy farming activities.

5. Pennsylvania Department of Agriculture, Crop Rotation Service -- county-level agricultural statistics.

6. Agricultural Extension Service, Washington County and Washington County ASCS Office -- location of dairy farms in area, and specific production information such as: number, density, and output of dairy animals.

7. Pennsylvania Department of Transportation, Bureau of Transportation Planning Statistics and U.S. Department of Transportation, Federal Highway Administration -- official highway maps.

Of these inputs, the site radioactivity data have the greatest inherent error because of the averaging process. Based on the number of results available for each site, the relative standard error has been statistically estimated at 20 percent. The inherent errors in the meteorological and population data are small and do not materially affect the overall data error. However, the overall accuracy of the MILDOS model (as with most mathematical models) is approximately a factor of 2. Thus, the calculated doses are within a factor of 2 of the upper limit doses that could be received by the general public and remedial-action workers at each site under each alternative. The total population and worker doses for each alternative were determined by summing the calculated doses at each site and adding to these sums the external gamma dose rates from buried materials. The specific input data used are described in the subsection that follows.

F.2.4 Specific input data

The population and meteorological data were specific for each site and alternative. The only inputs that changed among the alternatives were the radioactivity source terms. These radiological inputs are discussed in the following subsections on a site-by-site and alternative-by-alternative basis. The radon-release rates listed are the releases by diffusion out of the radium-bearing material; these are used as part of the input to the calculation of atmospheric dispersion of radioactivity. The radium- and uranium-release rates listed account for dust raised in loading and dumping contaminated materials; these rates are also used in the calculation of atmospheric dispersion. The radium and uranium concentrations listed are used in the calculations of resuspension. Thorium-230 and lead-210 inputs to the code were set equal to zero.

F.2.4.1 Canonsburg site

The Canonsburg site was divided into three area sources, Areas A, B, and C; one or more sources as a result of loading and unloading contaminated materials; and one or more sources for above-ground and in-ground tailings-pile storage during each of the remedial actions, as appropriate.

Alternative 1

Radioactivity		Canonsburg site Area A	B	C
Radon-222:	curies per year	94.1	16.4	37.3
Radium-226:	picocuries per gram	71.8	28.6	121
Uranium-238:	picocuries per gram	42.7	13.6	6.8

Alternative 2

Radioactivity		Canonsburg site Area A	B	C	Encapsulation[a] area
Radon-222:	curies per 96 weeks	145	27.8	268	0[a]
Radium-226[b]:	curies per 96 weeks	1.11 E-6	0	2.21 E-5	2.46 E-5
Uranium-238[b]:	curies per 96 weeks	6.52 E-7	0	1.26 E-6	1.69 E-6
Radium-226:	picocuries per gram	132	52.8	223	–[c]
Uranium-238:	picocuries per gram	78.8	25.1	12.6	–[c]

[a]The radon-222 release is 0 as that value is included in the Area A, B, and C values.

[b]These values are for loading and dumping contaminated materials.

[c]Dashes indicate that no input is required.

Alternative 3

Radioactivity		Canonsburg site Area A	B	C	Encapsulation area
Radon-222:	curies per 96 weeks	145	27.8	268	0[a]
Radium-226[b]:	curies per 96 weeks	1.11 E-6	0	2.21 E-5	2.34 E-5
Uranium-238[b]:	curies per 96 weeks	6.52 E-7	0	1.26 E-6	1.52 E-6
Radium-226:	picocuries per gram	132	52.8	223	---[c]
Uranium-238:	picocuries per gram	78.8	25.1	12.6	---[c]

[a]The radon-222 release is 0 as that value is included in the Area A, B, and C values.

[b]These values are for loading and dumping contaminated materials.

[c]Dashes indicate that no input is required.

Alternatives 4 and 5

Radioactivity		Canonsburg site Area A	B	C	Pile 1	2	3
Radon-222:	curies per 96 weeks	123	27.3	248	0.55	4.63 E-2	7.64
Radium-226[a]:	curies per 96 weeks	3.10 E-5	3.01 E-6	1.36 E-4	---[b]	---	---
Uranium-238[a]:	curies per 96 weeks	1.85 E-5	1.44 E-6	7.64 E-4	---	---	---
Radium-226:	picocuries per gram	93.8	47.4	206	38.7	3.31	51.5
Uranium-238:	picocuries per gram	55.9	22.7	45.0	23.0	1.58	11.2

[a]These values are for loading and dumping contaminated materials.

[b]Dashes indicate that no input is required.

After Alternatives 2 and 3

Radioactivity		Canonsburg site Area A	B	C
Radon-222:	curies per year	26.2	11 5	6.18

F.2.4.2 Burrell site

The Burrell site was divided into two area sources, E (the eastern portion of the site) and W (the western portion of the site), and one pile for above-ground-tailings storage during Alternatives 2 and 4.

Alternative 1

Radioactivity		Burrell site Area E	W
Radon-222:	curies per year	2.13	109
Radium-226:	picocuries per gram	1.78	203
Uranium-238:	picocuries per gram	0.76	21

Alternatives 2 and 4

Radioactivity		Burrell site Area E	Burrell site Area W	Pile
Radon-222:	curies per 96 weeks	1.22	62.9	22.8
Radium-226[a]:	curies per 96 weeks	1.53 E-7	1.74 E-5	1.76 E-5
Uranium-238[a]:	curies per 96 weeks	2.94 E-8	8.08 E-7	8.37 E-7
Radium-226:	picocuries per gram	2.05	234	73.7
Uranium-238:	picocuries per gram	0.88	24.2	8.09

[a]These values are for loading and dumping contaminated materials.

Alternatives 3 and 5

Radioactivity		Burrell site Area E	Burrell site Area W
Radon-222:	curies per 96 weeks	0.71	36.3
Radium-226:	picocuries per gram	0.59	67.7
Uranium-238:	picocuries per gram	0.25	7.0

After Alternatives 3 and 5

Radioactivity		Burrell site Area E	Burrell site Area W
Radon-222:	curies per year	21.3	10.7

F.2.4.3 Hanover site

The Hanover site is currently not contaminated with radioactive materials and is evaluated as a potential repository only under Alternatives 4 and 5. This site was considered to be a single area source.

Alternative 4

Radon-222:	curies per 96 weeks	1662
Radium-226[a]:	curies per 96 weeks	1.47 E-3
Uranium-238[a]:	curies per 96 weeks	1.51 E-4

[a]These values are for dumping contaminated materials.

Alternative 5

Radon-222:	curies per 96 weeks	788
Radium-226[a]:	curies per 96 weeks	1.45 E-3
Uranium-238[a]:	curies per 96 weeks	1.50 E-4

[a]These values are for dumping contaminated materials.

After Alternatives 4 and 5

Radon-222:	curies per year	25.2

Appendix F.3

RADIOLOGICAL IMPACT ASSESSMENTS

Appendix F.3

RADIOLOGICAL IMPACT ASSESSMENTS

F.3.1 Exposure pathways

Potential exposure pathways by which people could be exposed to radioactive materials during this project are shown on Figure F.3-1. The pathways of concern are inhalation of radon gas and particulate radioactive materials, external exposure due to submersion in a radioactive cloud, and exposure to materials deposited on or already in the ground. Exposure of individuals to radioactive materials in surface water for the no-action alternative is insignificant. Based on a projected soil loss of 1.15 tons per year from Area C, the most contaminated area, into Chartiers Creek, the resultant increase in radionuclide concentrations would be approximately 0.3 picocurie per liter, essentially undetectable. This concentration is not expected to increase during any of the remedial-action alternatives and thus is not evaluated. Individuals may also be exposed to radioactivity by eating locally grown foodstuffs. However, since the closest farms are not very close to the site, the impacts along this pathway should be minimal.

During the remedial action there will be no planned releases of radioactive materials directly into surface waters or into ground-water systems. The only releases that could occur, under normal operating conditions, would be because of the unavoidable release of small amounts of radioactivity resulting from the remedial action. If an accident occurred, potentially greater amounts of radioactive materials could be introduced to surface or ground waters; however, since neither Chartiers Creek nor the Conemaugh River are drinking-water sources and since ground water from the sites enters these surface waters directly, this potential exposure pathway is not significant. Thus, while there is a slight possibility of radionuclide release, the amounts involved will be minimal, and the dilution factor high; therefore, the impacts from the waterborne-exposure pathway to the general public becomes insignificant for this radiological assessment.

In order to evaluate the effects of exposure via the pathways of concern, the radiation doses have been calculated, and the health effects based on these doses have been determined. In all dose calculations the average radioactivity levels, less the normal background levels, are used for impact evaluation. Thus, the excess radiation exposures and health effects that would occur as a result of remedial action on the Canonsburg and Burrell sites have been calculated. The specific evaluation techniques are summarized in the paragraphs that follow.

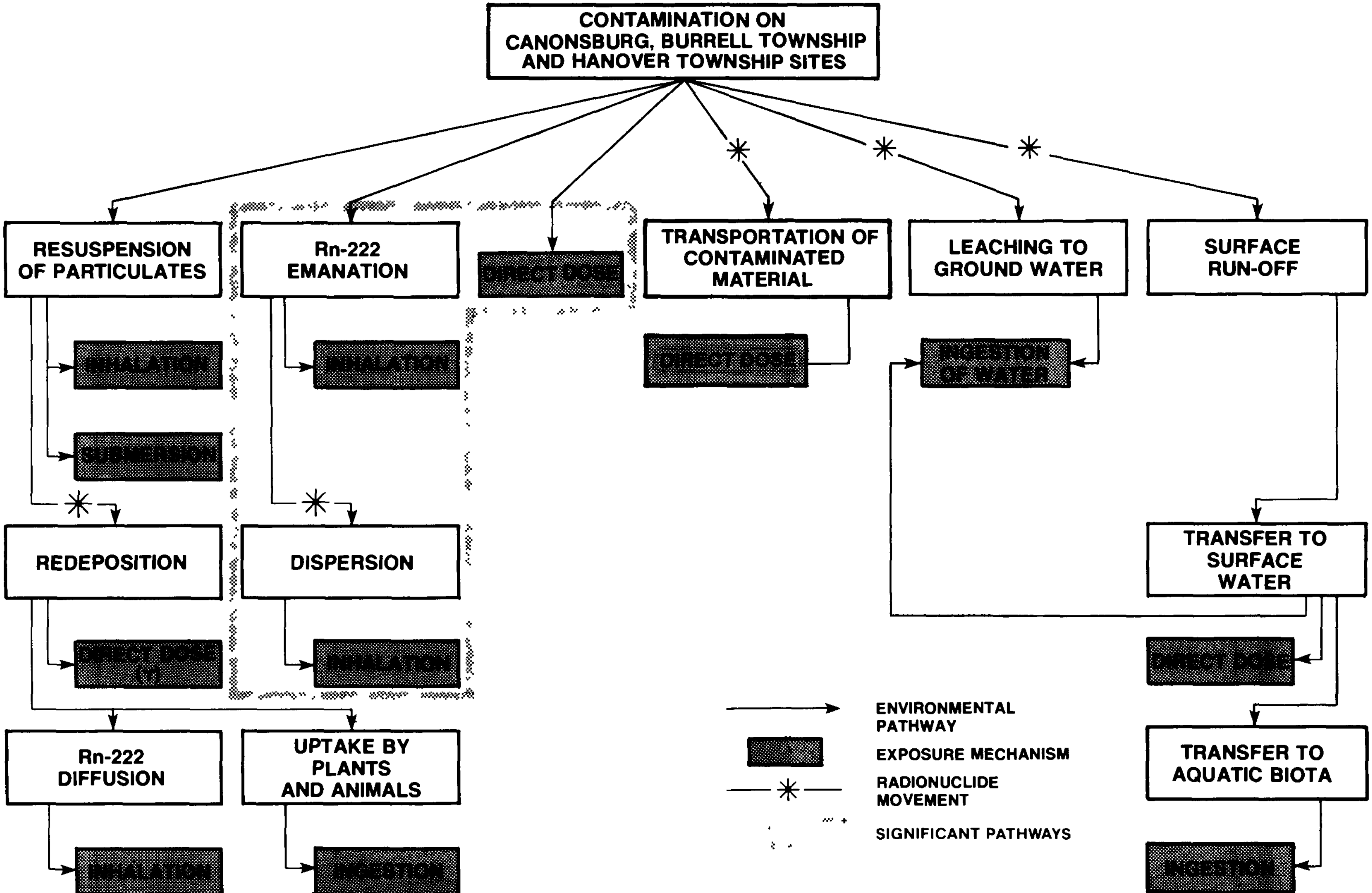


FIGURE F.3-1
POTENTIAL RADIATION EXPOSURE PATHWAYS TO THE GENERAL PUBLIC AND REMEDIAL ACTION WORKERS

The health effects from inhalation of radon-daughter products and other airborne radionuclides, direct external gamma radiation, and ingestion of locally grown foodstuffs are calculated by considering the measured or predicted dose and the size of the population exposed. The units for expressing these doses are the rem (where 1 rem is approximately equal to 1 roentgen) and the man-rem. The number of man-rems is determined by multiplying the dose in rems by the number of persons exposed.

F.3.2 Methods of impact assessment

Radiation doses to the general population and remedial-action workers were evaluated using the MILDOS computer program (U.S. NRC, 1980), which is described in Appendix F.2. The MILDOS program provides estimates of potential radiation exposure to individuals in the vicinity of a uranium-mill-tailings-disposal site. The inputs to this program consist of the following:

1. Population distribution data.
2. Meteorological data.
3. Radionuclide-emission-rate data.
4. Radionuclide-concentration data.

The meteorological and population data used are described in Appendices B.1 and G of this EIS, respectively.

The radionuclide-emission rates used were of several kinds: the emission of radon from the surface based on measured values; radon emissions from newly exposed radioactively contaminated materials; particulates made airborne by wind erosion; and particulates resulting from loading trucks. Radon-222 releases from newly exposed radioactively contaminated materials were inferred from radium-226 concentrations as reported by ORNL (Leggett et al., 1979a, b) using the relation, 1 picocurie per gram of radium-226 = 1 picocurie per square meter per second of radon-222.

The release of wind-eroded particulates depends on the areas of nuclide-containing material exposed during the remedial actions. These areas were obtained from the engineering plans for the alternatives outlined in Section 3.1. MILDOS contains wind-suspension factors based on experimental data. During truck loading of contaminated material, some contaminated particulates (dust) are picked up by the wind. This process and the amount of such dust are described in Section 5.3 and Appendix B.2. In estimating the amounts of airborne particulates, no credit was taken for the fugitive dust control techniques described in Section 5.21.

The outputs from this program thus include maximum probable estimates of the radiological doses from inhalation of radon-daughter products and other radionuclides, from external exposure to gamma radiation, and ingestion of locally produced foodstuffs.

In Alternatives 4 and 5, people are exposed to gamma radiation from passing trucks containing contaminated material from the Canonsburg site. This material contains a trace amount of radioactivity; the measured gamma levels on the Canonsburg site average 227 microroentgens per hour at a height of 3 feet (1 meter). At greater distances the levels will be less. The radiation dose commitment to the public from passing trucks has been calculated using equation F.3-1, assuming a population density of 2000 people per square mile and an average truck speed of 10 miles per hour.

$$D = \frac{2KP_d}{V} \int_d^{\infty} \frac{e^{-\mu r} B(r)\, dr}{r\sqrt{r^2-d^2}} \qquad (F.3\text{-}1)$$

Where:

- D = Dose commitment.
- K = Dose rate factor (227 microroentgens).
- P_d = Population density (0.00076 people per square meter).
- V = Truck speed (10 mph).
- μ = Attenuation coefficient (0.0035 per meter).
- r = Distance from source.
- $B(r)$ = Buildup factor (1).
- d = Minimum distance from source.

This dose commitment is about 0.01 man-microrem per loaded truck-mile. The dose commitment for truck drivers is about 22 man-microrems per loaded truck-mile.

Under Alternative 2 materials are brought from the Burrell site to the Canonsburg site. Using equation F.3-1 and a dose rate factor of 11 microroentgens, the population exposure is approximately 0.0005 man-microrem per loaded truck-mile and the dose commitment for the truck drivers is approximately 0.1 man-microrem per loaded truck-mile. Similarly under Alternative 4, the Burrell residues are transported to Hanover, and the population exposure is approximately 0.0002 man-microrem per loaded truck-mile based on a population density of 0.00036 people per square meter around the Burrell site. The truck driver dose commitment remains unchanged at 0.1 man-microrem per loaded truck-mile.

Excess cancer deaths due to radiation exposure were calculated using the following risk factors (National Academy of Sciences, 1980; Cohen, 1981; Evans, et al, 1981):

1. Lung cancer deaths from inhalation of radon-daughter products = 20 per lifetime of the exposed population per 1,000,000 man-rems

2. All cancer deaths from gamma exposure = 120 per lifetime of the exposed population per 1,000,000 man-rems

These risk factors are, in our opinion, realistic estimators of the true risk of lifetime cancer death. It should be pointed out, however, that literature values range from 13 to 102 lung cancer deaths due to inhalation of radon-daughter products, and from 50 to 621 cancer deaths due to gamma exposure (Cohen, 1981; Evans et al., 1981; Harley and Pasternack, 1982; National Academy of Sciences, 1980; National Academy of Sciences, 1972; United Nations, 1972; United Nations, 1977; United States Radiation Policy Council, 1980). Thus, the ultimate number of actual cancer deaths predicted in this Canonsburg FEIS are probably accurate to within a factor of 5. Since the same risk factors were used throughout this report, comparisons of radiological impacts under the different alternatives are valid, regardless of the accuracy.

Table F.3-1. Excess radiation doses within 10 kilometers (6.2 miles) of the expanded Canonsburg site during Alternative 1

Dose delivered to	Millirems per year, unless otherwise noted					
	Whole body[a]	Bone[a]	Lung[a]	Liver[a]	Kidney[a]	Tracheo-bronchial system[b]
Population within 10 kilometers[c]	11[d]	21[d]	62[d]	10[d]	10[d]	530[d]
Nearest building						
N	0.93	1.70	5.60	0.85	0.86	37
NNE	2.43	4.31	13.3	2.22	2.25	47
NE	5.69	10.2	31.8	5.20	5.26	133
ENE	10.5	18.7	55.6	9.55	9.65	265
E	15.8	28.1	79.2	14.4	14.6	393
ESE	12.5	21.5	57.5	11.5	11.6	129
SE	9.46	16.5	47.6	8.69	8.79	174
SSE	7.09	12.4	37.7	6.51	6.59	257
S	4.10	7.19	21.8	3.77	3.81	191
SSW	1.44	2.53	7.89	1.32	1.34	169
SW	0.45	0.79	2.43	0.42	0.42	88
WSW	0.29	0.50	1.47	0.27	0.27	23
W	0.14	0.24	0.77	0.12	0.13	64
WNW	0.72	1.27	3.74	0.66	0.67	45
NW	0.84	1.50	4.41	0.77	0.78	37
NNW	0.38	0.69	2.28	0.34	0.35	20
Canon-MacMillan High School	1.38	2.49	8.36	1.26	1.27	131
St. Patrick's Church and School	4.50	8.17	26.2	4.09	4.14	132

[a]Mainly exposure to gamma radiation.

[b]Mainly inhalation of radon-daughter products.

[c]63,942 people.

[d]Man-rems per year.

Table F.3-2. Excess radiation doses within 10 kilometers (6.2 miles) of the expanded Canonsburg site during Alternative 2

	Millirems, unless otherwise noted (Doses for the approximate 96-week remedial-action period)					
Dose delivered to	Whole body[a]	Bone[a]	Lung[a]	Liver[a]	Kidney[a]	Tracheo-bronchial system[b]
Population within 10 kilometers[c]	22[d]	39[d]	116[d]	20[d]	20[d]	1858[d]
Nearest building						
N	1.72	3.13	10.3	1.57	1.59	97
NNE	4.48	7.95	24.5	4.10	4.15	129
NE	10.5	18.8	58.7	9.59	9.70	313
ENE	19.3	34.5	103	17.6	17.8	980
E	29.3	52.1	147	26.8	27.0	1900
ESE	22.9	39.6	106	21.1	21.3	500
SE	17.4	30.3	87.7	16.1	16.2	826
SSE	13.1	23.0	69.5	12.1	12.2	1050
S	7.61	13.3	40.2	7.00	7.08	710
SSW	270	4.72	14.6	2.48	2.51	1010
SW	0.87	1.49	4.52	0.80	0.81	253
WSW	0.57	0.96	2.74	0.53	0.53	207
W	0.27	0.46	1.44	0.25	0.25	61
WNW	1.35	2.36	6.92	1.24	1.25	154
NW	1.57	2.78	8.15	1.44	1.45	127
NNW	0.70	1.28	4.21	0.64	0.72	54
Canon-MacMillan High School	2.64	4.67	15.5	2.41	2.44	434
St. Patrick's Church and School	8.30	15.1	48.4	7.56	7.65	385

[a]Mainly exposure to gamma radiation.

[b]Mainly inhalation of radon-daughter products.

[c]63,942 people.

[d]Man-rems per year.

Table F.3-3. Excess radiation doses within 10 kilometers (6.2 miles) of the expanded Canonsburg site during Alternative 3

Dose delivered to	Millirems, unless otherwise noted (Doses for the approximate 96-week remedial-action period)					
	Whole body[a]	Bone[a]	Lung[a]	Liver[a]	Kidney[a]	Tracheo-bronchial system[b]
Population within 10 kilometers[c]	22[d]	39[d]	116[d]	20[d]	20[d]	1860[d]
Nearest building						
N	1.72	3.13	10.3	1.57	1.59	97
NNE	4.48	7.95	24.5	4.10	4.15	129
NE	10.5	18.8	58.7	9.59	9.70	313
ENE	19.3	34.5	103	17.6	17.8	980
E	29.3	52.1	147	26.8	27.0	1900
ESE	22.9	39.6	106	21.1	21.3	500
SE	17.4	30.3	87.7	16.1	16.2	826
SSE	13.1	23.0	69.5	12.1	12.2	1050
S	7.61	13.3	40.2	7.00	7.08	710
SSW	2.70	4.72	14.6	2.48	2.51	1010
SW	0.87	1.49	4.52	0.80	0.81	253
WSW	0.57	0.96	2.74	0.53	0.53	207
W	0.27	0.46	1.44	0.25	0.25	61
WNW	1.35	2.36	6.92	1.24	1.25	154
NW	1.57	2.78	8.15	1.44	1.45	127
NNW	0.70	1.28	4.21	0.64	0.72	54
Canon-MacMillan High School	2.64	4.67	15.5	2.41	2.44	434
St. Patrick's Church and School	8.30	15.1	48.4	7.56	7.65	385

[a]Mainly exposure to gamma radiation.

[b]Mainly inhalation of radon-daughter products.

[c]63,942 people.

[d]Man-rems per year.

Table F.3-4. Excess radiation doses within 10 kilometers (6.2 miles) of the expanded Canonsburg site during Alternatives 4 and 5

	Millirems, unless otherwise noted (Doses for the approximate 96-week remedial-action period)					
Dose delivered to	Whole body[a]	Bone[a]	Lung[a]	Liver[a]	Kidney[a]	Tracheo-bronchial system[b]
Population within 10 kilometers[c]	18[d]	31[d]	94[d]	16[d]	16[d]	1720[d]
Nearest building						
N	1.33	2.41	7.94	1.21	1.22	89
NNE	3.45	6.13	19.0	3.16	3.20	118
NE	8.42	15.0	47.1	7.69	7.79	290
ENE	16.0	28.6	86.9	14.6	14.8	914
E	25.2	44.8	130	23.0	23.2	1770
ESE	18.5	31.9	86.3	17.0	17.2	462
SE	13.2	23.0	66.6	12.1	12.3	766
SSE	9.56	16.7	50.5	8.79	8.89	972
S	5.55	9.68	29.3	5.10	5.16	661
SSW	1.99	3.47	10.7	1.83	1.85	474
SW	0.66	1.13	3.40	0.61	0.62	234
WSW	0.45	0.74	2.12	0.41	0.42	193
W	0.21	0.35	1.11	0.19	0.19	56
WNW	1.05	1.83	5.43	0.96	0.97	145
NW	1.27	2.25	6.72	1.16	1.17	120
NNW	0.55	1.01	3.34	0.50	0.51	50
Canon-MacMillan High School	2.06	3.62	12.0	1.89	1.92	400
St. Patrick's Church and School	6.72	12.2	39.5	6.12	6.10	357

[a]Mainly exposure to gamma radiation.
[b]Mainly inhalation of radon-daughter products.
[c]63,942 people.
[d]Man-rems per year.

Table F.3-5. Excess radiation doses within 10 kilometers (6.2 miles) of the expanded Canonsburg site after completion of Alternative 2 or 3

Dose delivered to	Millirems per year, unless otherwise noted					
	Whole body[a]	Bone[a]	Lung[a]	Liver[a]	Kidney[a]	Tracheo-bronchial system[b]
Population within 10 kilometers[c]	0.254[d]	0.270[d]	0.258[d]	0.257[d]	0.267[d]	151[d]
Nearest building						
N	1.54 E-3[e]	1.54 E-3	1.54 E-3	1.54 E-3	1.54 E-3	11.6
NNE	1.49 E-3	1.49 E-3	1.49 E-3	1.49 E-3	1.49 E-3	15.5
NE	5.59 E-3	5.60 E-3	5.59 E-3	5.59 E-3	5.59 E-3	56.4
ENE	1.29 E-2	1.29 E-2	1.29 E-2	1.29 E-2	1.29 E-2	87.3
E	1.84 E-2	1.84 E-2	1.84 E-2	1.84 E-2	1.84 E-2	99.9
ESE	3.86 E-3	3.86 E-3	3.86 E-3	3.86 E-3	3.86 E-3	29.7
SE	7.18 E-3	7.18 E-3	7.18 E-3	7.18 E-3	7.18 E-3	51.8
SSE	1.18 E-2	1.18 E-2	1.18 E-2	1.18 E-2	1.18 E-2	74.7
S	1.03 E-2	1.03 E-2	1.03 E-2	1.03 E-2	1.03 E-2	57.2
SSW	1.03 E-2	1.03 E-2	1.03 E-2	1.03 E-2	1.03 E-2	51.4
SW	6.96 E-3	6.97 E-3	6.96 E-3	6.96 E-3	6.97 E-3	26.6
WSW	4.76 E-3	4.77 E-3	4.76 E-3	4.76 E-3	4.76 E-3	19.7
W	3.63 E-3	3.64 E-3	3.63 E-3	3.63 E-3	3.63 E-3	7.05
WNW	2.39 E-3	2.39 E-3	2.39 E-3	2.39 E-3	2.39 E-3	17.3
NW	1.39 E-3	1.39 E-3	1.39 E-3	1.39 E-3	1.39 E-3	14.2
NNW	1.16 E-3	1.16 E-3	1.16 E-3	1.16 E-3	1.16 E-3	6.32
Canon-MacMillan High School	2.64 E-2	2.65 E-2	2.64 E-2	2.64 E-2	2.65 E-2	35.8
St. Patrick's Church and School	1.17 E-2	1.17 E-2	1.17 E-2	1.17 E-2	1.17 E-2	44.0

[a]Mainly exposure to gamma radiation.

[b]Mainly inhalation of radon-daughter products.

[c]63,942 people.

[d]Man-rems per year.

[e]1.54 E-3 = 0.00154.

Table F.3-6. Excess radiation doses within 2 kilometers (1.24 miles) of the Burrell site during Alternative 1

Dose delivered to	Whole body[a]	Bone[a]	Lung[a]	Liver[a]	Kidney[a]	Tracheo-bronchial system[b]
	Millirems per year, unless otherwise noted					
Population within 2 kilometers[c]	0.0864[d]	0.0876[d]	0.0867[d]	0.0867[d]	0.0874[d]	47.8[d]
Nearest building						
N	2.90 E-3[e]	2.91 E-3	2.90 E-3	2.90 E-3	2.91 E-3	15.6
NNE	2.44 E-3	2.45 E-3	2.44 E-3	2.44 E-3	2.45 E-3	8.87
NE	5.42 E-3	5.43 E-3	5.42 E-3	5.42 E-3	5.43 E-3	25.2
S	4.74 E-3	4.81 E-3	4.75 E-3	4.76 E-3	4.80 E-3	5.13
SSW	6.67 E-2	6.73 E-2	6.68 E-2	6.69 E-2	6.72 E-2	73.7
SW	6.54 E-2	6.57 E-2	6.55 E-2	6.55 E-2	6.57 E-2	134
NW	5.51 E-3	5.52 E-3	5.51 E-3	5.51 E-3	5.52 E-3	33.8
NNW	4.00 E-3	4.00 E-3	4.00 E-3	4.00 E-3	4.00 E-3	34.0

[a]Mainly exposure to gamma radiation.

[b]Mainly inhalation of radon-daughter products.

[c]4,546 people.

[d]Man-rems per year.

[e]2.90 E-3 = 0.00290.

Table F.3-7. Excess radiation doses within 2 kilometers (1.24 miles) of the Burrell site during Alternatives 2 and 4

Dose delivered to	Whole body[a]	Bone[a]	Lung[a]	Liver[a]	Kidney[a]	Tracheo-bronchial system[b]
	Millirems, unless otherwise noted (Doses for the approximate 96-week remedial-action period)					
Population within 2 kilometers[c]	9.34 0.0934[d]	0.127[d]	0.262[d]	8.99 0.0899[d]	9.06 0.0906[d]	29.9[d]
Nearest building						
N	2.08 E-2[e]	5.71 E-2	9.87 E-2	1.90 E-2	1.90 E-2	8.88
NNE	3.11 E-2	5.60 E-2	0.155	2.84 E-2	2.84 E-2	5.96
NE	9.66 E-2	0.173	0.462	8.82 E-2	8.82 E-2	16.8
S	2.59 E-2	2.60 E-2	0.121	2.37 E-2	2.37 E-2	3.58
SSW	5.19 E-2	6.17 E-2	0.101	5.08 E-2	5.08 E-2	43.2
SW	4.40 E-2	4.99 E-2	7.45 E-2	4.33 E-2	4.33 E-2	71.3
NW	9.36 E-3	1.36 E-2	3.11 E-2	8.89 E-3	8.89 E-3	19.5
NNW	1.12 E-2	1.74 E-2	4.26 E-2	1.05 E-2	1.05 E-2	22.3

[a]Mainly exposure to gamma radiation.

[b]Mainly inhalation of radon-daughter products.

[c]4,546 people.

[d]Man-rems per year.

[e]2.08 E-2 = 0.0208.

Table F.3-8. Excess radiation doses within 2 kilometers (1.24 miles) of the Burrell site during Alternatives 3 and 5

Dose delivered to	Millirems, unless otherwise noted (Doses for the approximate 96-week remedial-action period)					
	Whole body[a]	Bone[a]	Lung[a]	Liver[a]	Kidney[a]	Tracheo-bronchial system[b]
Population within 2 kilometers[c]	0.0311[d]	0.0423[d]	0.0873[d]	0.0300[d]	0.0302[d]	9.97[d]
Nearest building						
N	6.93 E-3[e]	1.90 E-2	3.29 E-2	6.33 E-3	6.33 E-3	2.96
NNE	1.04 E-2	1.87 E-2	5.17 E-2	9.47 E-3	9.47 E-3	1.99
NE	3.22 E-2	5.77 E-2	0.154	2.94 E-2	2.94 E-2	5.60
S	8.63 E-3	8.67 E-3	4.03 E-2	7.90 E-3	7.90 E-3	1.19
SSW	1.73 E-2	2.06 E-2	3.37 E-2	1.69 E-2	1.69 E-2	14.4
SW	1.47 E-2	1.66 E-2	2.48 E-2	1.44 E-2	1.44 E-2	23.8
NW	3.12 E-3	4.53 E-3	1.04 E-2	2.96 E-3	2.96 E-3	6.50
NNW	3.73 E-3	5.80 E-3	1.42 E-2	3.50 E-3	3.50 E-3	7.43

[a]Mainly exposure to gamma radiation.
[b]Mainly inhalation of radon-daughter products.
[c]4,546 people.
[d]Man-rems per year.
[e]6.93 E-3 = 0.00693.

Table F.3-9. Excess radiation doses within 2 kilometers (1.24 miles) of the Burrell site after completion of Alternative 3 or 5

Dose delivered to	Whole body[a]	Bone[a]	Lung[a]	Liver[a]	Kidney[a]	Tracheo-bronchial system[b]
	Millirems per year, unless otherwise noted					
Population within 2 kilometers[c]	2.33	2.36	2.34	2.34	2.36	
	0.0233[d]	0.0236[d]	0.0234[d]	0.0234[d]	0.0236[d]	11.5[d]
Nearest building						
N	1.04 E-3[e]	1.04 E-3	1.04 E-3	1.04 E-3	1.04 E-3	3.90
NNE	8.39 E-4	8.38 E-4	8.39 E-5	8.39 E-4	8.39 E-4	2.66
NE	1.02 E-3	1.02 E-3	1.02 E-3	1.02 E-3	1.02 E-3	5.80
S	1.07 E-3	1.07 E-3	1.07 E-3	1.07 E-3	1.07 E-3	1.44
SSW	1.85 E-2	1.85 E-2	1.85 E-2	1.85 E-2	1.85 E-2	21.5
SW	1.53 E-2	1.53 E-2	1.53 E-2	1.53 E-2	1.53 E-2	29.9
NW	1.96 E-3	1.96 E-3	1.96 E-3	1.96 E-3	1.96 E-3	6.58
NNW	1.65 E-3	1.65 E-3	1.65 E-3	1.65 E-3	1.65 E-3	7.27

[a]Mainly exposure to gamma radiation.

[b]Mainly inhalation of radon-daughter products.

[c]4,546 people.

[d]Man-rems per year.

[e]1.04 E-3 = 0.00104.

Table F.3-10. Excess radiation doses within 2 kilometers (1.24 miles) of the Hanover site during Alternative 4

	Millirems, unless otherwise noted (Doses for the approximate 96-week remedial-action period)					
Dose delivered to	Whole body[a]	Bone[a]	Lung[a]	Liver[a]	Kidney[a]	Tracheo-bronchial system[b]
Population within 2 kilometers[c]	0.00889[d]	0.0103[d]	0.0169[d]	0.00877[d]	0.00881[d]	10.3[d]
Nearest building						
NNE	2.40 E-2[e]	3.18 E-2	5.86 E-2	2.32 E-2	2.33 E-2	26.3
NE	6.45 E-2	8.81 E-2	1.72 E-1	6.19 E-2	6.22 E-2	91.2
SE	1.54 E-2	2.22 E-2	3.96 E-2	1.46 E-2	1.47 E-2	14.1
SSE	2.20 E-2	3.15 E-2	5.86 E-2	2.10 E-2	2.11 E-2	23.0
SSW	8.94 E-3	1.26 E-2	2.09 E-2	8.54 E-3	8.57 E-3	5.63
SW	1.19 E-2	1.63 E-2	2.66 E-2	1.15 E-2	1.15 E-2	8.34
WSW	5.80 E-2	8.85 E-2	1.31 E-1	5.49 E-2	5.51 E-2	8.35
WNW	1.99 E-2	2.77 E-2	4.36 E-2	1.91 E-2	1.92 E-2	11.1
NW	5.13 E-2	5.91 E-2	8.97 E-2	5.06 E-2	5.09 E-2	44.1

[a]Mainly exposure to gamma radiation.
[b]Mainly inhalation of radon-daughter products.
[c]114 people.
[d]Man-rems per year.
[e]2.40 E-2 = 0.0240.

Table F.3-11. Excess radiation doses within 2 kilometers (1.24 miles) of the Hanover site during Alternative 5

Dose delivered to	Whole body[a]	Bone[a]	Lung[a]	Liver[a]	Kidney[a]	Tracheo-bronchial system[b]
	Millirems, unless otherwise noted (Doses for the approximate 96-week remedial-action period)					
Population within 2 kilometers[c]	4.75	6.05	1.26	4.62	4.64	
	0.00475[d]	0.00605[d]	0.0126[d]	0.00462[d]	0.00464[d]	4.88[d]
Nearest building						
NNE	1.43 E-2[e]	2.09 E-2	4.37 E-2	1.36 E-2	1.36 E-2	11.0
NE	4.71 E-2	7.09 E-2	0.156	4.45 E-2	4.47 E-2	44.5
SE	1.31 E-2	2.02 E-2	3.82 E-2	1.24 E-2	1.24 E-2	6.94
SSE	1.68 E-2	2.58 E-2	5.18 E-2	1.58 E-2	1.58 E-2	10.5
SSW	6.97 E-3	1.05 E-2	1.84 E-2	6.58 E-3	6.61 E-3	2.57
SW	9.41 E-3	1.38 E-2	2.42 E-2	8.92 E-3	8.96 E-3	4.06
WSW	5.97 E-2	9.16 E-2	0.137	5.61 E-2	5.63 E-2	4.14
WNW	1.41 E-2	2.07 E-2	3.50 E-2	1.34 E-2	1.34 E-2	5.25
NW	2.87 E-2	3.64 E-2	6.77 E-2	2.79 E-2	2.81 E-2	20.7

[a]Mainly exposure to gamma radiation.

[b]Mainly inhalation of radon-daughter products.

[c]114 people.

[d]Man-rems per year.

[e]1.43 E-2 = 0.0146.

Table F.3-12. Excess radiation doses within 2 kilometers (1.24 miles) of the Hanover site after completion of Alternatives 4 and 5

Dose delivered to	Millirems per year, unless otherwise noted					
	Whole body[a]	Bone[a]	Lung[a]	Liver[a]	Kidney[a]	Tracheo-bronchial system[b]
Population within 2 kilometers[c]	1.16 0.000116[d]	1.17 0.000117[d]	1.16 0.000116[d]	1.16 0.000116[d]	1.17 0.000117[d]	0.152[d]
Nearest building						
NNE	2.19 E-4[e]	2.21 E-4	2.19 E-4	2.19 E-4	2.21 E-4	0.413
NE	5.14 E-4	5.16 E-4	5.14 E-4	5.14 E-4	5.16 E-4	1.42
SE	7.52 E-5	7.52 E-5	7.52 E-5	7.52 E-5	7.52 E-5	0.208
SSE	1.32 E-4	1.32 E-4	1.32 E-4	1.32 E-4	1.32 E-4	0.355
SSW	4.93 E-5	4.97 E-5	4.94 E-5	4.93 E-5	4.96 E-5	8.75 E-2
SW	8.10 E-5	8.14 E-5	8.11 E-5	8.11 E-5	8.14 E-5	0.127
WSW	5.44 E-5	5.44 E-5	5.44 E-5	5.44 E-5	5.44 E-5	0.126
WNW	1.06 E-5	1.07 E-5	1.06 E-5	1.06 E-5	1.07 E-5	0.162
NW	6.31 E-4	6.32 E-5	6.31 E-5	6.31 E-5	6.31 E-5	0.634

[a]Mainly exposure to gamma radiation.
[b]Mainly inhalation of radon-daughter products.
[c]114 people.
[d]Man-rems per year.
[e]2.19 E-4 = 0.000219.

Table F.3-13. Excess radiation doses to the onsite workers during remedial action

Alternative	Site	Number of workers	Man-rems					
			Whole body[a]	Bone[a]	Lung[a]	Liver[a]	Kidney[a]	Tracheobronchial system[b]
2	Canonsburg	28	13.6	14.2	17.3	13.5	13.5	50.6
	Burrell	19	0.07	0.07	0.07	0.07	0.07	1.97
	Total	47	13.7	14.3	17.4	13.6	13.6	52.6
3	Canonsburg	28	13.6	14.2	17.3	13.5	13.5	50.6
	Burrell	15	0.006	0.006	0.006	0.006	0.006	0.50
	Total	43	13.6	14.2	17.3	13.5	13.5	51.1
4	Canonsburg	28	13.4	13.8	16.0	13.3	13.3	43.5
	Burrell	19	0.07	0.07	0.07	0.07	0.07	1.97
	Hanover	28	1.49	1.50	1.51	1.49	1.49	18.2
	Total	75	14.9	15.4	17.6	14.9	14.9	63.7
5	Canonsburg	28	13.3	13.8	16.0	13.3	13.3	43.5
	Burrell	15	0.006	0.006	0.006	0.006	0.006	0.50
	Hanover	29	1.07	1.07	1.09	1.06	1.06	11.3
	Total	72	14.4	14.9	17.1	14.4	14.4	55.3

[a]Mainly exposure to gamma radiation.

[b]Mainly inhalation of radon-daughter products.

Appendix F.4

RADIOLOGICAL MONITORING

Appendix F.4

RADIOLOGICAL MONITORING

F.4.1 Introduction

The monitoring program to be used during remedial action would consist of two components; i.e., environmental monitoring and occupational monitoring. The former would primarily measure and document the extent of construction-related radiological contaminants migrating off the site. The occupational monitoring would measure and record the exposures of the remedial-action workers to radiation in the work environment.

During the remedial action reports that present and discuss the results of the occupational and environmental monitoring programs and provide recommendations for modifications to the monitoring plan would be prepared. These reports and supporting documentation would be on file with the DOE and the Commonwealth, and would be available to the public.

F.4.2 Environmental monitoring

The monitoring program would include systems designed to detect minute levels of radioactivity that may be transported by air or water. The parameters to be monitored may include airborne particulates, radon gas, short-lived radon daughters, and radionuclides in surface and ground water. The samples may be analyzed for gross radioactivity levels and specific radionuclides of interest (e.g., Th-230, Ra-226, Ra-222, Pb-210, and Po-210).

Monitoring locations would be selected to fully characterize the site and surrounding environs during remedial action. It is anticipated that locations would be chosen that are representative of background and downwind (or downgradient) conditions, and are also representative of areas where exposures may be unusually elevated because of the proximity to the site. Other locations of particular concern to the local population, such as nearby schools, would also be monitored.

The details of the environmental monitoring program are under development (see Section 1.6) and would be subject to review and approval by the NRC and the Commonwealth, and would be available to the public.

F.4.3 Occupational monitoring

Although the potential hazards are very low, occupational monitoring would be employed to measure and record the exposure of workers to radiation in the work environment. Occasionally, excessive contamination could be detected and would have to be removed to prevent dispersal of radioactively contaminated materials to uncontrolled areas, and to minimize radioactive exposure to all personnel. Therefore, employees who are in contact with tailings during their work shift must be monitored before leaving the restricted area.

In addition, as vehicles and equipment are used in the restricted area, radioactive material is expected to accumulate on all surfaces in contact with the wastes. Instrument surveys and decontamination procedures will ensure that radioactive materials are not transported to uncontrolled areas.

Protocols for monitoring personnel and equipment, and decontamination procedures are under preparation (see Section 1.6) and would be included in the remedial action plan. To be included in the protocols are provisions for the following:

1. Instrumentation.
2. Methods of monitoring.
3. Limits of contamination.
4. Decontamination procedures.
5. Emergency procedures.

F.4.4 Surveillance and maintenance program

The long-term surveillance and maintenance program would be designed to ensure that the final site remains undisturbed and continues to function as designed. At this time, it is anticipated that surveillance would be conducted on a specific schedule (e.g., annually) for the first 5 years post-construction and less frequently thereafter if no problems are encountered. Inspections would also be conducted immediately upon completion of maintenance activities. Surveillance could consist of a walkover with photographic documentation of the cover, fencing, placards, side slopes, and maintenance efforts. Emphasis would be placed on erosion-protection features, cover and fence integrity, and other engineered features (e.g., diversion channels and vegetation).

Ground water would also be sampled for a variety of constituents. The final location of the wells and the frequency of sampling would be selected to ensure the effectiveness of the design. Although worst-case analyses indicate that the most mobile radionuclide would not migrate through the cell for more than 1000 years and then only in low concentrations (see subsection 5.6.2 and Appendix D.2), it is anticipated that two monitoring well fields would be established. One field of shallow wells would be installed immediately upgradient (south and west) and downgradient (north and east) of the encapsulation cell. The second field would be installed (shallow and deep wells) on the expanded Canonsburg site along Chartiers Creek (northeast and east). Given the existing shallow ground-water flow in the vicinity of the encapsulation cell (west-to-east), the expected decrease in water-table elevations in Areas A and B, and the predicted rate of radionuclide migration, the described well fields would be able to monitor the effectiveness of the disposal site and the encapsulation cell, as well as decreases in concentration of already-dissolved constituents in the ground water in Areas B and C.

Maintenance activities could consist primarily of the following:

1. Soil and rock replacement because of erosion, human intrusion, and cover disturbance (e.g., cracking, settlement, drying).

2. Vegetation maintenance such as mowing, reseeding, mulching, and the use of fertilizers or temporary irrigation.

3. Mechanical repairs to security fences, gates and locks, warning signs, and wells.

Reports and supporting documentation that discuss the results of the surveillance activities and recommend needed maintenance actions and future surveillance would be prepared and placed on file with the DOE, the NRC, and the Commonwealth. These documents would be available to the public.

Appendix F.5

RADIOLOGICAL SAFETY PLANNING

Appendix F.5

RADIOLOGICAL SAFETY PLANNING

F.5.1 Introduction

The radiation levels present on the Canonsburg site are relatively low and present no imminent hazard; however, in order to be conservative and protect the public, a health and safety plan for the protection of employees, subcontractor personnel, and the general public would be developed as part of the remedial action plan (see Section 1.6). This health and safety plan would include policies and procedures to ensure compliance with applicable state and Federal radiation protection criteria, regulations, and guidelines.

F.5.2 Employee training

The health and safety plan would initially require all personnel to attend an orientation session where they would be instructed in the following:

1. Potential hazards associated with the job.

2. Measures that could and would be taken to ameliorate these hazards.

3. Purpose and types of radiation monitoring that would be performed.

4. Individual and collective responsibilities in worker and radiation safety and accident prevention.

5. Specific safety procedures that would be followed include the following:

   a. Description of the entry and exit procedures.
   b. Dosimetry.
   c. Special clothing.
   d. Use of the employees' change facilities.

The purpose would be to instruct employees concerning potential hazards, to make them aware that safety procedures, although at times burdensome, have been established for their protection and that of the public, and that they should maximize the use of these procedures and minimize exposure. It would be impressed on all personnel that deviations from the health and safety plan are cause for their dismissal.

F.5.3 Safety equipment and exposure monitoring

In order to properly implement the health and safety plan, all workers would have to wear radiation dosimeters at all times when on the job site. This step would be necessary in order to evaluate any potential radiation exposure, which by design, would be kept as low as reasonably achievable. Personnel would also be required to adhere to all applicable protection criteria and guidelines in order to minimize potential accidents. Appropriate local, Commonwealth, and Federal officials would be notified if there was a significant accidental release of radioactively contaminated materials.

Personnel radiation exposure and accident potential on the job site would be minimized by having all employees report to the change facility where they would be issued apppropriate protective clothing prior to entering the job site. They would then report to their specific job locations. Any time personnel leave the site, or at the end of the work day, they must report to the change facility, return all protective clothing, and be monitored for possible radiation contamination.

Radiation exposure of the offsite general public would be prevented by monitoring and cleaning all equipment prior to its leaving the job site. Exposure would also be prevented by conducting the operation in such a manner that mitigates the spread of contaminated materials off the site. This operation would include stopping all work or providing other mitigation measures under the environmental monitoring program or the personnel and workplace monitoring programs under adverse environmental conditions if levels of radioactivity in excess of specified limits were detected leaving the site.

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Appendix G

LAND USE, POPULATION, AND SOCIOECONOMICS

Appendix G

LAND USE, POPULATION, AND SOCIOECONOMICS

G.1 INTRODUCTION

This appendix contains a description of the socioeconomic surveys performed in the Canonsburg, Burrell, and Hanover site areas, and survey results and baseline data used in preparing Sections 4.9, 4.11, and 4.12. This supporting material is presented in the order in which it is discussed in the main text.

G.2 SOCIOECONOMIC ELEMENT

G.2.1 Canonsburg site

The socioeconomic work element for this study was developed through the steps discussed in the paragraphs that follow.

G.2.1.1 Step 1: Data review -- baseline information gathering

Under this step the Canonsburg site and the communities within the 1-mile radius and the 5-mile radius of the Canonsburg site were identified on U.S. Geological Survey (USGS) quads. The municipalities within the 1-mile radius of the Canonsburg site and within Washington County, in which the Canonsburg site is located, were contacted by telephone calls, letters, and visits to the municipal and county offices and real-estate agencies to collect baseline information on socioeconomic, land-use, and transportation-related data. The information collected included the following:

1. Local and county land-use studies and comprehensive plans.
2. Local area population distribution and projections.
3. Employment locations.
4. Municipal zoning and subdivision regulations.
5. Recreational studies.
6. Traffic patterns and transportation networks.
7. Community facilities and utility services.
8. Tax structure and revenue sources.

Commonwealth and Federal agencies were contacted for transportation, population, and historical and archaeological information.

From a preliminary review of the available data, it was concluded that there was a need for a socioeconomic door-to-door survey covering the 1-mile radius area of the Canonsburg site, especially to estimate the current population, and their type of employment, outdoor activities, food habits, etc.

G.2.1.2 Step 2: Conduct detailed field surveys

The data collected under step 1 were updated or supplemented by conducting a windshield survey within the 1-mile radius analysis area of the Canonsburg site. This windshield survey helped in organizing the door-to-door socioeconomic survey conducted during the week of September 24, 1979.

In preparation for the door-to-door socioeconomic survey, a two-page questionnaire with 28 related items was prepared, and given approval by the DOE UMTRA Project Office. (A copy of this questionnaire follows.) Local municipalities were contacted by telephone and by letter requesting their cooperation with the survey team. The local residents were also informed of the survey through press releases to local newspapers.

The survey team consisted of four persons led by a Weston senior staff person (a certified planner). After a reconnaissance survey of the 1-mile radius area of the Canonsburg site, each team member took a different street, and visited every fourth house on either side of the street within the one-quarter-mile radius area of the Canonsburg site, every eighth house within the one-quarter to one-half-mile zone of the Canonsburg site, and every fifteenth house within the one-half to 1-mile zone of the Canonsburg site. The homes visited were identified on a master map; comparisons were made at regular intervals to avoid duplication of survey effort. The survey covered more than 10 percent of the households within the 1-mile radius area of the Canonsburg site. The major types of data obtained from the survey included the following:

1. Population living in each sector and within the three zones; up to one-quarter mile, one-half mile, and 1-mile from the Canonsburg site.

2. Age distribution.

3. Employment location.

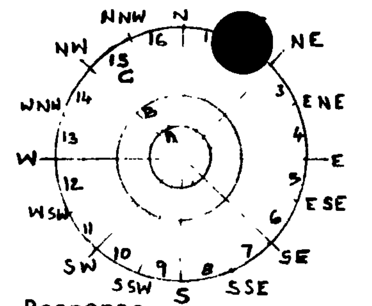
4. Family income.

5. Time spent in outdoor activities.

6. Produce raised in vegetable gardens, and use of area wells.

7. Ethnic background of the population.

Contacts were made with local municipalities and regional, Commonwealth, and Federal agencies to supplement or update the data collected under step 1.



SOCIOECONOMIC SURVEY

QUESTIONNAIRE

Response

1. Street Address . . . . Municipality . . . .
2. Previous Address . . . . Municipality . . . .
3. Duration of stay at the Present Address (No. of years)
   (A) 0-2 (B) 2-5 (C) 5-10 (D) 10-20 (E) >20 3
4. Type of Home:
   (A) Single Family (B) Apartment (C) Town House (D) Duplex/Twin (E) Other 4
5. Number of persons presently living at this address 5
6. Age/Sex Distribution of Occupants:

	< 0-1	< 1-5	< 5-11	< 11-17	< 17-40	< 40-65	65 and >
Male							
Female							

7. Estimate of time (hours/day) spent at home:

Male							
Female							

8. Number of employed persons: (A) 1 (B) 2 (C) 3 (D) >3 8
9. Place of Employment:
   (A) Canonsburg/Houston (B) North Strabane (C) Chartiers (D) Cicil/Peters
   (E) South Strabane (F) Washington/Pittsburgh (G) Other 9
10. Distance to work (miles): (A) <1 (B) 1-2 (C) 2-5 (D) >5 10
11. Mode of Travel: (A) Car (B) Bus (C) Walk (D) Other 11
12. Type of Occupation (such as Teacher, Executive, Clerical, Coal Miner, etc.) 12
13. Duration of Work (Hours Per Week):
    (A) 0-20 (B) 20-40 (C) 40-60 (D) 60-80 (E) >80 13
14. Number of Working Hours spent in the Open:
    (A) None (B) 0-20 (C) 20-40 (D) 40-60 (E) 60-80 (F) >80 14

(Note: If response to Question 8 is other than (A), complete for (B) and (C) similar to that of (A)).

15. Did you ever work at Canon Industrial Park? (A) Yes (B) No 15
16. If yes, When? (A) At present, since 19 . .
    (B) During 19 . . to 19 . . Period 16
17. Annual family income ($1,000):
    (A) <5 (B) 5-10 (C) 10-15 (D) 15-25 (E) >25 17

SOCIOECONOMIC SURVEY
QUESTIONNAIRE (CONTINUED)

Response

18. Outdoor activities of members of household:
    (A) Hiking (B) Biking (C) Swimming (D) Gardening (E) Other 18

19. Use of Chartiers Creek for:
    (A) Fishing (B) Boating (C) Swimming (D) Other 19

20. Did/do your children play in/around Canon Industrial Park?
    (A) Yes (B) No 20

21. If yes, 1. When? (A) At present (B) Previously 21.1
    2. For how long? (hours/day)
    (A) <2 (B) 2-5 (C) >5 hours 21.2

22. Transient use of Canon Industrial Park and vicinity:
    (A) Regular (B) Occasional (C) Seldom 22

23. If (A) Regular, purpose of such use:
    (A) Drive thru (B) Hike (C) Walk (D) Other 23

24. Use of backyard/frontyard of your home:
    (A) Recreational (B) Vegetable garden (C) Other 24

25. If you have a vegetable garden,
    1. Type of products:
       (A) Leafy vegetables (lettuce, spinach, cabbage, . . .
       (B) Root variety (carrots, beats, potatoes, onions, radishes, . . .
       (C) Others (beans, cauliflower, tomato, peas, ... 25.1
    2. Use of garden products: (A) Home Consumption (B) Sale (C) Friends/Relatives 25.2
    3. Duration of consumption: (A) Seasonal (B) Year-round 25.3
    4. Vegetable produced from the garden and used for home consumption as percent of total required vegetable diet for the season/year.
       (A) <25 (B) 25-50 (C) 50-75 (D) 75-100 . . . . 25.4
    5. If sold/given away, to: (A) Neighbor (B) General area (C) Outside 25.5
    6. Method of preservation, if applicable. 25.6
    7. Do you use surface or groundwater for your garden? (A) Yes (B) No 25.7
    8. If yes, which? (A) surface water (B) Groundwater (C) Other 25.8
    9. Is there any other home-grown products?
       (A) None (B) Milk (C) Egg (D) Meat (E) Fruit (F) Other 25.9

26. Do you have an on-site well? (A) Yes (B) No 26

27. If yes, 1. Depth of the well (ft.) 27.1
    2. Depth of the casing of the well (ft.) 27.2

28. Ethnic background of the household. 28

Survey conducted by Roy F. Weston, Inc., West Chester, Pennsylvania, as supplemental data for the preparation of the Environmental Impact Statement for the Canon Industrial Park vicinity, Canonsburg in Washington County, PA, September 1979

G.2.1.3 Step 3: Baseline data documentation and impact assessment

The data collected in steps 1 and 2 were analyzed and documented in the format specified by the DOE (U.S. DOE, 1981). The impacts of the remedial-action alternatives on the socioeconomic setting of the Canonsburg site were determined and documented in accordance with the guidelines (U.S. DOE, 1981). The major items considered were the following:

1. Loss of employment at the Canon Industrial Park.

2. Temporary employment during the remedial action period.

3. Potential for new employment and economic growth after the cleanup effort is completed.

4. Changes in the tax base of the Canonsburg site and the vicinity properties, including their market values.

5. Effect on the residential communities in the vicinity of the Canonsburg site.

6. Effect on community services including schools, hospitals, utilities, police and fire, and recreation from changes in the number of users.

7. Effect on the local streets and their users during and after the completion of the project.

G.2.2 Burrell site

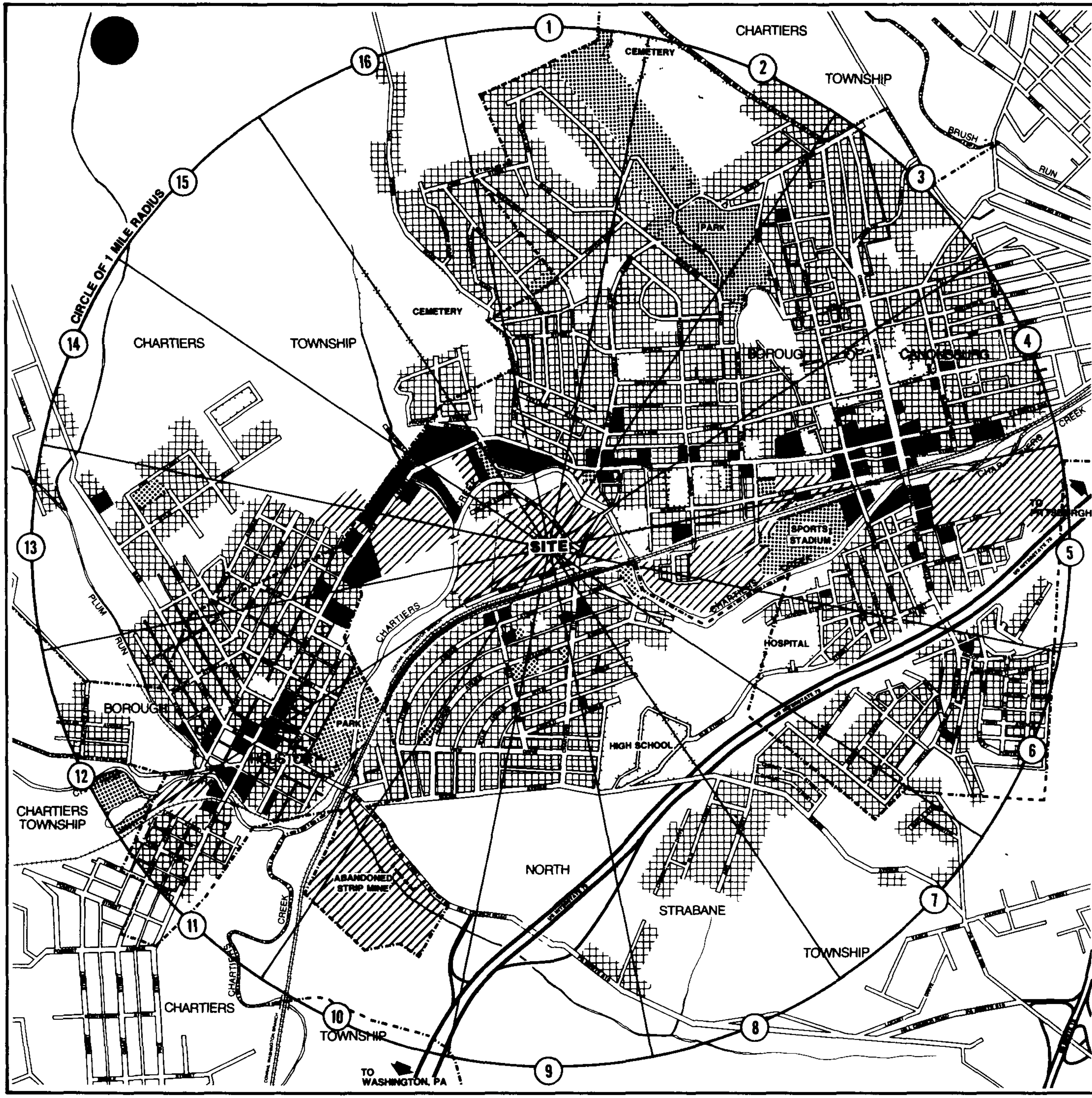
Except for the door-to-door socioeconomic survey, all of the steps used for the Canonsburg site were also used for the Burrell site to prepare the baseline socioeconomic setting and impact assessment. The study-area communities were determined and identified on the USGS quads using aerial photographs of the area obtained from the U.S. Army Corps of Engineers' (COE) office associated with the Conemaugh Reservoir project.

The 1-mile radius analysis area of the Burrell site included parts of Burrell Township and Blairsville Borough in Indiana County and Derry Township in Westmoreland County. Most of the baseline data were collected through contacts and visits to the respective municipal and county agencies. The local area population distribution and land-use data were collected through a series of windshield surveys conducted by Weston personnel and assisted by the local municipal authorities. In addition, meetings were held on several occasions with representatives of the associated municipalities and the Torrance State Hospital, located approximately 1 mile south of the Burrell site.

G.2.3 Hanover site

Much of the information on the Hanover site and its vicinity was obtained through a review of aerial photographs, and contacts with Washington County and Hanover and Jefferson Township officials. In addition, local real-estate agencies and Commonwealth and Federal agencies were contacted for data on the economic growth potential of the Hanover site and its vicinity, and the transportation network in the general area connecting the Hanover site with the Canonsburg and Burrell sites.

A field reconnaissance survey was conducted to identify the land uses and population distribution within the 1-mile radius of the Hanover site. The baseline information and impact assessment were documented in a manner similar to that done for the Canonsburg site.



NORTH

400 200 100 0 400 800 1200

SCALE IN FEET

RESIDENTIAL (EXCLUDING RURAL)

COMMERCIAL

INDUSTRIAL (INCLUDED MINERAL EXTRACTION)

PUBLIC/SEMI-PUBLIC (INCLUDING GOVERNMENT BUILDING SCHOOLS CHURCHES HOSPITALS AND CEMETERIES)

RECREATIONAL (PUBLICLY OR PRIVATELY OWNED)

OPEN/UNDEVELOPED (INCLUDING AGRICULTURAL WOODS RURAL RESIDENTIAL WATER AND TRANSPORTATION)

BOROUGH AND TOWNSHIP BOUNDARIES

SECTORS USED IN ANALYSIS OF DOOR TO DOOR SURVEY

SOURCES
1 LAND USES — DOOR TO DOOR SOCIOECONOMIC SURVEY SEPTEMBER 1979 AND WINDSHIELD SURVEY FEBRUARY 1982
2 MAP FROM BOROUGH AND TOWNSHIP MAPS CHECKED AGAINST PENNDOT COUNTY MAP (WASHINGTON CO — 1976) AND USGS 7½ MIN QUADS (PHOTO REVISED TO 1969)

FIGURE G-1
EXISTING LAND USES — 1980, IN THE VICINITY OF THE CANONSBURG SITE

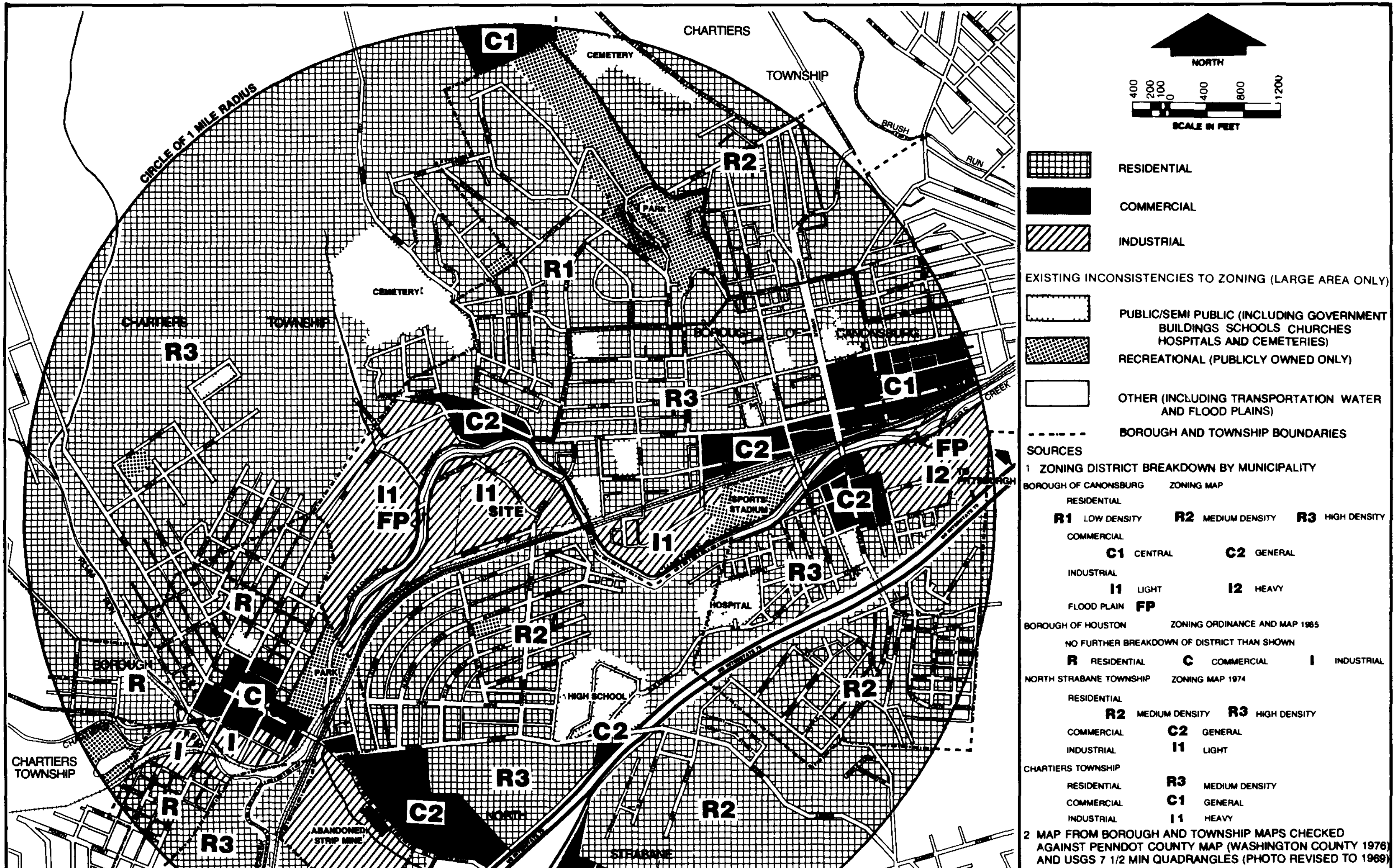
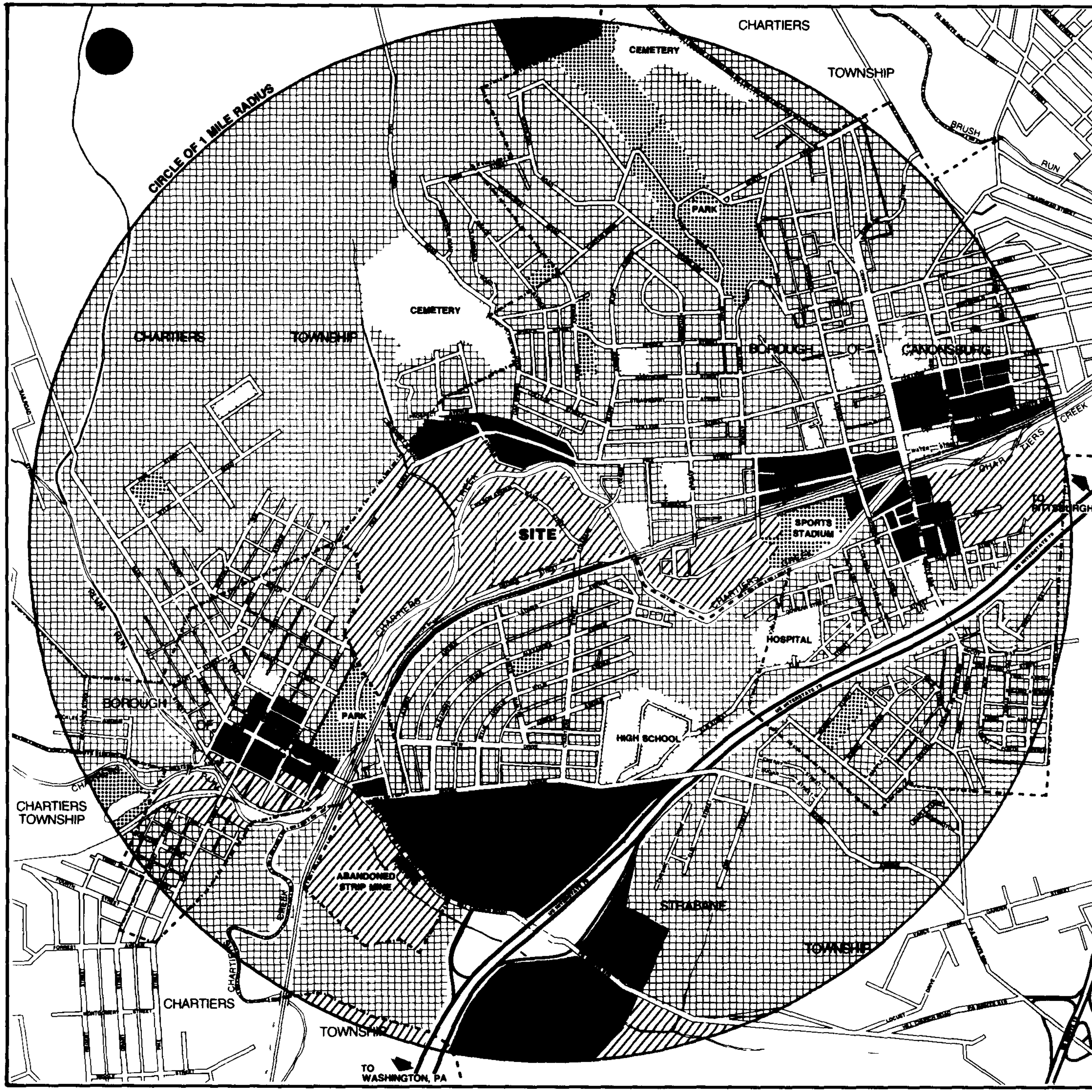


FIGURE G-2
LAND USE ZONING IN THE VICINITY OF THE CANONSBURG SITE



NORTH

400 200 100 0 400 800 1200

SCALE IN FEET

RESIDENTIAL (INCLUSIVE OF ALL DENSITIES)

COMMERCIAL

INDUSTRIAL

PUBLIC/SEMI-PUBLIC (INCLUDING GOVERNMENT BUILDINGS SCHOOLS CHURCHES HOSPITALS AND CEMETERIES)

RECREATIONAL (PUBLICLY OWNED ONLY)

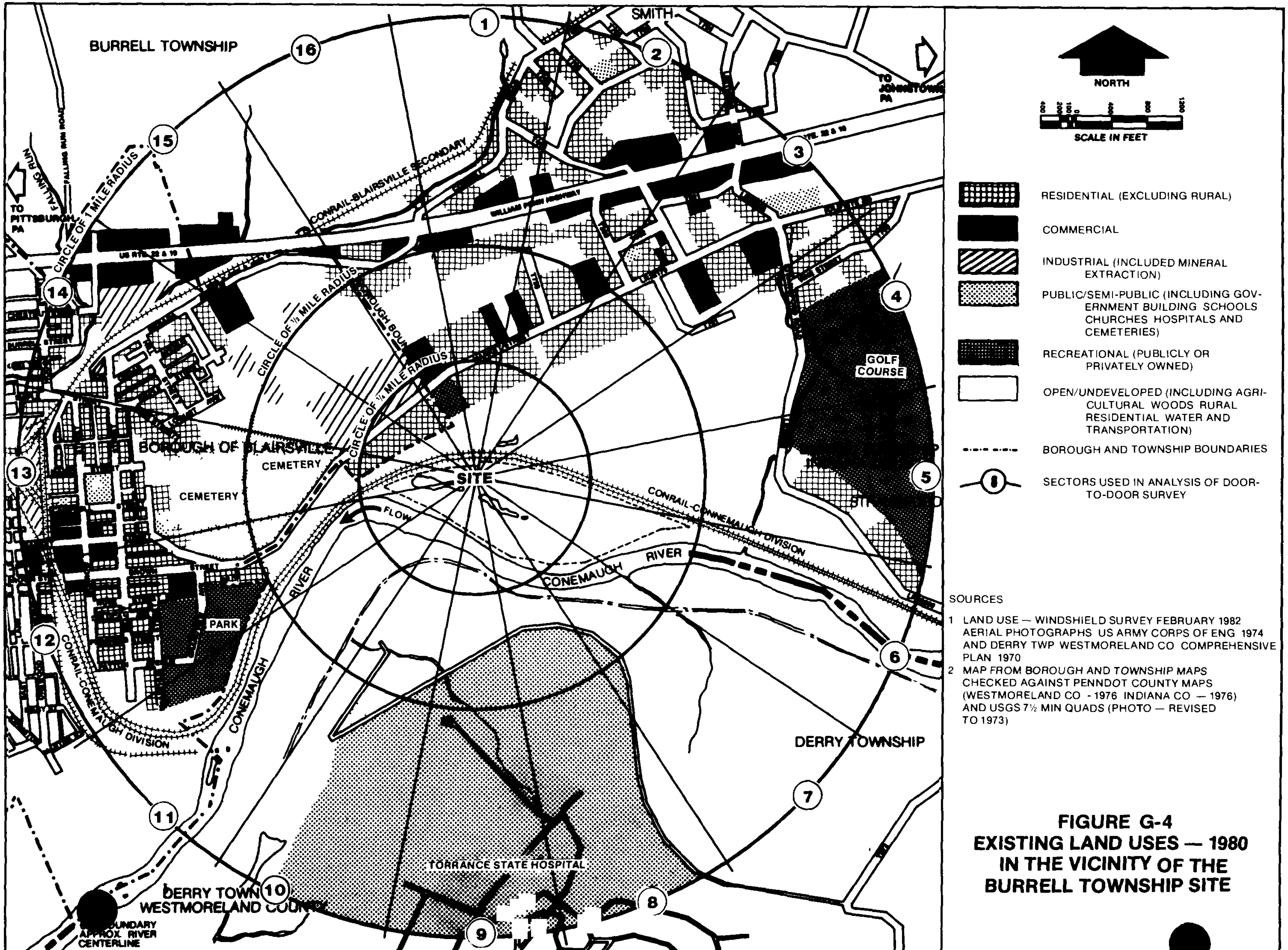
OTHER (INCLUDING TRANSPORTATION WATER AND FLOOD PLAIN)

BOROUGH AND TOWNSHIP BOUNDARIES

SOURCES

1 BOROUGH OF CANONSBURG COMPREHENSIVE PLAN 1971
  BOROUGH OF HOUSTON (NO COMPREHENSIVE PLAN USE OF ZONING)
  NORTH STRABANE TOWNSHIP COMPREHENSIVE PLANNING PROGRAM PARK AND RECREATION PLAN 1977
  CHARTIERS TOWNSHIP MASTER PLAN 1974
2 MAP FROM BOROUGH AND TOWNSHIP MAPS CHECKED AGAINST PENNDOT COUNTY MAP (WASHINGTON COUNTY 1976) AND USGS 7 1/2 MIN QUADRANGLES (PHOTO-REVISED TO 1969)

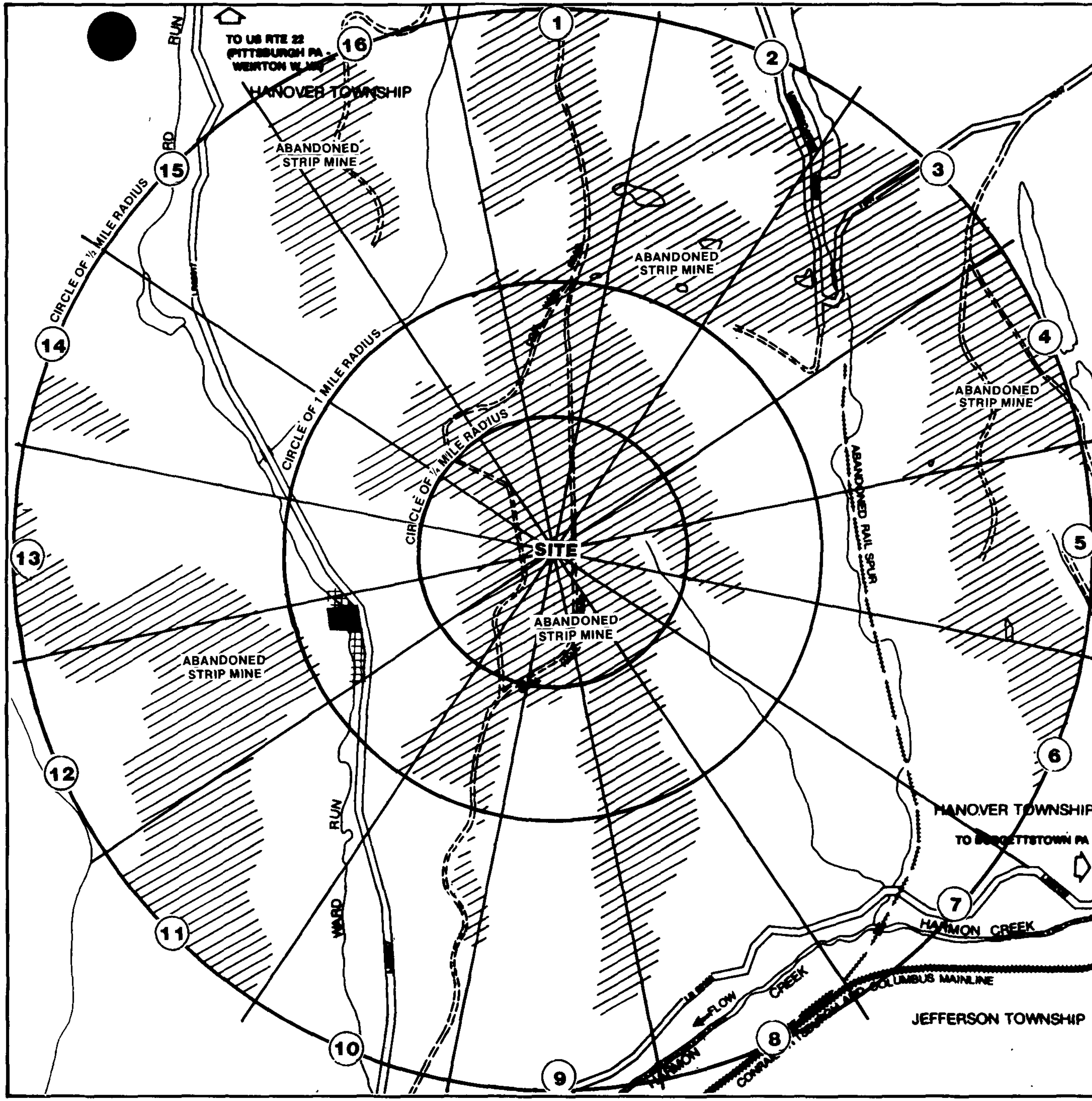
FIGURE G-3
FUTURE LAND USE PLAN IN THE VICINITY OF THE CANONSBURG SITE



SOURCES

1 LAND USE — WINDSHIELD SURVEY FEBRUARY 1982 AERIAL PHOTOGRAPHS US ARMY CORPS OF ENG 1974 AND DERRY TWP WESTMORELAND CO COMPREHENSIVE PLAN 1970
2 MAP FROM BOROUGH AND TOWNSHIP MAPS CHECKED AGAINST PENNDOT COUNTY MAPS (WESTMORELAND CO - 1976 INDIANA CO — 1976) AND USGS 7½ MIN QUADS (PHOTO — REVISED TO 1973)

FIGURE G-4
EXISTING LAND USES — 1980 IN THE VICINITY OF THE BURRELL TOWNSHIP SITE



NORTH

SCALE IN FEET

RESIDENTIAL (EXCLUDING RURAL)

COMMERCIAL

INDUSTRIAL (INCLUDED MINERAL EXTRACTION)

PUBLIC/SEMI-PUBLIC (INCLUDING GOVERNMENT BUILDING, SCHOOLS, CHURCHES, HOSPITALS AND CEMETERIES)

RECREATIONAL (PUBLICLY OR PRIVATELY OWNED)

OPEN/UNDEVELOPED (INCLUDING AGRICULTURAL WOODS, RURAL RESIDENTIAL, WATER AND TRANSPORTATION)

TOWNSHIP BOUNDARIES

SECTORS USED IN ANALYSIS OF DOOR-TO-DOOR SURVEY

SOURCES

1 LAND USE — WINDSHIELD SURVEY FEBRUARY 1982 AND AERIAL PHOTOGRAPHS 1967 AND 1980
2 MAP FROM TOWNSHIP MAPS CHECKED AGAINST PENNDOT COUNTY MAP (WASHINGTON CO — 1976) AND USGS 7½ MIN QUADS (PHOTO — REVISED TO 1979)

FIGURE G-5
EXISTING LAND USES — 1980 IN THE VICINITY OF THE HANOVER TOWNSHIP SITE

(15) SECTORS USED IN ANALYSIS OF DOOR-TO-DOOR SURVEY

POPULATION BY SECTOR

1 ¼ MILE RADIUS DIVISION

1 ¼ TO ½ MILE RADIUS DIVISION

1 ½ TO 1 MILE RADIUS DIVISION

-·-·-·- BOROUGH AND TOWNSHIP BOUNDARIES

SOURCES

1 *POPULATION- DOOR TO DOOR SOCIOECONOMIC SURVEY, SEPTEMBER 1979, AND WINDSHIELD SURVEY, FEBRUARY 1982*
2 MAP FROM BOROUGH AND TOWNSHIP MAPS CHECKED AGAINST PENNDOT COUNTY MAP (WASHINGTON CO — 1976) AND USGS 7½ MIN QUADS (PHOTO-REVISED TO 1969)

FIGURE G-6
POPULATION DISTRIBUTION – - 1980, IN THE VICINITY OF THE CANONSBURG SITE

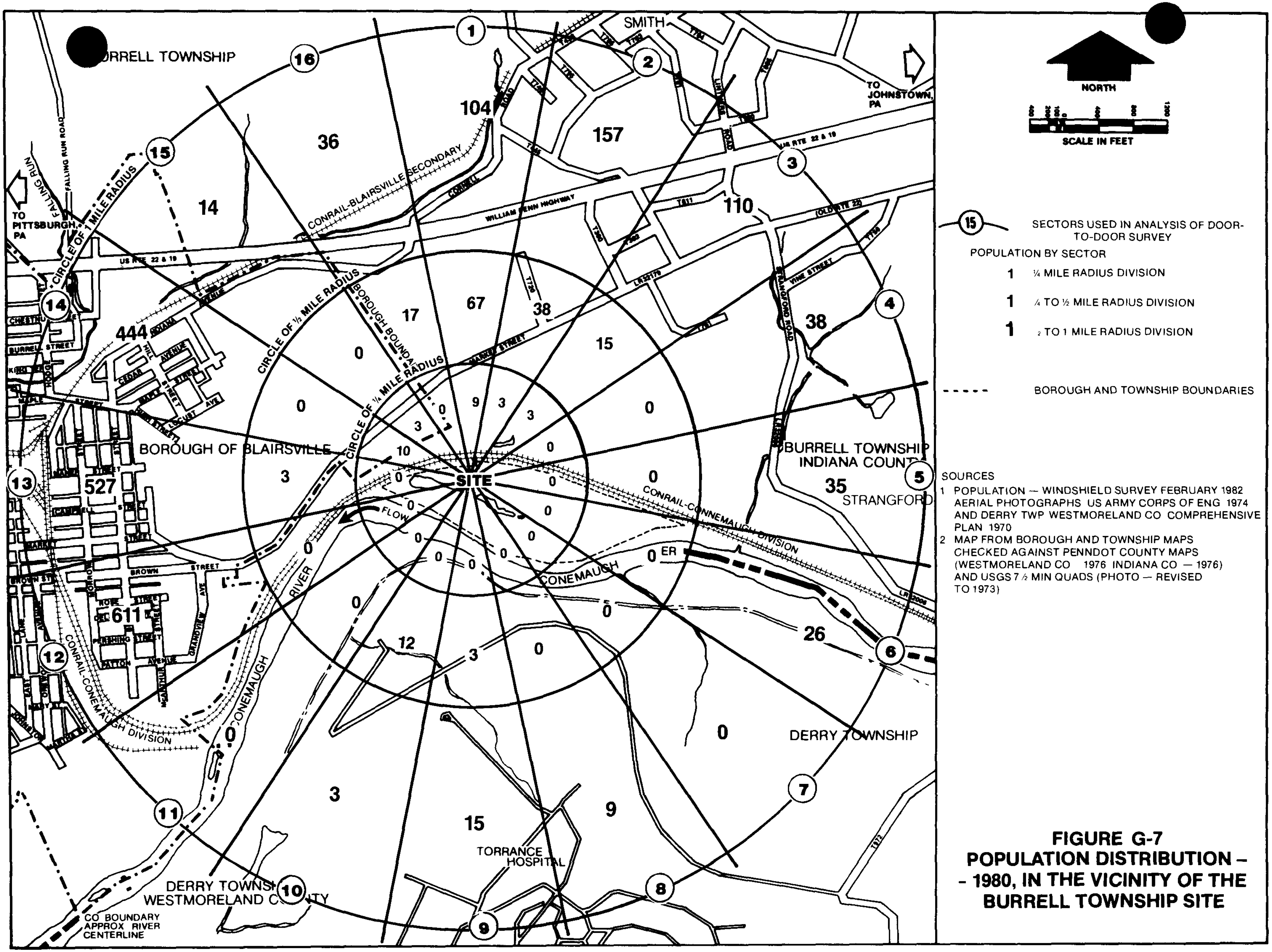


FIGURE G-7
POPULATION DISTRIBUTION – 1980, IN THE VICINITY OF THE BURRELL TOWNSHIP SITE

Table G-1. Generalized land uses (1980) -- Canonsburg site vicinity

Land-use category	Distance from site (miles) 0 - 1/4 Acres	% of Total	1/4 - 1/2 Acres	% of Total	1/2 - 1 Acres	% of Total	Total Acres	% of Total
Residential (excluding rural)	32	25.4	112	29.7	390	25.9	534	26.6
Commercial	9	7.1	19	5.0	20	1.3	48	2.4
Industrial	33	26.2	23	6.1	60	4.0	116	5.8
Public/semi-public	5	4.0	44	11.7	50	3.3	99	4.9
Recreational	4	3.2	14	3.7	40	2.7	58	2.9
Open, undeveloped	43	34.1	165	43.8	947	62.8	1155	57.4
Total	126	100.0	377	100.0	1507	100.0	2010	100.0

Notes: Refer to Figure G-1.
Industrial -- Also includes quarries and strip-mining areas.
Public/semi-public -- Includes government buildings, schools, churches, hospitals, and cemeteries.
Recreational-(public or private) -- Parks, etc., including halls, clubs, bowling alleys, and open spaces.
Open/undeveloped -- Agricultural, rural-residential, woods, water bodies, and transportation networks.

Sources: USGS quads; socioeconomic survey, September 1979; site visits, April and July 1981, January 1982; reviews of community data and reports.

Table G-2. Generalized land uses (1982) -- Burrell site vicinity

Land-use category	Distance from site (miles) 0 - 1/4 Acres	% of Total	1/4 - 1/2 Acres	% of Total	1/2 - 1 Acres	% of Total	Total Acres	% of Total
Residential (excluding rural)	13	10.3	26	6.9	166	11.0	205	10.2
Commercial	1	0.8	2	0.5	77	5.1	80	4.0
Industrial	3	2.4	38	10.1	23	1.5	64	3.2
Public/semi-public	0	0	57	15.1	274	18.2	331	16.5
Recreational	1	0.8	2	0.5	112	7.4	115	5.7
Open, undeveloped	108	85.7	252	66.9	855	56.8	1215	60.4
Total	126	100.0	377	100.0	1507	100.0	2010	100.0

Notes: Refer to Figure G-4.
Industrial -- Also includes quarries and strip-mining areas.
Public/semi-public -- Includes government buildings, schools, churches, hospitals, and cemeteries.
Recreational-(public or private) -- Parks, etc., including golf courses, halls, clubs, and open spaces.
Open/undeveloped -- Agricultural, rural-residential, woods, water bodies, and transportation.

Sources: USGS quads; site visits, April and July 1981, January 1982; reviews of community data and reports; meetings with representatives of municipalities and institutions.

Table G-3. Generalized land uses (1982) -- Hanover site vicinity

Land-use category	Distance from site (miles) 0 - 1/4 Acres	% of Total	1/4 - 1/2 Acres	% of Total	1/2 - 1 Acres	% of Total	Total Acres	% of Total
Residential (excluding rural)								
Commercial	0		2	0.5	0		2	0.1
Industrial	100	79.4	173	45.9	523	34.7	796	39.6
Public/semi-public	0		0		0		0	
Recreational	0		0		0		0	
Open, undeveloped	26	20.6	202	53.6	984	65.3	1212	60.3
Total	126	100.0	377	100.0	1507	100.0	2010	100.0

Notes: Refer to Figure G-5.
Industrial -- Also includes quarries and strip-mining areas.
Open/undeveloped also includes rural-residential, agricultural, water bodies, and transportation.

Sources: USGS quads; site visit, January 1982; review of community data and reports; and contact with representatives of county and municipal agencies.

Table G-4. Structures of historical interest located in the general vicinity of the sites

Structure/location	Date
<u>Canonsburg site</u>	
Black Horse Tavern North Central Avenue, Canonsburg A favorite rendezvous for the Whiskey Insurrectionists	1790
John Hegarty House Houston	1805
Hill Church Route 19, North Strabane Township	1776
Jefferson Academy (old Jefferson College Building) North Central Avenue, Canonsburg	1780
Pittsburgh National Bank Pike and Central Streets	1850
Polish National Church College Street	Early 20th century
Quail House Route 19, Canonsburg	1832
St. John's Russian Orthodox Church Vine Street, Canonsburg	1918
St. Michael's Byzantine Catholic Church East College Street	1949
Tenement House Pike Street, Canonsburg	1840
<u>Burrell site</u>	
None	
<u>Hanover site</u>	
Florence Academy Old Route 22	1833
Phillips House Route 538, Kings Creek Road	1820
Smith, Della House Route 352, Burgettstown	1820
Tucker Methodist Episcopal Church Route 22, 2 miles west of Florence	1824
Wallace House Route 18 North	

Source: Washington County Planning Commission (1979a).

Table G-5. Population distribution by direction (1980) -- Canonsburg site vicinity

Sector	Direction	Population at distance from site (miles) 0-1/4	1/4-1/2	1/2-1	Total
1	N	41	233	479	753
2	NNE	28	258	274	560
3	NE	28	376	650	1054
4	ENE	34	218	399	651
5	E	46	15	507	568
6	ESE	18	50	750	818
7	SE	85	9	245	339
8	SSE	89	57	125	271
9	S	81	191	15	287
10	SSW	65	212	28	305
11	SW	50	112	359	521
12	WSW	0	107	661	768
13	W	0	129	564	693
14	WNW	9	0	61	70
15	NW	16	22	0	38
16	NNW	12	47	183	242
	Total	602	2036	5300	7938

Sources: Socioeconomic survey, September 1979; U.S. Bureau of the Census, 1980 census advance counts.

Table G-6. Age and sex characteristics (1980) -- Canonsburg site vicinity

Age group	Percent distribution Male	Female	Total
Less than 1 year	2.4	0.6	1.5
1 to 5 years	3.8	3.5	3.6
5 to 11	8.0	10.1	9.0
11 to 17	12.4	12.1	12.3
17 to 40	29.2	29.2	29.2
40 to 65	31.6	28.4	30.0
65 and over	12.6	16.1	14.4
Total	100.0	100.0	100.0

Source: Socioeconomic survey, September 1979; U.S. Bureau of the Census, 1980 census advance counts.

Table G-7. Historical and future populations of municipalities -- Canonsburg site vicinity

Municipality	Historical[a] 1960	1970	1980	Projected[b] 1990	2000
Canonsburg Borough	17,877	11,439	10,459	10,212	9,814
Houston Borough	1,865	1,812	1,568	1,502	1,411
North Strabane Township	7,332	7,578	8,490	9,422	9,534
Chartiers Township	7,225	7,324	7,715	8,606	8,840

Sources:

[a]U.S. Bureau of the Census 1960 and 1970 censuses; 1980 census advance counts.

[b]Washington County Planning Commission (1981).

Table G-8. Historical and projected population distribution among municipalities within a 1-mile radius of the Canonsburg site

Municipality	Historical (1980) Population	Percent of total population	Land area (acres)	Population (persons/acre)	Projected (2000) Population
Canonsburg Borough	4481	56.4	794	5.64	4293
Houston Borough	1201	15.1	197	6.10	1081
North Strabane Township	1316	16.6	498	2.64	1478
Chartiers Township	940	11.9	521	1.80	1077
Total	7938	100.0	2010	3.95	7929

Sources: U.S. Bureau of the Census, 1980 census advance counts; Tables G-5 and G-7.

Table G-9. Population distribution by direction (1980) -- Burrell site vicinity

Sector	Direction	Population at distance from site (miles) 0-1/4	1/4-1/2	1/2-1	Total
1	N	9	67	104	180
2	NNE	3	38	157	198
3	NE	3	15	110	128
4	ENE	0	0	38	38
5	E	0	0	35	35
6	ESE	0	0	26	26
7	SE	0	0	0	0
8	SSE	0	0	9	9
9	S	0	3	15	18
10	SSW	0	12	3	15
11	SW	0	0	0	0
12	WSW	0	0	611	611
13	W	0	3	527	530
14	WNW	10	0	444	454
15	NW	3	0	14	17
16	NNW	0	17	36	53
	Total	28	155	2129	2312

Sources: Photo interpretation of 1974 COE aerial photographs; USGS quads for the area; U.S. Bureau of the Census, 1980 census advance counts; contacts with representatives of municipalities and institutions.

Table G-10. Historical and future populations of municipalities - Burrell site vicinity

Municipality	Historical[a] 1960	1970	1980	1980 population within 1-mile radius of site[b] Population	Percent of total population	Projected[c] 1990	2000
Blairsville Borough	4,930	4,411	4,166	1,636	70.8	4,126	4,640
Burrell Township	3,476	3,672	4,152	634	27.4	4,064	5,096
Derry Township	15,445	15,902	16,193	42	1.8	17,050	19,078
Total				2,312	100.0		

Sources:

[a]U.S. Bureau of the Census, 1960 and 1970 censuses; 1980 census advance counts.

[b]Table G-9, Figure G-7.

[c]Southeastern Pennsylvania Regional Planning Commission (1980).

Table G-11. Population distribution by direction (1982) -- Hanover site vicinity

Sector	Direction	Population at distance from site (miles)			
		0-1/4	1/4-1/2	1/2-1	Total
1	N	0	0	0	0
2	NNE	0	0	3	3
3	NE	0	0	6	6
4	ENE	0	0	0	0
5	E	0	0	0	0
6	ESE	0	0	0	0
7	SE	0	0	15	15
8	SSE	0	0	9	9
9	S	0	0	0	0
10	SSW	0	0	12	12
11	SW	0	0	12	12
12	WSW	0	9	0	9
13	W	0	0	0	0
14	WNW	0	0	6	6
15	NW	0	0	6	6
16	NNW	0	0	0	0
	Total	0	9	69	78

Sources: Site visit, January 1982; U.S. Bureau of the Census, 1980 census advance counts.

Table G-12. Historical and future populations of municipalities - Hanover site vicinity

Municipality	Historical[a] 1960	1970	1980	Projected[b] 1990	2000
Burgettstown Township		2118	1867	1803	1653
Hanover Township	2456	3016	3275	3411	3340
Jefferson Township		1301	1369	1435	1397
Smith Township		5812	5583	5746	5790

[a]U.S. Bureau of the Census, 1960 and 1970 censuses; 1980 census advance counts.

[b]Washington County Planning Commission (1981).

G.3 ECONOMIC STRUCTURE

This subsection presents the characteristics of the economic structure of the Canonsburg, Burrell, and Hanover site areas. Also included here is the information available at the county, municipal, and local levels. This subsection focuses on the basic economic resources and sources of income in Washington and Indiana Counties, Pennsylvania.

G.3.1 Canonsburg site

Canonsburg Borough is geographically situated on Interstate Highway 79, which links Washington, the county seat of Washington County, with Pittsburgh. In addition, Canonsburg is located north of Interstate Route 70, which ties into the Pennsylvania Turnpike at New Stanton, Pennsylvania, east of Canonsburg. As as result, Washington County and Canonsburg are significantly influenced by the Pittsburgh economy, as demonstrated by the easterly concentration of population and industry in Washington County.

In terms of land use, forest land covers 35 percent of Washington County, and crop and pasture land covers an additional 47 percent. Washington County produces agricultural products valued at $16 to 20 million annually (Washington County Planning Commission, 1979a). The dairy industry leads Washington County in agricultural sales, with earnings averaging more than $10 million, followed by meat animals ($3 million), poultry ($1.6 million), and field crops ($3.3 million). Most of the revenue produced by Washington County farms remains in the area as families purchase goods and services from local suppliers. In addition, there are more than 70 agriculture-related industries engaged in the manufacture of foods and associated products, with annual payrolls of more than $4 million.

The major industries in Washington County are coal mining and manufacturing. The total value of industrial production was estimated at $1.145 billion in 1976. Washington County leads all other counties in Pennsylvania in annual coal production and the amount of available coal reserves. More than 12.4 million tons of coal were mined during 1976; 11 million tons were taken from deep mines, and the remainder from strip mines. In 1976, 61 deep and strip mines were operating in Washington County with an average payroll estimated at more than $80 million. The associated support industries producing mining machinery and equipment have an estimated average payroll of over $12 million annually (Washington County Planning Commission, 1979a).

In 1976, manufacturing in Washington County was led by steel and primary metals with an annual payroll in excess of $84 million. The manufacture of electrical machinery was second with an annual payroll of over $45 million, and glass manufacturing equipment was third with a payroll of over $35 million.

Canonsburg Borough is a significant location for industrial activity in Washington County. At one time, the Canonsburg area (Chartiers and North Strabane Townships) was active in coal mining. Today the area surrounding Canonsburg Borough has many abandoned strip- and deep-mine sites, and is reported to be underlain with mineable coal and natural gas reserves (Kohl and Briggs, 1976; Wagner and Lytle, 1976; Washington County Planning Commission, 1979b). It is believed that no economically recoverable coal deposits lie beneath the Canonsburg site.

The economy of Canonsburg Borough and the surrounding area is typical of Washington County, supporting agriculture, coal mining, and primary metals. Industries are engaged in manufacturing mining machinery, steel fabrication and distribution, and food preparation and distribution. Machine shops and light-manufacturing high-technology operations are also evident.

G.3.2 Burrell site

The Burrell site can be reached from Pittsburgh by U.S. Highway 22, and is characterized by commercial and light industrial development. Indiana, the largest city in Indiana County, is located 10 miles north of the Burrell site in the central part of Indiana County.

In 1977, Indiana County produced more than 10.5 million tons of coal and ranked second to Washington County in total coal production in the western Pennsylvania 27-county region. Indiana County, with 54 percent of its area in forest land, is the leading producer of forest and maple products in the Commonwealth. Indiana County annually harvests more than 20 million Christmas trees. Indiana County also has a substantial deer population and derives additional income from deer hunting.

In 1976, an estimated 1445 farms in the Indiana County produced cash crops worth nearly $22.5 million. Approximately 71 percent of the total was derived from livestock products. The leading industry in Indiana County is manufacturing. The value of production during 1976 was $203.9 million, when Indiana County ranked 46th among the Commonwealth's 67 counties. In 1977, the value of production increased to $240.4 million, an increase of over 15 percent. The primary production activity in 1977 was in fabricated metal products, estimated at $67 million (28 percent), and nonelectrical machinery, estimated at $30.6 million (13 percent).

Indiana County offers numerous tourist attractions including four covered bridges, several museums, and state and local parks. In 1976, tourist-related revenue was estimated at $14.3 million; the tourist-related payroll was approximately $2.9 million.

Most of the industrial activity in Indiana County in 1977 was centered in Indiana Borough and White Township, located 15 miles north of Blairsville. There are 66 industrial establishments in Indiana County. Of these, 25 are located in Indiana Borough and White Township and in 1977 they accounted for 64 percent of Indiana County's wages and salaries, and 62 percent of its production value.

The area including Burrell Township and Blairsville is a secondary center of production and employment, as is Homer City. These centers are linked by U.S. Highways 119 and 22 and rail transportation to Indiana. These secondary centers account for the major portion of the remaining economic activity in Indiana County. There are three industrial firms in Burrell Township and nine in Blairsville. In 1977, these firms accounted for $3.5 million in wages and salaries, $24.0 million in production, and $9.2 million in manufacturing (Pennsylvania Department of Commerce, 1978).

G.3.3 Hanover site

In addition to the local and Washington County economies, the Hanover site area is influenced by the nearby communities of Weirton, West Virginia, and Steubenville, Ohio, and the significant steel manufacturing activity in these areas. For example, in Weirton, West Virginia, Weirton Steel (a division of National Steel) employs 12,500 people, and Wheeling-Pittsburgh Steel Corporation in Steubenville employs over 1,000 people. In Toronto, Ohio, the Titanium Metals Company provides employment for 750 to 1000 people (Weirton, West Virginia and Steubenville, Ohio, 1982).

In the Pittsburgh SMSA, one out of every ten employed persons works in the primary metals industry (Pennsylvania Department of Labor and Industry, 1979). In Hanover Township, this ratio is probably higher. In addition to the primary metals industries, coal, oil, and gas resources are located in Hanover Township. As a result, major portions of Hanover Township are owned by coal companies (i.e., Starvaggi and Bologna) and have been strip mined. Today, Hanover Township has many unreclaimed and abandoned strip and deep mines, as well as abandoned oil wells. Hanover Township is reported to have moderate to major mine pollution problems (Washington County Planning Commission, 1979b). The local economy is characterized by small machine and metal shops and by trucking and coal-related facilities.

The communities nearest the Hanover site are Burgettstown in Smith Township, Pennsylvania and Weirton, West Virginia. Due to its undeveloped rural setting, the Hanover site area is suited for outdoor recreation (Hillman State Park and State Game Lands No. 117 are located in the Hanover site area), but strip mine and chemical dump wastes limit this potential.

G.4 WORK FORCE

G.4.1 Canonsburg site

The total employment in the Canonsburg area can be determined from data for the Pittsburgh SMSA (including Washington, Allegheny, Beaver, and Westmoreland Counties). The total employment in December 1981, including the nonagricultural manufacturing and nonmanufacturing work forces, was approximately 934,900 persons (Pennsylvania Department of Labor and Industry, 1982; Wilson, 1982). Over the preceding year, employment declined by 22,200 from 957,100 employees, reflecting the effects of the 1981 economic recession. The 1981 Pittsburgh SMSA data show the following breakdown by major employer: industrial manufacturing -- 225,700 employees; services -- 215,800 employees; retail trade -- 163,100 employees; transportation -- 55,400 employees; wholesale trade -- 52,400 employees; construction -- 43,600 employees; and finance -- 45,100 employees.

During 1981 declines were reported in all categories except wholesale trade and construction.

In Washington County 336 industries and businesses were reported in 1980 (Washington County Board of County Commissioners, 1980). These firms employed 27,878 people. In December 1981, Washington County's resident civilian labor force was approximately 96,200 people (Pennsylvania Department of Labor and Industry, 1982; Wilson, 1982) with 87,700 employed, and approximately 60,000 working in firms located in Washington County. By category, the major employers in 1980 were: mining -- 5845 employees; steel -- 3956 employees; electronics -- 3323 employees; glass equipment -- 2385 employees; trucking -- 628 employees; and machine/job shops -- 1089 employees.

Steel manufacturing in Washington County and in West Virginia (e.g., Weirton Steel Co.) also provides major employment opportunities for Washington County residents. Between 1978 and 1980 industrial opportunities were fairly stable. The 1980 Industrial Directory of Washington County (Washington County Board of County Commissioners, 1980) lists 30 industries or businesses not listed in 1978, and deletes 30 industries or businesses that consolidated under a new name, went out of business, or moved.

In 1979, Washington County as a whole had a labor-force-participation rate of 41.8 percent (ratio of number of persons in the labor force to total population) in a total estimated population of 215,519 persons. Within the 1-mile radius of the Canonsburg site, however, the labor-force-participation rate was much lower because of the larger proportion of persons aged 65 years and over compared to that of the Pittsburgh SMSA. The high percentage of households remaining in their present locations for at least 20 years has indirectly contributed to the lowering of the labor-force-participation rate. Assuming a lower labor-force-participation rate (38.9 percent) for the Canonsburg site area, based on the Commonwealth's estimate of population and labor force for Washington County, the Canonsburg site area had a total labor force of 3088 people. By the year 2000, Washington County's labor-force-participation rate should be 40.9 percent, and the projected labor force within the 1-mile radius of the Canonsburg site should be 4107 people.

Employment data collected from the socioeconomic survey in September 1979 showed that about 34.4 percent of the total population in the Canonsburg site area were employed on either a full-time or part-time basis (equivalent to 2730 persons employed out of the total population of 7938 persons). Thus, the Canonsburg site area had an unemployment rate of nearly 11.6 percent (ratio of number of persons unemployed to the total labor force). For comparison, the unemployment rate for the Pittsburgh labor market area (Allegheny, Beaver, Washington, and Westmoreland Counties combined) in December 1981 was 8.2 percent (8.8 percent adjusted seasonally) (Pennsylvania Department of Labor and Industry, 1982) and 5.7 percent in 1978.

Between 1973 and 1980 mining employment experienced major growth in Washington County. Over this period mining employment increased from 3966 to 5845 people. This 47-percent increase reflects the expanded economic interest in western Pennsylvania coal, oil, and gas resources. The ten largest employers in Washington County in 1980 are given in Table G-13.

Table G-13. Ten largest employers in Washington County (1980)

Company	Municipal location	Employment
Wheeling-Pittsburgh Steel Co.	Allenport	2361
McGraw Edison Power Systems Division[a]	Canonsburg	2296
Bethlehem Mines Corp.	Eighty-four sites	1826
Consolidated Coal Co.[a]	Washington	1646
Corning Glass Works	Charleroi	1135
RCA Corp.[a, b]	Meadowlands	1001
U.S. Steel Co. (Frick Distributors Coal Operation)	New Eagle	934
Jessop Steel Co.[a]	Washington	920
Brockway Glass Co.[a]	Washington	900
Washington Steel Co.[a]	Washington	675

[a]Within the vicinity of the project sites.

[b]Facility under new ownership.

Source: Washington County Board of County Commissioners (1980).

The manufacturing employment statistics show that the 21 industries in Canonsburg employed 2828 persons. The major manufacturing employer was the McGraw-Edison Power Systems Division, employing 2296 persons. The nine industries in Houston employed 255 manufacturing workers. The industrial employment in North Strabane Township was 255 (seven firms), and the industrial employment in Chartiers Township was 1428 (11 firms). The most recent employment counts of major industrial firms are given in Table G-14. Employment in Canonsburg firms with more than 15 employees accounted for 3626 workers in 1980, and five firms in Houston with more than 15 employees accounted for 141 workers. The majority of the firms in the Canonsburg area employ either 15 to 30 people or 100 to 300 people. Historically, these firms expand and decline with the general economic conditions. Between 1978 and 1980 six firms listed in Table G-14 increased their levels of employment and six declined. These changes resulted in a net increase of 66 employees in the firms listed.

In 1978, 15 firms were operating in the Canon Industrial Park, employing approximately 70 persons. The firms included a truck-freight terminal, a metal-work operation, machine shops, climate-control equipment services, a laundry terminal, and various warehouses. In October 1982 six firms operated in the Park; Crile Metallizing Co. -- 20 employees; A.P.A. Transport Co. -- 10 employees; Controlled Climate Systems -- 7 employees; Coyne Laundry -- 8 employees; Lunardini, Inc. -- 10 employees; and Harley, Weaver and Hayses -- 5 employees (Brown, 1982). As of April 1983 there were two firms employing a total of approximately 11 persons still occupying the Canonsburg site (Yusko, 1983). Both of these firms will vacate the Canonsburg site by October 1983.

Major employment centers within the one-quarter mile radius of the Canonsburg site are the RAX Restaurant (31 employees), and the Woodcraft Company (20 employees), both located on Pike Street. The total number of employees within the one-quarter mile radius of the Canonsburg site ranges between 200 and 220 persons, most of whom live in the general Canonsburg site area, and work a minimum of 40 hours a week. In addition, there are a number of private clubs in the Canonsburg site area that employ local residents. These are: VFW on Pike Street; AFU No. 149 on Selwyn Street; Strabane International Ballroom on Chartiers Street; SNPJ Hall and Bowling Alley on Latimer Avenue; and Moose Lodge on West Pike Street.

The establishments in the immediate vicinity of the Canonsburg site include bars, gasoline and service stations, repair and service shops, and grocery and eating places. The Alexander Cooperative Market on Latimer Avenue is the closest establishment that is frequented by a large number of customers from within the 1-mile radius of the Canonsburg site.

A survey conducted in the Canonsburg site area revealed that 8.6 percent of the households have a family member who had worked at the Canon Industrial Park at one time. A large percentage of the persons who worked at the Canon Industrial Park are in the 65 years and over age group. The 1974 employment statistics for the municipalities in the immediate vicinity of the Canonsburg site are presented in Table G-15.

Table G-14. Industrial employment (1980) -- Canonsburg site vicinity

Establishment	Location	Product	Number of employees
All-Clad Metalcrafters, Inc.	R.D. 2	Cookware	25
American Specialty Foods	R.D. 1	Potato chips, etc.	60
Canon Tool Company	Valley Road	Nuclear components	35
Canonsburg General Woodcrafting Co.	W. Pike Street	Cabinets, vanities	20
Canonsburg Milling Co.	N. Central Avenue	Animal/poultry feeds	22
Clad Metals, Inc.	R.D. 2	Speciality clad metals	62
Controlled Climate Systems, Inc.	Canon Industrial Park	Heating/air conditioning	17
Crile Metallizing Co.	Canon Industrial Park	Manufacturing operations	18
Donaldson Supply and Equipment	Murdock Street	Builders supplies	18
Forbes Steel Corporation	Iron Street	Steel fabricating	150
Fort Pitt Bridge Division	Meadow Lane	Fabricated steel structures	305
Hankison Corporation	Philadelphia Street	Air dryers, metal products	148
Joy Manufacturing Company	Meadowlands	Warehousing	114
Michael J. Lunardini, Inc.	Canon Industrial Park	Equipment supplies	5
Mac Plastics, Inc.	Murdock Street	Plastics	162
McGraw-Edison Power Systems Div.	Canonsburg	Electrical power equipment	2296
Quasitronics, Inc.	W. Water Street	Electrical control systems	19
Ram Construction Company	R.D. 2	Heavy/highway construction	150
Canon Plastics	Plum Run Road	Plastics	50
Fort Pitt Fixture Company	W. Pike Street	Store fixtures	29
J & F Tire	Route 519	Tire retreading	20
Superior Concrete Products Co.	Johnson Road	Concrete block	20
Swanson Analysis Systems	Johnson Road	Structural analysis	22

Note: Industries with less than 15 employees are excluded from this list.

Source: Washington County Board of County Commissioners (1980).

Table G-15. Industrial classification of persons employed in municipalities (1974 and 2000) -- Canonsburg site vicinity

Category	Canonsburg Borough 1974	Canonsburg Borough 2000	Houston Borough 1974	Houston Borough 2000	North Strabane Township 1974	North Strabane Township 2000	Chartiers Township 1974	Chartiers Township 2000
Agriculture	12	7	0	0	45	24	59	31
Mining	132	280	0	0	0	0	0	0
Construction	50	47	64	51	304	379	70	117
Transportation, utilities, communications	75	141	22	22	27	47	129	206
Wholesale trade	60	80	0	2	71	177	69	193
Retail trade	438	445	180	181	391	600	65	203
Finance, insurance, real estate	123	185	14	20	13	20	16	36
Services	787	1424	132	141	447	523	647	916
Government	182	173	22	21	19	18	185	176
Manufacturing	3734	3958	164	159	260	295	2823	3222
Total	5593	6740	598	597	1577	2083	4063	5100

Source: Southeastern Pennsylvania Regional Planning Commission (1980).

About one-half of all the employees in the Canonsburg site area work within 2 miles of their homes, and more than one-third work at least 5 miles away, as seen in Table G-16.

Table G-16. Distances people travel to work -- Canonsburg site vicinity

Distance from place of residence	Percent of total employees in area
Less than 1 mile	13.7
1 to 2 miles	34.8
2 to 5 miles	14.1
More than 5 miles	37.4
	100.0

Source: Socioeconomic survey, September 1979.

The December 1981 unemployment rate in the Pittsburgh SMSA (including Washington, Allegheny, Beaver, and Westmoreland Counties) was estimated at 8.2 percent (unadjusted) and 8.8 percent (seasonally adjusted). In Washington County employment trends are depressed (decrease of 13,800 employees) below December 1980 levels, and unemployment rates are 8.5 percent and 8.8 percent (seasonally adjusted). The major losses are: primary metals industry (i.e., steel) -- decrease of 5200 people; fabricated metals industry -- decrease of 800 people; machinery -- decrease of 1100 people; electrical machinery -- decrease of 100 people; and transportation equipment -- decrease of 4100 people.

Similar losses have also affected nonmanufacturing industries with decreases in Commonwealth and local government employment (4900 employees), transportation (3700 employees), and services (1800 employees).

The per capita income in Washington County was estimated at $8,362 in 1976. This compares with other counties in the Pittsburgh SMSA: Allegheny County -- $9,704; Beaver County -- $8,331; and Westmoreland County -- $8,321. The Commonwealth average per capita income was $8,558.

Recent income data at the municipal level (socioeconomic survey, September 1979) show that more than 33 percent of all of the families within the 1-mile radius of the Canonsburg site earned more than $15,000 annually, and 10.7 percent of the families within a 1-mile radius of the Canonsburg site had an annual income of less than $5,000. The income distribution among families is given in Table G-17.

Table G-17. Annual family income (1979) -- Canonsburg site vicinity

Annual family income (in 1979 dollars)	Percent of total number of families
Less than $ 5,000	10.7
$5,000 - $10,000	24.5
$10,001 - $15,000	29.3
$15,001 - $25,000	27.6
More than $25,000	7.9
	100.0

Source: Socioeconomic survey, September 1979.

G.4.2 Burrell site

In December 1981, the total employment in Indiana County, in the manufacturing and nonmanufacturing industries, was 32,200 persons (an increase of 800 over 1980), out of a total civilian labor force of 43,400. Approximately 26,900 employees worked in nonmanufacturing jobs; the remaining 5,300 employees were employed in manufacturing positions. The number of people unemployed was 3700, or 8.5 percent (Pennsylvania Department of Labor and Industry, 1982).

In 1977, according to the industrial census, the total employment in the 66 manufacturing industries in Indiana County was 5658, of which 4107 were production and related workers. There are four Standard Industrial Classification (SIC) categories that are significant employers in Indiana County, and represent 75 percent of the total manufacturing employment. The categories are given in Table G-18.

Table G-18. Manufacturing employment (1977) -- Indiana County

SIC	Total employment	Percent of county employment
Rubber	566	10
Fabricated metals	1575	28
Machinery	823	14
Measuring/analyzing	1333	23

Source: Pennsylvania Department of Commerce (1978).

In 1977, there were 12 manufacturing firms employing 385 people in Burrell Township and Blairsville Borough (Table G-19).

The major employer in the Burrell site area makes transportation equipment; more than 50 percent of the industrial employment in the Burrell site area was reported by this single manufacturer of tanks and tank components. The second largest employer (60 employees) manufactured wearing apparel, followed by an employer who produced fabricated metals with 43 employees.

Nonmanufacturing employment in Indiana County was estimated at 26,900 in December 1981, an increase of 600 employees over December 1980 data (Pennsylvania Department of Labor and Industry, 1982). The 1981 nonmanufacturing employment was primarily in mining (5600 employees), wholesale and retail trade (6100 employees), and service and miscellaneous categories (4200 employees). Smaller components of the nonmanufacturing work force included transportation (2200 employees), finance (800 employees), and construction (800 employees). Over the period 1980 to 1981 employment varied slightly with employment increases in wholesale and retail trade (200 employees), and services (400 employees). Declines in employment were reported in transportation (200 employees), while mining, contract construction, and finance were unchanged (Wilson, 1982). Nonmanufacturing work-force estimates were not available at the local level.

Table G-19. Industrial employment (1977) -- Burrell site vicinity

Municipality	Category	Number of businesses	Number of employees
Blairsville Borough	Apparel	1	60
	Lumber	1	8
	Printing	1	5
	Stone/clay	1	32
	Fabricated metals	2	36
	Machinery	2	12
	Transportation	1	206
Burrell Township	Lumber	1	2
	Fabricated metals	1	7
	Electrical	1	17
Total		12	385

Source: Pennsylvania Department of Commerce (1978).

The per-capita income in Indiana County was estimated at $7,312 in 1976. This compares with other counties in the nearby Pittsburgh SMSA as follows: Allegheny County -- $9,704; Beaver -- $8,331; and Westmoreland -- $8,321. The Commonwealth average per-capita income was $8,558 in 1976.

G.4.3 Hanover site

The Hanover site area is influenced primarily by the steel and primary metals industries in nearby Weirton, West Virginia, and Steubenville and Toronto, Ohio. The employment statistics for Hanover Township identify one machinery firm with eight employees. Burgettstown, which is approximately 5 miles east of the Hanover site, reports 67 employees; 5 employees in newspapers, and 62 employees in mining machinery (Pennsylvania Department of Commerce, 1980). Detailed information on the employment, income, and unemployment situations in Washington County, in which the Hanover site is located, are given in subsection G.4.1.

Table G-20. Number of housing units in the municipalities in the vicinity of the sites

Municipality	1970	1980	Percent change
Canonsburg site			
Canonsburg Borough	3,857	4,228	9.6
Chartiers Township	2,202	2,678	21.6
Houston Borough	655	668	2.0
North Strabane Township	2,345	2,972	26.7
Total	9,059	10,546	
Burrell site			
Blairsville Borough	1,610	1,765	9.6
Burrell Township	1,129	1,452	28.6
Derry Township	4,386	5,487	25.1
Total	7,125	8,704	
Hanover site			
Hanover Township	888	1,082	21.8
Burgettstown Township	680	725	6.6
Jefferson Township	373	461	23.6
Smith Township	1,849	2,001	8.2
Total	3,790	4,269	

Source: U.S. Bureau of the Census, 1980 census advance counts.

Table G-21. Asking prices of dwelling units (1980) -- Canonsburg site vicinity

Municipality/location	Description	Price ($)
Canonsburg Borough		
Marple Avenue	Two story, 1 bedroom, frame	22,900
W. College Avenue	Two story, 2 bedroom, stucco	31,000
Ridge Avenue	Two story, 2 bedroom, frame	38,500
Duquesne Avenue	Ranch, 3 bedroom	38,900
N. Central Avenue	Two story, townhouse, 2 bedroom, brick	45,900
W. College Avenue	Two story, 4 bedroom, stone	52,000
Hutchinson Avenue	Semi-colonial, 3 bedroom, brick	55,000
W. College Avenue	Two story, brick and frame	70,700
Houston Borough		
N. Maine Street	Two story, duplex, 3 bedroom, frame	37,500
Reed Avenue	Two story, 3 bedroom, brick	46,500
Meadow Oaks Development	Split entry, 3 bedroom, brick and aluminum	87,900
Chartiers Township		
Washington Avenue	Ranch, 3 bedroom	49,500
Ridgeview Way	Ranch, 3 bedroom, brick	59,900
Washington Avenue	Two story, 4 bedroom, brick	138,000
North Strabane Township		
Latimer Avenue	One story, 2 bedroom	29,900
Dicio Street	Cape Cod, 4 bedroom, brick	56,900
Old Meadow Court	Colonial, 3 bedroom	59,900
Mansfield Road	Ranch, 3 bedroom, brick	64,500
Pearl Drive	Two story, 4 bedroom, brick	79,900

Note: The variations in prices reflect the accessories, age, and location of the building.

Source: Local real estate listings from area realtors.

Table G-22. Financial statistics of municipalities (1978) -- Canonsburg site vicinity

Municipality	Revenues						Expenditures	
			Real estate					
	Total revenues	Total taxes collected	Assumed valuation	Tax rate (mills)	Real estate taxes	Total Act 511	Total expend-itures	Total O&M
Canonsburg Borough	$1,631,594	$ 729,923	$11,854,000	39.25	$469,873	$260,050	$1,754,342	$1,696,007
Chartiers Township	$ 838,376	$ 379,229	$10,221,000	12.00	$122,969	$256,260	$ 626,594	$ 626,594
Houston Borough	$ 155,845	$ 81,663	$ 1,626,000	23.00	$ 36,457	$ 43,631	$ 134,927	$ 125,047
North Strabane Township	$ 893,719	$ 509,214	$15,249,000	13.00	$200,528	$308,686	$1,117,441	$ 731,947
Total	$3,519,534	$1,700,029	$38,950,000		$829,827	$868,627	$3,633,304	$3,179,595
Percent of county	15	15	14		17	14	14	15

Source: Pennsylvania Department of Community Affairs (1981).

Table G-23. Assessed values, market values, and tax rates for municipalities (1982) -- Canonsburg site vicinity

	Assessed valuation[a] (million $)	Market value[a] (million $)	Tax rate[a,b]	
			Munic-ipality (mills)	School (mills)
Canonsburg Borough	12.890	143.2	41.25	99
Chartiers Township	12.963	144.0	14.0	119
Houston Borough	1.800	20.0	23.0	119
North Strabane Township	18.332	203.7	27.0	99

[a]Washington County Tax Assessors Office, 1982 original charts.
[b]Washington County Tax Assessors Office, 1981-1982.

Table G-24. Financial statistics of municipalities (1978) -- Burrell site vicinity

Municipality	1978 fiscal statistics	
Burrell Township		
Total revenue		$ 324,778
Real estate tax	$ 21,851	
Act 511 tax	$ 85,770	
Total taxes collected	$108,238	
Total expenditures		$ 583,218
Total O&M	$493,912	
Assessed valuation		$5,383,000
Tax rate (mills)		4
Blairsville Borough		
Total revenues		$ 774,928
Real estate tax	$107,808	
Act 511 tax	$117,852	
Total taxes collected	$225,660	
Total expenditures		$ 767,180
Total O&M	$756,190	
Assessed valuation		$7,351,000
Tax rate (mills)		15

Source: Pennsylvania Department of Community Affairs (1981).

Table G-25. Tax rates for municipalities -- Burrell site vicinity

Municipality	1980[a] County	1980[a] School district	1980[a] Municipal	1980[a] Total	1981[a] County	1981[a] School district	1981[a] Municipal	1981[a] Total
Burrell Township	16	73.9	3	92.9	19	84	5	108
Blairsville Borough	16	73.9	14.75	104.65	19	84	19	122

Source: Indiana County Tax Assessment Office (1982).

[a]Figures in mills (tax per $1,000 market value).

Table G-26. Financial statistics (1979) -- Hanover Township

Item		1979 fiscal statistics[a]
Total revenue		$ 237,987[b]
Real estate tax	$ 25,686	
Act 511 tax	$ 87,429	
Total taxes collected	$113,115	
Total expenditures		$ 270,407
Total operations and maintenance	$218,567	
Assessed valuation of real estate		$3,517,000

[a]Pennsylvania Department of Community Affairs (1982).

[b]Includes total taxes collected in 1979 and miscellaneous revenues from sources such as the issuance of licenses and permits, fines and forfeits, state and Federal grants, and surcharges for current services rendered by municipal departments.

G.5 COMMUNITY SERVICES

G.5.1 Canonsburg site

G.5.1.1 Community services

The Canonsburg site area is served by the Canon-McMillan and Chartiers-Houston School Districts. The Canon-McMillan Senior High School, bounded by Hitchman Street, Boone Avenue and Interstate I-79, is within one-half mile of the Canonsburg site. Most of the school traffic uses Strabane Avenue and passes through the Canonsburg site. The school closest to the Canonsburg site is St. Patrick's School at Hutchinson Avenue, one-quarter mile from the Canonsburg site. Other nearby schools are: Hawthorne School (elementary) on Hawthorne Street, Canonsburg; South Central Elementary School, South Central Avenue, Canonsburg; Houston Elementary School, Cherry Avenue, Houston; Canon-McMillan Junior High School, Canonsburg; and First Street School, Canonsburg.

The population of the Canonsburg site area and the surrounding region is served by the Canonsburg General Hospital located on Barr Street within one-half mile of the Canonsburg site. Primary access to the Canonsburg General Hospital from the Canonsburg site is via Strabane Avenue (Chartiers Street to Boone Avenue and Elm Street). For the surrounding communities, the I-79 Canonsburg or Houston exits are the primary access to Canonsburg General Hospital. Washington Hospital is the next closest facility to the Canonsburg site with a 500-bed capacity. In addition, St. Clair Hospital and numerous other medical centers located between Washington and Pittsburgh are available for the health-care needs of the area's population.

The municipalities in the Canonsburg site area have their individual police forces and patrol cars providing 24-hour protection. There are a number of call boxes located throughout Canonsburg, providing a direct communication link for the residents with the police-station emergency-communication system.

The Canonsburg site area is protected by volunteer fire organizations located in the boroughs and the townships. The various fire companies operating in these and adjacent municipalities have a reciprocal relationship for emergencies, thus providing greater fire protection than the capabilities of a single fire company.

The sanitary sewerage system of the Canonsburg-Houston Joint Authority provides offsite disposal facilities for the Houston and Canonsburg Boroughs, Strabane Village of North Strabane Township, and along the southeastern and eastern portions of Chartiers Township. The treatment plant is being renovated to provide increased capacity and tertiary treatment. Chartiers Creek is the receiving stream for the treatment facility.

The municipalities are served by public water provided by the Western Pennsylvania Water Company (Chnupa, 1983). Rural areas of North Strabane and Chartiers Townships use onsite sources, primarily wells, for their water supply.

Solid wastes, including garbage, rubbish, and inorganic wastes, are collected once a week from residences in the Canonsburg site area by an independent hauler (Table G-27).

Table G-27. Landfills -- Canonsburg site vicinity

Landfill	Location
Arden Landfill site	Chartiers Township
South Hills site	North Strabane Township
Pittsburgh Coal Company site	Chartiers and Mt. Pleasant Townships
Pittsburgh Coal Company site	Cecil Township

Source: Washington County Planning Commission (1979b).

Electricity for the Canonsburg site area is provided by West Penn Power Company, while natural gas used as heating fuel is furnished by three companies: Columbia Gas of Pennsylvania, Equitable Gas Company, and People's Natural Gas Company.

G.5.1.2 Recreational activities

The major recreational locations within a 1-mile radius of the Canonsburg site are identified on the existing land-use map (Figure G-1, Table G-28). The closest location to the Canonsburg site for recreational activities was Area C (3.1 acres) of the Canonsburg site, located east of Strabane Avenue, where a ball diamond had been placed over filled ground. For the past two years, however, the ballfield has been fenced and unavailable for public use because of the presence of radioactively contaminated materials. The ballfield was used by 6 percent of the Canonsburg site area population until it was fenced.

Table G-28. Public recreational facilities -- Canonsburg site vicinity

Location	Area (acres)	Facilities, comments
Borough of Canonsburg[a]		
Borough Park	38.0	Swimming pool, bathhouse, wading pool, sun deck, three pavilions, picnic areas, children's play area, tennis courts, basketball courts, volleyball area.
Cecil Street (Valley View Road)	0.34	Swings, slides, teeter-totter.
Gladden Avenue (Cecil Township)	11	
School site recreational facilities		
- Hawthorne Elementary, Canonsburg Memorial Stadium, and baseball field		
- Glenn Avenue area		
- South Central Avenue Elementary Senior High		
- Junior High		
- First Street Elementary		
- Perry Como Playground		
Borough of Houston		
Borough of Houston recreational area between East McNutt Street and the Pennsylvania Railroad, on either side of Chartiers Creek.		
North Strabane Township[b]		
Alexander Parkette	0.5	Facilities for children and teenagers.
Canon-McMillan Senior High School	2.2	Play areas and tennis courts.
Lindley Mine Park	70	Area was originally strip mined, and needs reforestation to provide a setting for active and passive recreational facilities.
Chartiers Township[c]		
No designated recreational areas exist within the 1-mile radius, except open fields and the private cemetery properties often used for recreational purposes.		
In addition, there are a number of regional recreational facilities in the general site area, including:		
Canonsburg Lake located off Route 19		Facilities primarily for fishing (Pennsylvania Fish Commission site).
Mingo Creek County Park, located off Route 88	2,500 (approx.)	Designed to preserve its natural state and provide picnic areas, trails, a swimming pool, and camping, as well as game areas and facilities for winter sports.
Cross Creek Park located off Route 50	3,000	Man-made lake for swimming, fishing, boating, and flood control.
Allegheny County -- Regional Park No. 7, South Park, and Regional Park No. 6		

[a]Canonsburg Borough Planning Commission (1971).
[b]North Strabane Township Planning Commission (1977).
[c]Selck Minnerly Group (1974).

Although 5 percent of the population uses Chartiers Creek for recreational purposes, fishing success is minimal. The SNPJ Hall and Bowling Alley on Latimer Avenue is the closest place of recreational and cultural activities to the Canonsburg site. This facility is a private club catering to the cultural and recreational needs of the local community.

G.5.2 Burrell site

G.5.2.1 Community services

The Burrell site area is served by two school districts: the Blairsville-Saltsburg School District for the Indiana County portion of the Burrell site area; and the Derry Area School District for the portion of the Burrell site area in Westmoreland County.

The Blairsville Borough Water Authority serves all of the Town of Blairsville and a limited area outside of and adjacent to Blairsville (Chnupa, 1983). The town's sewer system has a 1-mgd capacity, and is designed to serve a population of 7500 persons. It serves all of the present water users in the town and parts of adjacent areas.

The Burrell Township water supply is administered by the Lower Indiana County Municipal Authority. The Central Pennsylvania Water Supply Company also serves areas near the Burrell site (Chnupa, 1983). There are also a number of individual wells in Burrell Township. Burrell Township does not have a public-sewer system (Bartos, 1982).

There are a number of private water-supply companies in the Derry Township portion of the Burrell site area. In parts of Derry Township people also depend on privately owned wells for their water supply. There is no public sewage system in Derry Township; however, Derry Township is in the process of joining the Latrobe Borough sewer system. Torrance State Hospital operates and maintains its own collection system and disposal plant on McGee Run (Bolinger, 1979). Torrance State Hospital also has an impounding dam on Shirey Run and a water treatment plant and an open finished water reservoir located on the hospital grounds (Chnupa, 1983).

Fire stations close to the Burrell site are in Blairsville and Black Lick. Police protection for the Burrell site area is provided by the Pennsylvania State Police. The nearest hospital to the Burrell site is in Blairsville.

G.5.2.2 Recreational activities

The immediate Burrell site vicinity, between the ConRail tracks and the Conemaugh River, is occasionally used for hunting. The U.S. Army Corps of

Engineers (Corps) permits limited recreational use of the Conemaugh River reservoir area for hunting, picnicking, and other recreational activities but not use of the river itself due to its polluted condition (U.S. Army Corps of Engineers, 1974). Under a license agreement with the Corps, the Town of Blairsville maintains two ballfields in the reservoir area (Bellante and Clauss, Inc., 1967). There are a number of major parks and recreational attractions outside the 1-mile radius of the Burrell site, such as Keystone State Park, Laurel Highlands, the Latrobe Elks Club south of the Conemaugh River, and Mannito Country Club north of Strangford (Baker, 1970).

G.5.3 Hanover site

G.5.3.1 Community services

There are no community facilities located within the 1-mile radius of the Hanover site. The closest community facility to the Hanover site is the Hanover Township School located on old U.S. Route 22, more than 2 miles north of the Hanover site. The closest community services to the Hanover site are in Burgettstown, about 4 miles east of the Hanover site, and Weirton Heights on Route 22 in West Virginia. In fact, the local economy near the Hanover site is very dependent on the industrial firms located in Weirton County, West Virginia.

G.5.3.2 Recreational activities

There are no recreational facilities located within the 1-mile radius of the Hanover site. The State Game Lands No. 117 (4919 acres), located in Smith Township, provides hunting opportunities. The undeveloped Hillman State Park (3654 acres) is located north of State Game Lands No. 117 in Hanover Township.

There are three privately owned and operated paid fishing lakes in Hanover Township, all located along SR 18; i.e., Star Lake, Lake Suzanne, and Bennett Lake. The Pennsylvania Fish Commission has designated Aunt Clara Fork in Hanover Township as "approved trout waters" for a length of 4.0 miles (Weirich, 1982).

Devil's Dam, located north of Paris in Hanover Township, is one of the 11 natural areas in Washington County accessible to the public for entertainment, and is a geological and ecological resource.

Table G-29. Traffic counts (1980)

Location	Average daily traffic (ADT)
Canonsburg Borough	
Route I-79 (between Meadowlands and Houston)	25,800
U.S. Route 19 (just north of Pennsylvania Route 519 intersection)	15,000
Pennsylvania Route 519 (near Boone Avenue intersection)	10,000
Pennsylvania Route 980 (Adams Avenue)	12,500
West Pike Street (west of Strabane Avenue)	12,500
West Pike Street (between Strabane and Central Avenues)	10,600
East Pike Street (between Central and Adams Avenue)	12,900
Strabane Avenue (south of Pike Street)	3,150
South Central Avenue (south of Pike Street)	8,400
North Central Avenue (north of Pike Street)	4,300
Chartiers Street (near Boone Avenue)	3,600
Burrell Township	
U.S. Route 22 (crossing Conemaugh River and before Blairsville)	17,200
U.S. Route 22 (near LR 32006)	17,100
Pennsylvania Route 217 (at the bridge over Conemaugh River)	7,300
Pennsylvania Route 217 (south of LR 64059)	5,200
Pennsylvania Route 217 (just before LR 32179 in Blairsville)	11,000
LR 32006 (near intersection with township road 784)	125
LR 32179 (in Blairsville at township line)	5,500
LR 64059 (east of intersection with Pennsylvania Route 217)	2,500
Hanover Township	
U.S. Route 22 (old)	7,000
U.S. Route 22 (new)	4,000
Pennsylvania Route 18	6,500
LR 62017	550
LR 62122	225

Source: Pennsylvania Department of Transportation (1982).

COMMONWEALTH OF PENNSYLVANIA
PENNSYLVANIA HISTORICAL AND MUSEUM COMMISSION
WILLIAM PENN MEMORIAL MUSEUM AND ARCHIVES BUILDING
BOX 1026
HARRISBURG, PENNSYLVANIA 17120

March 17, 1982

Mr. Korah T. Mani, AICP
Roy F. Weston, Inc.
Weston Way
West Chester, Pennsylvania 19380

Re: W.O. 2143-01-01
Historic & archeological site findings within and in the immediate vicinity of two sites in Washington County and one site in Indiana County, Pa. associated with the disposal of radiation-contaminated waste materials.
File No. ER 82-042M-0114

Dear Mr. Mani:

The above named project has been reviewed by the Bureau for Historic Preservation in accordance with Section 106 of the National Historic Preservation Act of 1966, Executive Order 11593 and the regulations of the Advisory Council on Historic Preservation (36 CFR 800).

To our best knowledge, there are no eligible or listed historic or archeological properties in the area of this proposed project and therefore, this project should have no effect upon such resources. Should the applicant become aware, from any source, that historic or archeological resources are located at or near the project site, please contact the Division of Planning & Protection, Bureau for Historic Preservation, Pennsylvania Historical & Museum Commission, Box 1026, Harrisburg 17120 or call (717) 783-8947.

Sincerely,

Greg Ramsey

Greg Ramsey, Chief
Division of Planning & Protection
Bureau for Historic Preservation
(717) 783-8947

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Appendix H

ACOUSTICAL SURVEY RESULTS AT THE CANONSBURG SITE

APPENDIX H

ACOUSTICAL SURVEY RESULTS AT THE CANONSBURG SITE

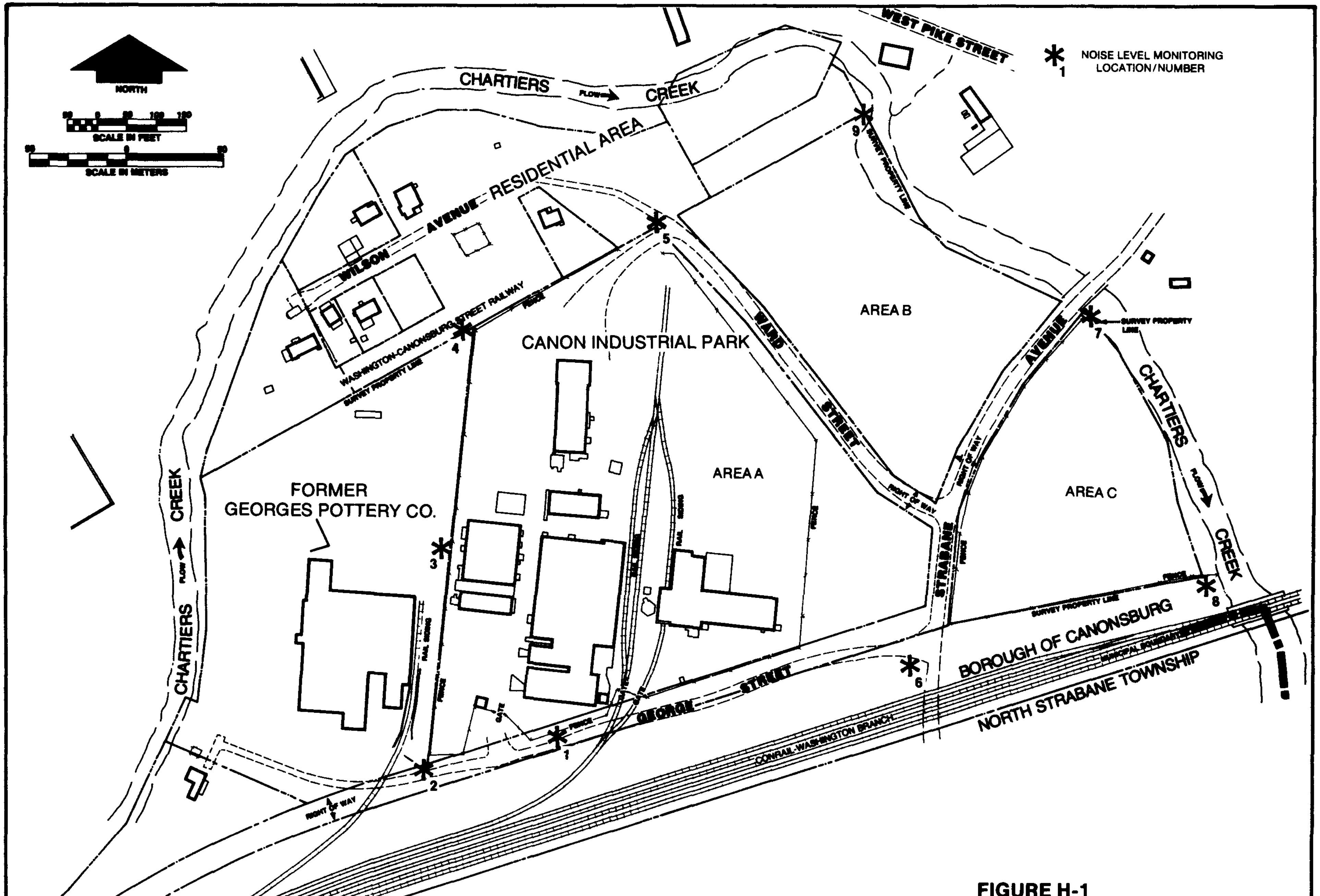
The Franklin Research Center, a division of the Franklin Institute, located in Philadelphia, Pennsylvania, performed an acoustical survey (Hargens, 1979) at the Canonsburg site on 13 September 1979. This appendix presents the results of the measurements and the assessment of the baseline noise levels in the Canonsburg site area (National Research Council, 1977).

The Hargens (1979) report also included a brief assessment of potential noise levels that might be experienced in the area due to remedial action at the Canonsburg site. This evaluation was made before the development of the engineering design plans for the remedial action, and only presented a single noise level for any activity at the Canonsburg site. Because it is not based on any of the engineering designs that are presently being developed, and does not discriminate between any of the alternative remedial actions, this impact assessment is not included in this appendix. Such an assessment cannot be conducted until the final engineering design is completed.

The data from the Hargens (1979) study was gathered to provide a comprehensive study of the Canonsburg site as well as of the surrounding community. The survey points were positioned to include specific sound-producing areas such as the nearby rail lines (see Figure H-1). In addition to the sound-level measurements, tape recordings were made at each sampling point for future reference. Table H-1 summarizes the A-weighted background noise levels for the Canonsburg site survey points.

Nearly all of the background sounds at the various locations were steady within several dB except for passing aircraft or land vehicles which were discounted in the normal way. Because the sources had minimal diurnal variation, it was reasonable to compute an equivalent day-night average sound level, L_{dn} (see Table H-2).

Remedial action at the expanded Canonsburg site may involve a variety of equipment. Figure H-2 gives average noise levels for typical construction equipment. Operation of several pieces simultaneously, can increase the individual noise level by as much as 6 to 10 dB.



NOTE THIS [illegible] IS BASED ON A SURVEY AND TOPOGRAPHY BY [illegible] HOUSELY & ASSOC., PITTSBURGH, PA, DATED [illegible]3, AND ON MAPS OF THE CHARTIERS CREEK BASIN, [illegible], BY THE US ARMY, CORPS OF ENGINEERS, PITTSBURGH, PA, DATED 6/3/73

FIGURE H-1
NOISE LEVEL TEST AND MONITORING LOCATIONS
EXPANDED CANONSBURG SITE

Table H-1. Recorded sound levels

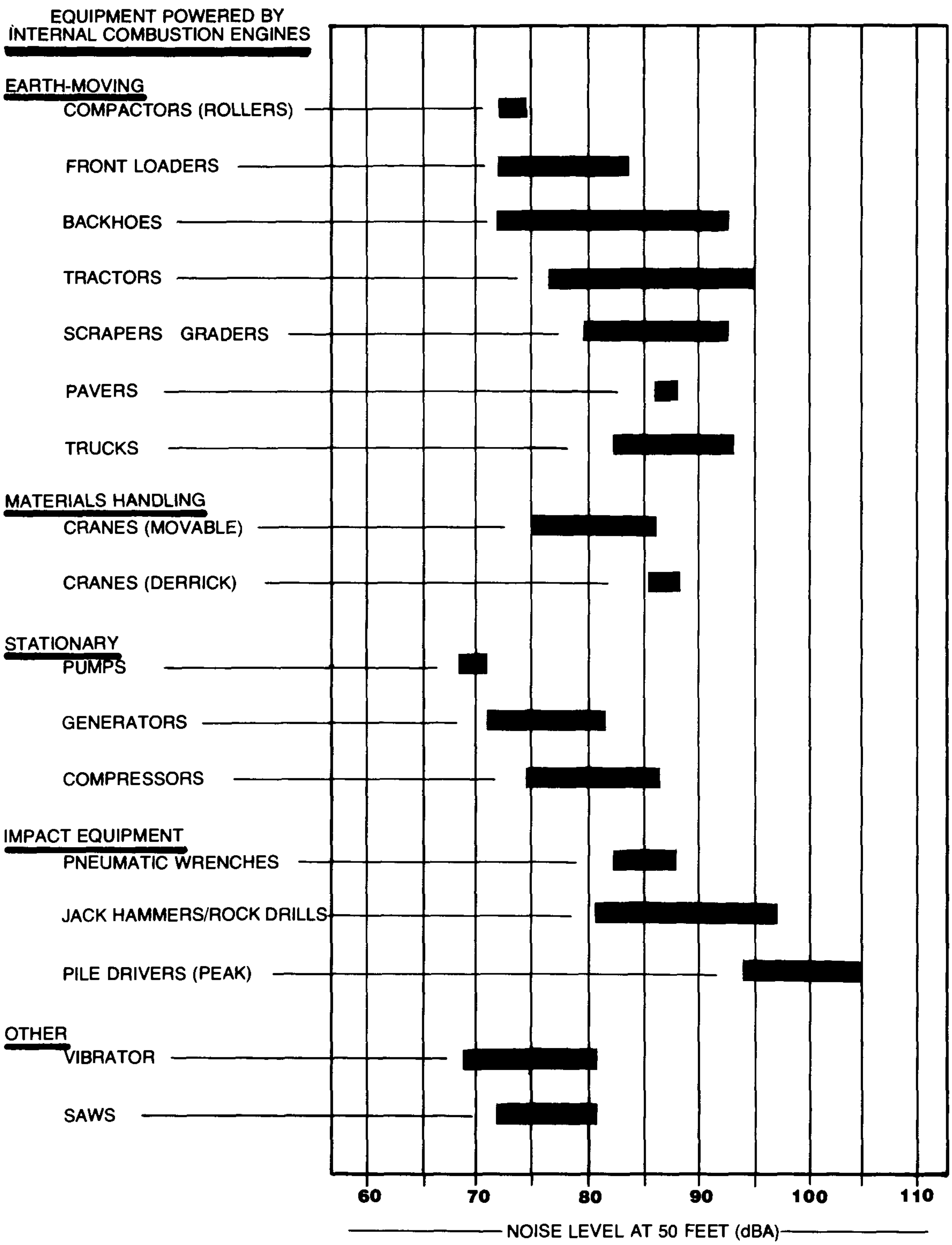
Location/measurement	Equipment
Canonsburg Area A	GR 1933 Slm + Nagra recorder
<u>Location 1 -- Property line</u>	
Building 15 (see Figure H-1) Background: 55 dBA Manufacturing pulses: +1 to 2 dB No particular sound source.	GR 1933 set on 40-50-60 dB scale Modulometer: - 15 dB Nagra reference: -6 dB
<u>Location 2</u> -- Near residential properties 300-500 feet south of indicated property corner	
No manufacturing activity. Aircraft overflight only sound: 60 dBA. Background: 47 dBA	
<u>Location 3</u> -- South-north mid-property line	
Workers - painting, etc. Background: 45 dBA	
<u>Location 4</u> -- Northwest corner	
Residences 200 feet away. Background: 45 dBA Aircraft overflights: 60 - 70 dBA, 5-10 minutes apart. Forklifts, occasional sounds associated with trucking operations.	
<u>Location 5</u> -- Areas A and B (including nearby residences)	
Highway to north. Background: 55 dBA average	
<u>Location 6</u> -- Areas A and C	
Background: 52 dBA -- cars and trucks passing naturally drive this level upward.	
<u>Location 7</u> -- Areas B and C (near bridge over Chartiers Creek)	
Background: 55 dBA -- aircraft and cricket sound sources.	
<u>Location 8</u> -- Area C	
Background: 50 dBA -- aircraft, waterfall, and insect sound sources.	
<u>Location 9</u> -- Area B	
Background: 57 dBA -- mostly acceptable natural sounds, rapids in stream, and insect sound sources. Highway on other side of water. Populated area experiences background similar to this and location 7.	

Table H-2. Present day-night average sound levels (L_{dn})[a]

Location	L_{dn} (dB)
1	61
2	53
3	51
4	51
5	61
6	58
7	61
8	56
9	63
	Average = 57

[a]Characterization of average sound levels in residential areas throughout the day and night, L_{dn}.

$$L_{dn} = 10 \log_{10} \left[\frac{1}{24} \left(\int_{0000}^{0700} 10^{[L_A(t) + 10]/10} \, dt + \int_{0700}^{2200} 10^{L_A(t)/10} \, dt + \int_{2200}^{2400} 10^{[L_A(t) + 10]/10} \, dt \right) \right]$$



NOTE

BASED ON LIMITED AVAILABLE DATA SAMPLES

SOURCE US EPA, 1971 a, b

FIGURE H-2
EXAMPLES OF NOISE LEVELS
FROM CONSTRUCTION EQUIPMENT

REFERENCES FOR APPENDIX H

Hargens, C. W., 1979. "Acoustical Survey and Environmental Impact Projection for Operations at Canonsburg, Pennsylvania," Report No. C5240-01, Franklin Research Center, The Franklin Institute, Philadelphia, Pennsylvania.

National Research Council, National Academy of Sciences, 1977. "Guidelines for Preparing Environmental Impact Statements on Noise," Report of Working Group 69 on Evaluation of Environmental Impact of Noise, Committee on Hearing, Bioacoustics, and Biomechanics (CHABA), Washington, DC.

U. S. EPA (U. S. Environmental Protection Agency), 1971a. "Noise from Construction Equipment and Operations, Building Equipment and Home Appliances," Report PB 206717, Washington, DC.

U. S. EPA (U. S. Environmental Protection Agency), 1971b. "Transportation Noise and Noise from Equipment Powered by Internal Combustion Engines," Report NTID 300.13, Washington DC.

Appendix I

TRANSPORTATION OF URANIUM-MILL TAILINGS FROM SELECTED SITES

TRANSPORATION OF
URANIUM MILL TAILINGS
FROM SELECTED SITES

SEPTEMBER 13, 1982

Transportation and Distribution Associates, Inc.
600 N. Jackson Street
Media, PA 19063
215-565-0238

A subsidiary of Day & Zimmermann, Inc. Telex: 845192 Cable: DAYZIM

September 16, 1982

Mr. Jack C. Newell, P.E.
Vice President
Program Department
Weston
Weston Way
West Chester, PA 19380

Dear Mr. Newell:

Transportation and Distribution Associates, Inc. (TAD) is pleased to submit this final report pertaining to the movement of uranium mill tailings from selected sites.

Very truly yours,

Alan B. Buchan
Vice President

ABB/sb
0110/282900/1370

TABLE OF CONTENTS

I INTRODUCTION

BACKGROUND

In 1978, Congress passed the Uranium Mill Tailings Radiation Control Act (UMTRCA) acknowledging the potential health hazards associated with uranium-mill tailings. Under this act the U.S. Environmental Protection Agency (EPA) was charged with establishing standards for these sites and the U.S. Department of Energy (DOE) was authorized to work with affected states and Indian tribal governments to clean up these sites. The UMTRCA specifically listed the Canonsburg, Pennsylvania site as one of the sites requiring cleanup. Included with Canonsburg is a site in Burrell Township which contains material previously imported from Canonsburg. The DOE and the Commonwealth of Pennsylvania entered into a cooperative agreement on September 5, 1980 to perform remedial work at the site.

In 1980 the Commonwealth of Pennsylvania studied a number of potential disposal sites for the Canonsburg material to be used if the site was to be decontaminated. This study resulted in the selection of a property in Hanover Township, Pennsylvania, as the best available site. This property (the Hanover site) is located in Washington County, approximately 16 miles northwest of Canonsburg. The site is basically a long, dry trench that was formed by strip-mining activities on a ridgetop.

OBJECTIVE

The objective of this report is to provide costs for various transportation alternatives and discuss the impact of moving the uranium mill tailings by truck versus by rail.

SCOPE

The scope of work is as outlined below.

1. Determine the cost to rehabilitate/construct rail loading/unloading facilities at the Canonsburg, Burrell, and Hanover sites (this task is confined to the costing of track additions/modifications only).

2. Determine the cost to transport the contaminated material from staging piles adjacent to the railroad side track at each site via rail to unload at a point adjacent to the receiving railroad side track.

   As part of the cost to ship via rail, develop equipment requirements based on various types of rail cars, i.e., hoppers, gondolas, or box cars, etc., including issues involved in the tainting of railcars.
3. Determine the cost to transport clean fill via rail from borrow pits (specified by Weston) to the contaminated sites.
4. Report on the highway network from borrow pit locations to state highways based on ground reconnaissance including a review of bridges, traffic density, grades, and built-up areas.
5. Report on the highway network from contaminated sites to state highways based on ground reconnaissance similar to item 4.
6. While in the Pittsburgh area, determine the availability of trucking firms and equipment and hauling costs.
7. Develop a discussion of the feasibility and impacts of moving the contaminated material by truck versus by rail from the engineering and safety standpoints.

II RAIL ALTERNATIVE

FACILITY REQUIREMENTS

Burrell Township

Present facilities for loading rail cars at the Burrell Township site are non-existent. Based on the present triweekly frequency of local freight service on the adjacent rail line, the lading capacity of appropriate freight equipment and the project duration, sufficient track capacity to load and store 20 rail cars of 60-foot overall length each will be required. It is recommended that this be accomplished by constructing two 1,200-foot stub-end tracks connected to the Conrail main track with a 200-foot lead. Construction of rail spurs will present no unusual problems as the ground is presently properly graded and follows the grade of the adjacent right-of-way (ROW).

Canonsburg

Facilities for loading rail cars at the Canonsburg site presently exist in the form of two yard tracks north of the Conrail Washington Branch main track. Based on the present triweekly frequency of local freight service on this branch, the lading capacity of appropriate freight equipment, and the project duration, sufficient track capacity to store 20 rail cars of 60-foot overall length each will be required. Sufficient yard track presently exists to meet this requirement but some rehabilitation (primarily in the form of tie renewal) should be undertaken to reduce the probability of any derailments. Also, a crossover should be installed just west of Strabane Ave. In order to load the cars while standing on these yard tracks it will be necessary for the contractor to lease the tracks for the duration of the project. Conrail presently stores some flat cars on the west end of these yard tracks; however it is believed that storage room for these flat cars can be found elsewhere within the Canonsburg area.

Hanover Township

The Hanover Township site at one time had a spur track extending about one mile from the Conrail main track and which terminated within 4,000 feet of the proposed trench in Area 7. This spur has been abandoned for years as evidenced by the growth of trees up to four inches in diameter within the ROW. Most of the ROW is intact and reconstruction of the spur would require only minor clearing, limited regrading, reconstruction of two culverts, partial bank restoration, and track installation. Two open deck steel plate girder bridges over Hanover Creek and Legislative Route (LR) 62122 are in good condition and need only new timber decks. Some erosion of soil around the header walls was observed but is not believed to be a problem. About 50% of the rail required to reopen the spur is on-site and could be used; however, ownership of both the ROW and rail is unknown. In addition to the spur a two-track, stub-end yard with capacity to hold 20 cars would be required at the end of the line. This assumes that the Burrell and Canonsburg sites would be worked sequentially rather than concurrently. If the Burrell and Canonsburg sites were worked concurrently and rail was used from both sites the yard capacity would need to be expanded to accommodate 40 cars.

EQUIPMENT

The feasibility of utilizing various railcar designs is governed by tradeoffs among material handling ease, security, decontamination, etc. It is readily apparent that most types of rail equipment are not specifically designed to match all expected requirements for waste hauling. Further, the scope of the project in terms of carloads and time will require the dedication of carrier equipment or the purchase or lease of private cars.

In general two types of cars can be considered, bulk-handling cars and open or closed cars for various palletized or packaged commodities. Examples of these types have been abstracted from The Car and Locomotive Cyclopedia 1980 Edition, Simmons Boardman, Omaha, NE and are shown in Appendix A.

Bulk handling cars include open and covered hoppers, high- and low-side gondolas, and side dump cars.

Open Top Hoppers

Hopper cars transport ladings varying from heavy ores to lighter materials such as coal. Although hopper cars could be easily loaded at the cleanup sites, major constraints on the use of hoppers are: bottom unloading capabilities such as trestles would be desirable to facilitate unloading; lumpy or cohesive materials such as soils may pack in the pockets, impeding unloading; and, in some cases, cubic capacities are so great that weight limits may be exceeded if completely filled with dense commodities.

Covered Hoppers

Covered hoppers are designed for less-dense, free-flowing commodities, such as grains, chemicals, and pelletized plastics requiring protection from the elements. Security is greatly enhanced in such cars at the expense of loading ease through top hatches. Furthermore, unloading gates would be more likely to be plugged by soils and cubic capacities are generally well above requirements.

Gondolas

High-side gondolas are solid-floor cars of capacities similar to hoppers. While bottom unloading problems are eliminated, specialized unloading facilities such as rotary dumpers are required for unloading and cubic capacities may greatly exceed load limits imposed by soils.

Low-side or conventional gondolas are smaller capacity designs commonly used in hauling steel mill products and high-density ladings. They are ideally suited to moving soils in terms of weight and cubic capacity limits but unloading could be tedious.

Side Dump Cars

Side dump cars are a specialized type of gondola designed for handling of railway construction materials. The car body can be tilted to either side by pneumatic cylinders allowing rapid discharge of the load in less than 10 seconds at trackside. While they are ideally suited in capacities and loading and unloading characteristics, availability could be limited since they are dedicated to railway maintenance of way usage.

Open or closed cars for various palletized or packaged commodities include box cars and flat cars.

Box Cars

Box car designs accommodate very light lading densities such as appliances, packaged foods, etc. They afford excellent containment but impose more laborious loading and unloading techniques.

Flat Cars

Flat cars deserve consideration only if wastes can be containerized. While this allows flexibility in material-handling concepts, net weights transported are reduced by the tare weights of both the rail car and the containers used. Some flat cars are specifically designed to accept standardized containers or trailers but load limits of these cars are on the order of 70 tons to match highway loading limits on trailers.

LADING DENSITY

Quantitative evaluations of lading densities, cubic capacities, and weight limits have been developed as follows:

- Typical lading density values were derived for each car type using the ratio of load limits to cubic capacities. This tabulation demonstrates that, except for gondolas and some aggregate cars, most cars are designed for ladings of lower density than the wastes.

- Next, car volumes were tabulated in cubic feet and cubic yards, along with maximum weights in tons to permit calculation of allowable loads.
- Maximum loads in cubic yards were then calculated, applying a soil density of 1.21 tons per cubic yard[1]. In most cars, the load limits were reached before the cars could be filled to maximum cubic capacities, which implies that special monitoring would be essential at loading sites to preclude overloading. Several designs were well suited; namely, the side dump car and the gondola in that cubic capacities nearly equal the volumes of maximum loads.

EQUIPMENT APPLICATIONS

From an applications viewpoint, a variety of factors were assessed by assigning qualitative scores ranging from 1 to 4 implying poor to excellent characteristics, against weighted objectives (ranging from 0 to 3) defined as follows:

1) Loading ease considers the placement of excavated soil in cars by means of front-end loaders, clamshell buckets, or conveyor belt and is weighted at 2.0.
2) Unloading ease considers removal by bottom dumping, side dumping, clam shell bucket, or container handling to facilitate transfer to the

1 Standard Handbook for Civil Engineers Pg. 7-58, 1968 Edition, McGraw-Hill, New York, NY.

disposal site and is weighted at 3.0 as the most critical factor.

3) Spill prevention considers the packaging (car body) integrity in preventing contamination of transfer points and rights of way due to leakage and is weighted at 1.0. For example, hopper doors and pockets generally allow leakage and would require patching, special linings or sealing gaskets to eliminate such problems.

4) Security enroute considers public access to the wastes based on the package type. This is both a psychological factor, i.e., the reaction of people to the knowledge that a hazardous waste is nearby in a given container type, and also a physical factor, i.e., the prospect of tampering by trespassers and is weighted at 1.0.

5) Overload prevention considers matching the weight and volume limits along with the likelihood of greatly exceeding load limits if cubic capacities are too large. This factor can be controlled by loading monitors and is thus weighted at 0.5.

6) Decontamination and reuse aspects consider the the ease of cleaning the equipment and the risks, both real and esthetic, that subsequent use of the cars could impact on food chains. These are important aspects weighted at 2.0.

A detailed assessment of each applicable car type follows, ranking the various car types for suitability to the clean-up project based on the evaluations shown in Exhibit II-1. However, additional factors such as regulations, availability, and costs (carrier supplied versus purchased or leased cars), must also be considered.

Open top hoppers attained a score of 28.0 out of a possible 38.0. For these cars, loading ease is excellent.

EQUIPMENT REQUIREMENTS FOR RAIL TRANSPORT

EQUIPMENT REQUIREMENTS FOR RAIL TRANSPORT

		EQUIPMENT CHARACTERISTICS					EQUIPMENT APPLICATIONS ASPECTS [4] (Qualitative Estimates)							CAR LOAD REQUIRED PER ALTERNATIVE			
REF.*	Car Type	Lading Density Range lb/cu.ft.	Capacity [1] cu.ft.	Capacity [1] cu.yd.	Max. Load (tons)	Max. Load [2] (cu.yd.)	Loading Ease [3] F=2.0	Unloading Ease F=3.0	Spill Prevention F=1.0	Security Enroute [5] F=1.0	Overload Prevention F=0.5	Decontamination & Reuse Aspects F=2.0	Score	#2 80K cu.yd. 272K cu.yd.	#3 N/A 323K cu.yd.	#4 330K cu.yd. 471K cu.yd.	#5 250K cu.yd.[7] 493 cu.yd.[8]
A	Coal Hoppers	50/65	3420	127	100	82.6	4	2	2	3	2	4	28.0	·970	0	4000	3030
B	Ballast	82	2400	89	96	79.3	4	2	2	3	3	4	28.5	1070	0	4170	3160
C	H7d0717	100	2000	74	100	82.6	4	2	2	3	4	4	29.0	970	0	4000	3030
D	Aggregate	91	2200	81	100	82.6	4	2	2	3	4	4	29.0	970	0	4000	3030
E	Gons	89	2244	83	100	82.6	4	2	3	3	4	4	30.0	970	0	4000	3030
F	HS Gons	50	4240	157	106	87.6	4	1	3	3	2	4	25.0	920	0	3800	2880
G	Cov Hop	70	2980	110	104	86	2	1	3	4	1	1	16.5	930	0	3840	2910
H	Cov Hop	70	2917	108	102	84.3	2	1	3	4	1	1	16.5	950	0	3920	2970
I	Cov Hop	70	3000	111	105.5	87.2	2	1	3	4	1	1	16.5	920	0	3800	2880
J	Box	27	6540	242	89	73.5	1	1	4	4	1	1	14.5	1090	0	4500	3410
K	Box	29	5277	195	77.3	63.9	1	1	4	4	1	1	14.5	1260	0	5160	3910
L	Box	33	5277	195	86.3	71.3	1	1	4	4	1	1	14.5	1120	0	4620	3500
M	Side Dump	135/140	1480	55	94	77.7	4	4	2	3	4	4	35.0	1460	0	6000	4550
	(Specialized M of W Cars)				72.6	60.0								1340	0	5500	4170
N	Flat	Variable			77												
N	20ft. Cont.	29	1250	46.3	18	12	4	3	3	4	2	3	31.0	1450		5990	4540
	@ 4/car		5000	185.2	67[9]	55.4											
N	40ft. Cont.	29	2500	92.6	27	18	4	3	3	4	2	3	31.0	1800		7430	5630
	@ 2/car		5000	185.2	54	44.6											

NOTES:

1 Struck Capacities for for Hoppers, Gondolas, and Side Cars

2 Soil Density Loose: 90lb./cu.ft. = 1.21 tons/cu.yd.

3 Relative merit factor = F

4 1 = Poor, 2 = Acceptable 3 = Good, 4 = Excellent

5 Assumes tarpaulins over loads in open top cars

6 Calc by waste $\frac{\text{cu.yd.}}{\text{21 tons car loads}} \div \text{cu.yd.}$

7 Waste material exported

8 Fill material imported
Not included in car loads estimate

9 Less 500 lbs. per container.

10 At struck capacity

11 At heaped capacity

* See Appendix A

EXHIBIT II-1

Unloading could be troublesome if facilities are not upgraded and if soils tend to cohere and hamper bottom dumping. Spill prevention was classed acceptable provided that pockets and doors are capable of being sealed to prevent leakage. If loads are covered with tarpaulins, security enroute was rated good. Overload prevention was rated acceptable, but since these cars would have about 40 cubic yards of excess capacity, test loads would have to be run over a track scale and stripes painted on each car to indicate the allowable load height. Decontamination/reuse aspects were rated excellent since washing and wipe tests should eliminate any residual radioactivity and the normal assignments of these cars do not involve food chains.

Three variations of hopper cars were also evaluated leading to slightly higher scoring. All of the above comments apply except that the cars with lesser cubic capacities were less likely to be overloaded thus increasing ratings for this factor.

Gondola cars were judged excellent for loading ease but poor for unloading. The unloading problems could be eliminated by using containers since removing soil by clam shell bucket would be inefficient. Spill prevention is improved for gondolas since they have flat solid bottoms eliminating enroute leakage. Security enroute was rated good if tarpaulins are used. Gondolas are also available with covers, normally in three sections and a crane is required for removal. Overload protection was considered excellent as were decontamination/reuse aspects leading to an overall score of 32.0.

High side gondolas were rated lower since they are of similar capacity to open top hoppers and typically have internal diagonal braces which would greatly complicate unloadings.

Several types of covered hoppers were evaluated leading to similar low scores. Both loading and unloading would be troublesome due to the configuration of top hatches and pocket gates. Some penalty is associated with this car type since reuse for grain service or other food processing industries would be compromised.

Box cars were found to have similar characteristics as covered hoppers except that loading would be even more awkward; consequently, their scores were even lower.

Side dump cars were found to provide a nearly ideal match to project requirements. Special attention could be required to the side seals to prevent leakage while underway and afford adequate security but all other application factors were judged excellent. Provided that sufficient cars are available for assignment to this project, car-cycle times would be greatly improved and unloading site upgrading costs minimized.

Finally, flat cars got a high score if provisions could be made to containerize the wastes. If dumping capabilities were included in container design criteria, considerable savings at the unloading site would be possible. Containers could also be loaded into gondola cars to permit transport of greater weights. This approach would allow a load limit of 100 tons per car rather than the 77 tons typical of intermodal flat car designs and could also minimize some tie down problems.

In summary, the equipment rankings at this stage indicate that side dump cars are preferred, followed by containerized loads in gondolas, and, lastly, bulk in gondolas.

REGULATORY AND TARIFF CONSIDERATIONS

The feasibility of rail transport is also governed by various regulations of federal and state agencies along with any rates and constraints imposed by Conrail.

The attached abstracts from BOE Tariff 6000-A, Hazardous Material Regulations, define Low Specific Activity (LSA) wastes as less than .001 milliCuries/gram or $1\mu C/gm$. In contrast, the wastes at the two sites range from 5 to over 100 picoCuries/gram. Since one pC is $10^{-6}\mu C$, the materials involved are on the order of $1 \times 10^{-4}\mu C/gm$. ($100pC = 100 \times 10^{-6}\mu C = 1 \times 10^{-4}\mu C$).

A further limit for shipment is that surface radiation from carloads must not exceed 10 millerem/hour at any point 2 meters (about 6 feet) from vertical planes projected from the outer edges of the vehicle. Open carloads would develop a gross activity of approximately 9 milliCuries; thus radiation levels in rem/hr should be surveyed or estimated for such lading configurations to assure compliance. It has been called to our attention by Mr. D. McDonald of the Pennsylvania Bureau of Radiation Protection and Toxicology, Harriburg, PA that some "hot spots" may exist in a former lagoon zone at Canonsburg at which specific activities considerably exceed 100pC/gm but it was not known whether they exceed 1µC/gm.

The recent Resource Conservation and Recovery (RCR) Act stipulates manifest requirements for generators, transporters, and disposers of hazardous wastes. Conrail's Safety and and Environmental Control Departments would be involved in technical evaluations arising from these regulations. In the Conrail Safety Department, Mr. James McNally at 215-893-6505 would evaluate transportation aspects, while Mr. Tom Pendergast at 215-893-6542 would rule on compliance with Conrail's environmental controls and manifesting aspects.

During transport, spillage and fugitive dust aspects must be considered. Open top equipment would necessitate use of tarpaulins to cover loads or possibly treatment with dust control agents such as are supplied for coal transfer and storage sites. The state regulators (Mr. E. Sajeski of the Pennsylvania Department of Transportation, Harrisburg) have indicated that their regulations simply parallel the U.S. Department of Transportation regulations previously referred to.

RAIL OPERATION AND FLEET SIZE

Duration of Project

Given the expected duration of the project at Canonsburg (104 weeks), Burrell (81 weeks), and Hanover (120 weeks), it is assumed that all of the contaminated material should be removed from Canonsburg in one and one-half years or 75 weeks, leaving the remaining time for site restoration. This will require removal of approximately 700 cubic yards of contaminated material per day or about 850 tons per day, assuming 1.21 tons per cubic yard. Assuming the same rate of removal the duration of the Burrell removal is 24 weeks.

If Canonsburg and Burrell are progressed sequentially, 21 weeks would be available at Hanover for finishing operations. Approximate elapsed times for each task are as follows:

Move in Canonsburg material	75	weeks
Move in Burrell material	24	weeks
Available for Finishing and Cleaning	21	weeks
Allocated time for Hanover	120	weeks

A sequential loading operation will permit the use of the same rail equipment at each loading site, minimizing track construction requirements at Hanover and reducing the rail car fleet requirements.

Existing Rail Services

Existing rail service at the Burrell site is by a triweekly turnaround local on Monday, Wednesday, and Friday by a train originating at Kiskiminetas Junction yard located near Freeport.

Existing local rail service at Canonsburg is by a train originating at Canonsburg five days per week. On Monday, Wednesday, and Friday this train works north to Scully near Carnegie where it connects with through trains. Contaminated material moving to Hanover would move on these days. On Tuesdays and Thursdays this train operates to Washington and return.

Existing local rail service at the Hanover site is by a train operating from Conway to Weirton and Mingo Junction seven days a week.

See Exhibit II-2 for rail network diagram.

Fleet Size

In developing a fleet size for the movement of contaminated material, it is necessary to determine an equipment cycle time which is based on the connections of these local trains plus the other trains required for road moves. This is done by sequentially following a set of cars through loading, movement to Hanover, unloading, and return to loading site to be loaded again. Care must be taken to assure that sufficient sets of equipment exist for loading each day. This is especially critical where train service is triweekly because a failure to place or pull cars could mean the loss of two days' loadings and bring some of the activities at the site to a standstill.

The maximum number of equipment sets to support rail movement, based on present Conrail operating plans, are as follows:

Burrell to Hanover	6 sets of 10 cars each
Canonsburg to Hanover	5 sets of 10 cars each
Burrell to Canonsburg	6 sets of 10 cars each

It is expected, therefore, that 60 rail cars will be required to adequately support the movement of these materials.

Unloading Operations

Based on the previously discussed evaluation, the car types in order of preference are side dump cars and gondolas. Side dump cars are not immediately available, especially while maintenance of way activities are in full operation on the railroad, usually April to October. Purchase of such cars would be prohibitively expensive and a canvassing of car leasing companies reveals these cars are generally not available for leasing. Therefore, it is expected gondolas will be used.

In unloading gondolas a clamshell bucket would be utilized. The maximum load that a 30-ton crane can lift when equipped with clamshell and with a 40-, 50-, or 60-foot boom is

RAIL NETWORK DIAGRAM

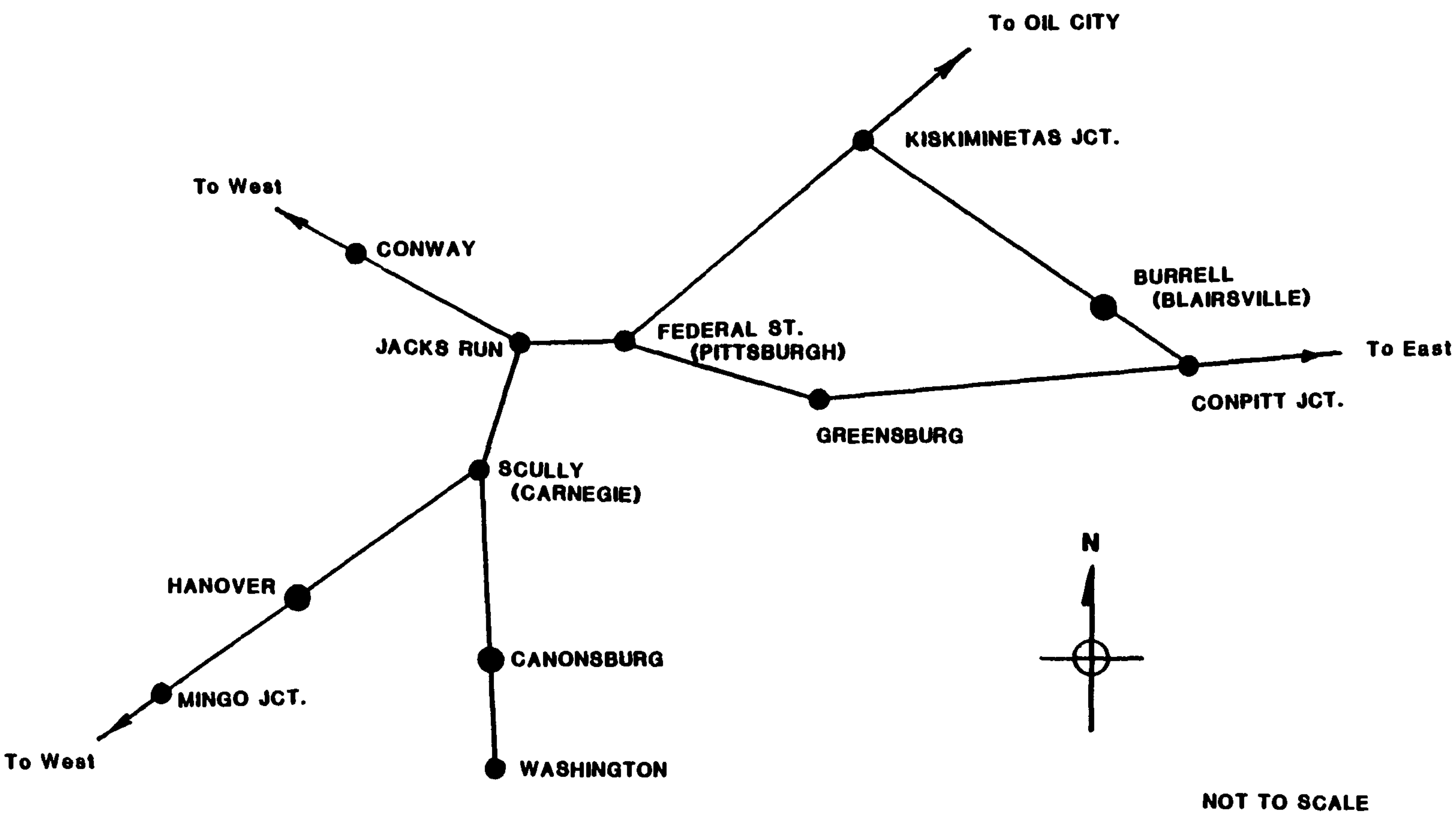


EXHIBIT II-2

10,300 pounds.[1] The largest bucket that can be handled is 1.5 cubic yards (the 2-cubic yard bucket exceeds to the crane's capacity by 531 pounds).

Bucket Size (Cubic Yards)	Capacity in[2] Cubic Feet at Plate-Line	Bucket Weight Pounds	Lading Weight[3]	Total Weight
1 1/4	37.6	4,980	3,384	8,364
1 1/2	43.7	6,000	3,933	9,933
2	51.5	6,206	4,635	10,841

The crane and bucket must be capable of unloading 20 rail cars per day (two days' loadings). With an expected unloading cycle of about 30 seconds[4], 146 cubic yards can be unloaded and placed into trucks for disposal in a 45-minute hour. This results in 90 cycles per hour.

Twenty carloads are the equivalent of 1,400 cubic yards which would be handled with an expected unloading time of 9.59 hours. If production could be pushed to 100 cycles per hour, i.e., 50 productive minutes per hour, the unloading time would still exceed eight hours by 28 minutes.

In the case of cars from Burrell, the overtime could be avoided by modifying Conrail's operating plan as only ten cars per day would need to be unloaded. Not only will this plan eliminate the overtime, but it will reduce the fleet size by ten cars. However, to achieve this plan operationally, Conrail would have to give absolute cooperation which we believe could be difficult over a sustained period of 24 weeks. Should the

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[1]R.L. Penrifoy, Construction Planning, Equipment, and Methods, McGraw-Hill, 1979 (page 236).

[2]Ibid, page 243.

[3]At 90 lbs. per cubic foot.

[4]Ibid, page 245.

material be moved from Burrell to Hanover by rail under a modified operating plan it is recommended that the fleet of rail cars be held at 60. This would permit some slippage on Conrail's part without jeopardizing production. It will also give the unloading contractor the ability to get out of trouble by working overtime. He would not have this ability when overtime is planned into the schedule.

In the case of the movement of material from Canonsburg to Hanover, the use of a 60-car fleet requires unloading of only ten cars per day.

In addition to the crane and clamshell, a group of four or five laborers with hand shovels will have to clean each gondola because the bucket is not able to clean the corners or along the edges of the car. These men would be subject to breathing dust because they would be working in a confined area where wind would not readily carry away the dust.

Use of Containers to Facilitate Unloading Operations

Youngstown Steel Door provides a 200 cubic yard container which was widely used in the steel mill operations. Eleven of these containers will fit into a standard 52-foot 6-inch gondola. The containers have a bottom unloading door which will permit discharge directly into trucks.

Because of the heavy weight of the material being handled only 178 cubic feet (eight tons) of each container's capacity is usable.

In unloading operations a crane moving adjacent to the rail cars can affix a sling to the container, lift and swing the container over a waiting truck, discharge the contents into the truck, and return the container to the car. Using this method 240 containers (21 carloads) can be unloaded per day. This daily productivity is sufficient to unload two day's loadings without overtime. No men will be required to clean the interior of the car. No movement of rail cars will be necessary once placed by Conrail.

Loading Operations

Without containerization, a tractor loader or crane would be used to load the gondola cars. A tractor loader with a 2.5-ton bucket will handle about 95 cubic yards of material per hour and load 700 cubic yards of material in 7.37 hours.

A 30-ton crane with a 1.5-cubic yard clamshell bucket will be able to load 700 cubic yards in 4.8 hours. In either case a Trackmobile will move and spot the rail cars at the loading location.

In a containerized operation, a Trackmobile would move cars to a surge bin equipped with a loading chute similar to that used in grain loading. A 30-ton crane with a 1.5-cubic yard clamshell bucket will place exactly four buckets (eight tons) into the surge bin which will then be unloaded into the container on the rail car. As the Trackmobile is positioning the next container, the crane is recharging the surge bin. It is estimated that a container can be loaded every four minutes.

Loading and Unloading Costs

The cost of loading rail cars at each loading site is assumed to be the same. The costs were developed for movements with and without the use of containers.

The operaton consists of:

- A 30-ton crawler crane with clamshell bucket
- A Trackmobile capable of moving ten loaded cars
- Equipment operators and helpers
- Clean up laborers

The projected cost per ton is $1.31 using containers and $1.45 not using containers.

The cost of unloading rail cars is assumed to be the same at each location. As with loading, the costs were developed with and without the use of containers.

The operation consists of:

- A 30-ton crane with a clamshell bucket for use without containers or with a sling for use with containers
- Equipment operators and helpers
- Clean up laborers.

The projected cost per ton is $0.88 using containers and $1.44 not using containers.

Cost Advantage In Using Containers

As can be seen from the previous discussion, the use of containers lowers the costs of loading and unloading. The estimated cost for a new container is $2,750 and it is assumed that upon completion of the project the containers would be scrapped. If all contaminated material (330,000 cubic yards) was outloaded in containers the cost of using containers is $4.28 per ton. It is therefore assumed that containers would not be used if the rail option were selected.

The resulting cost differential is $3.58 in favor of not using containers as shown in Exhibit II-3.

RAIL LOADING/UNLOADING COST/TON

	Cost Per Ton	
Operation	With Containers	Without Containers
Loading	$1.31	$1.45
Unloading	0.88	1.44
Container Purchase	$4.28*	-
	$6.47	$2.89

* Assumes maximum use of 330,000 cubic yards

EXHIBIT II-3

COST

Facilities

The cost to rehabilitate/construct the necessary rail facilities at each site is estimated below, including expected salvage (scrap) value, all in 1982 dollars.

Burrell Township
Installation 1400' side track and two turnouts - $220,000
Expected Salvage value - $10,800.

Canonsburg
Renew 1600 yard ties, renew 1 set switch timber and
Install one crossover - $63,050
Expected salvage value - $902

Hanover
Install two turnouts, construct 5250' track,
Rehabilitate 2850' track and install two timber
Bridge decks - $498,000.

(Not including purchase of ROW and assuming rail presently at site would be left there upon project completion)

Expected salvage value - $15,500

Equipment

Costs to Use Carrier-Supplied Cars

Conrail's Open Top Hopper Business Group, has indicated that LSA wastes can be hauled in hopper or gondola cars at a rate of $.75 per hundred weight (from Canonsburg) to $1.15 per hundred weight (cwt) (from Burrell) for loads of 90 tons or more. For shipments in 100 ton open top cars this amounts to $1900 per carload. Further, if special trains are run, a surcharge of $2200 per train is imposed. This information is published in Conrail's Tariff 4426B, Schedule D, and is included in Appendix C. Conrail has also indicated that rates are negotiable depending on the volumes of waste, daily carloading estimates, and their adaptability to existing freight schedules. In other words, rates in the tariff basically consider movements of one to a few carloads; since several thousand carloads could be generated by the clean up project, lower rates could be negotiated.

Costs to Lease Cars

Of five inquiries, two lessors have responded with estimated costs so far. PLM indicates that 4000-cubic-foot capacity, three-pocket hopper cars can be leased on a full lessor maintenance basis for $400 per car-month. Evans Railcar indicates that lower capacity gondolas or hoppers can be leased for $300 to $400 per car-month depending on type, age, availability etc. All lessors are sensitive to the radioactivity aspects and would require clauses to assign liabilities for contamination of equipment to the lessee.

The cost to lease a fleet of 60 cars has been estimated to be $432,000 to $960,000.

It must be recognized that leasing arrangements are seldom straightforward, simple contracts since the railroads also influence operating costs. In some instances, the railroads allow rebates on a car mile basis for leased cars since their own cars do not experience wear and tear. The lessors interviewed would not venture estimates of what rebates, in cents per car mile, might be negotiated. Further they indicated that no rebates might be available presently; in fact, surcharges might even be imposed in some circumstances. Since Conrail now has many cars idle, it is not too likely that they would welcome use of a leased fleet for this project.

Costs to Buy and Operate Cars

Given the current low levels of traffic and utilization, it is likely that older but suitable cars could be purchased from either railroads or lessors and scrapped upon completion of the project. Prices for new open top cars are in the $45,000 range; however, cars 30 or so years old could be acquired at prices not exceeding $8,000 each, leading to the following estimate:

Purchase 60 open top cars	= $480,000
Maintenance at 5¢/car-mile	= 22,000
Scrap credit at $40 per ton	= 72,000
Total Estimated Cost	$574,000

Recommendation

Based on the above evaluation the use of carrier supplied cars is recommended.

Transportation of Contaminated Material

Burrell to Hanover - 80,000 cubic yards

Burrell to Canonsburg - 80,000 cubic yards

Loading @$1.45/ton	$ 141,520
Over-the-road @$1.15/cwt	1,840,000
Unloading @$1.44/ton	140,544
	$2,122,064

Canonsburg to Hanover - 250,000 cubic yards

Loading @$1.45/ton	$ 442,250
Over-the-road @$0.75/cwt	3,750,000
Unloading @$1.44/ton	439,200
	$4,631,450

Transportation of Fill Material

While specific borrow pit locations were not identified it was assumed that when the project begins sufficient borrow pits will be located within 10 to 20 miles of each site. With the borrow pits in such close proximity to the site, coupled with the double handling required if moved by rail the moving of land fill by rail was disregarded as too costly and as presenting too much of a logistical problem, especially if rail was to be used to move out contaminated material.

COST SUMMARY*

Contaminated Material Burrell to Hanover (Aternative 4)

Facilities	$ 718,000
Movement out	2,122,064
Expected salvage	(26,300)
Net	$2,813,764

Contaminated Material Burrell to Canonsburg (Alternative 2)

Facilities	$ 283,050
Movement out	2,122,064
Expected salvage	(11,700)
	$2,393,414

Contaminated Material Canonsburg to Hanover (Alternative 4)

If material from Burrell was moved by rail to Hanover:

Facilities	$ 63,050
Movement out	4,631,450
Expected salvage	(900)
	$4,693,600

If material from Burrell was not moved by rail (ie. truck) to Hanover:

Facilities	$ 561,050
Movement out	4,631,450
Expected salvage	(16,400)
	$5,176,100

Contaminated Material Canonsburg to Hanover (Alternative 5)

Facilities	$ 561,050
Movement out	4,631,450
Expected salavage	(16,400)
	$5,176,100

*Does not include movement of fill material to each site.

III TRUCK ALTERNATIVE

SITE ACCESS

Burrell Township

Present access to the Burrell Township Site from public roads is fair at best. Access for evacuation of contaminated material from its present location to existing public roads will require the following:

- Construction of 1,350-foot two-lane gravel and dirt access road from loading areas to the Conrail ROW property line.
- Rehabilitation of a two-lane private gravel grade crossing over the Conrail three-track main line. A Conrail flagman will also be required at the crossing during all hours of use.
- Rehabilitation of a two-lane 2,800-foot cinder access road adjacent to the Conrail tracks to a point of junction with Strangford Road.

Strangford Road, LR 32004, is the only available public road from the site and is deemed to be inadequate to support a sustained operation of a fleet of dump trucks (about 4,500 round trips are involved; approximately 4.6 trucks in each direction per hour, eight hours per day, five days per week for 24 weeks) to and from the site.

The road has a 15-ton load limit with asphalt paving which ranges from 12 to 15 feet wide with inadequate shoulders. The grade of the road varies and is moderately steep for short distances. The road traverses a sparse to medium density residential area for a distance of about 4,500 feet where it connects with old Route US 22, LR 32179 (Old 22), a two-lane, uncontrolled-access highway with a 45 to 50 mph speed limit and no special weight restrictions. The intersection of Strangford Road and Old 22 will prove to be extremely hazardous because of inadequate sight distance from Strangford Road to observe oncoming eastward traffic on Old 22, because of the Old 22 speed limits, and because of an inadequate turning radius for trucks to turn off Strangford Road eastward to Old 22. Improvement of sight distance by vegetation removal and regrading would, by itself, be inadequate. A speed restriction to 30 mph would be required for 1,500 feet on both sides of the intersection on Old 22, installation of "Caution-Turning Truck" signs, and quite possibly Caution/Stop flashers at the intersection. Improvement of the turning radius requires relocation of an existing two-story, single-family, frame dwelling about 300 feet. Property exists for such a relocation. An alternative would be to relocate the Strangford/Old 22 intersection about 300 feet to the east, thus improving the sight distance and the turning radius. This can be accomplished with minimal disruption as the present property is only a cut grass field. From this point the access to the present US 22 (Blairsville By-Pass) is adequate.

Canonsburg

Present access to the Canonsburg site is via Strabane Avenue, to West Pike Street, to PA 519, and to I-79.

Strabane Avenue north of Chartiers Creek is essentially lined with single family dwellings for about 400 feet. The intersection with West Pike Street is controlled by a traffic light. While the turning radius at this intersection is small it is alleviated to some degree by the set back of the stop lines. The turning radius could be further improved by setting the stop lines further back for the eastward traffic on West Pike Street. West Pike Street is heavily settled, mixed residential, commercial, and light industrial for about 5,600 feet to its intersection with PA 519 in the Borough of Houston. This intersection is also controlled by traffic signals. While the turning radius is better than the Strabane Avenue intersection, traffic stop lines will have to be relocated back from the lights to facilitate a larger turning radius. PA 519 is essentially commercially developed, with development decreasing as I-79 is approached. PA 519 will be travelled for 2,500 feet to the intersection of I-79.

While this route is capable of supporting a truck traffic density of about 14,000 round trips (approximately 4.7 trucks in each direction per hour, eight hours per day, five days per week for 75 weeks), portions of the road will no doubt require resurfacing on completion of the project. While not specifically part of the scope of this report it is believed that local public opinion will make this an undesirable route even if the inhabitants realize that the contaminated material is being removed.

An alternative exists in that an access road can be constructed to the south of and adjacent to the Conrail branch line between Strabane Avenue and PA 519. A railroad access road exists for most of the distance now and could be extended by eliminating the Conrail stub-end track west of Strabane Avenue. There is no apparent reason for Conrail to resist removal of this track. If that is not possible, a similar route could be accomplished either via Strabane Avenue, south to Latimer Avenue, and then west to PA 519; or, alternatively, via Strabane Avenue, south to Boone Avenue, and then west to PA 519.

Hanover Township

The only present access to the Hanover Township site which could be found during a ground reconnaissance without traversing private roads was via LR 62122 which parallels the Conrail mainline and Harmon Creek westward from PA 18, then via coal-haul roads. LR 62122 traverses the heart of Burgettstown and any volume of truck movement through the town would be virtually impossible. Access revealed through a map reconnaissance indicates a possibility of using T647 westward from PA 18; this route does not traverse any built-up areas. Also, Old US 22 west from the vicinity of Florence could be used to enter the site from the north.

OVER THE ROAD OPERATIONS

Burrell to Hanover

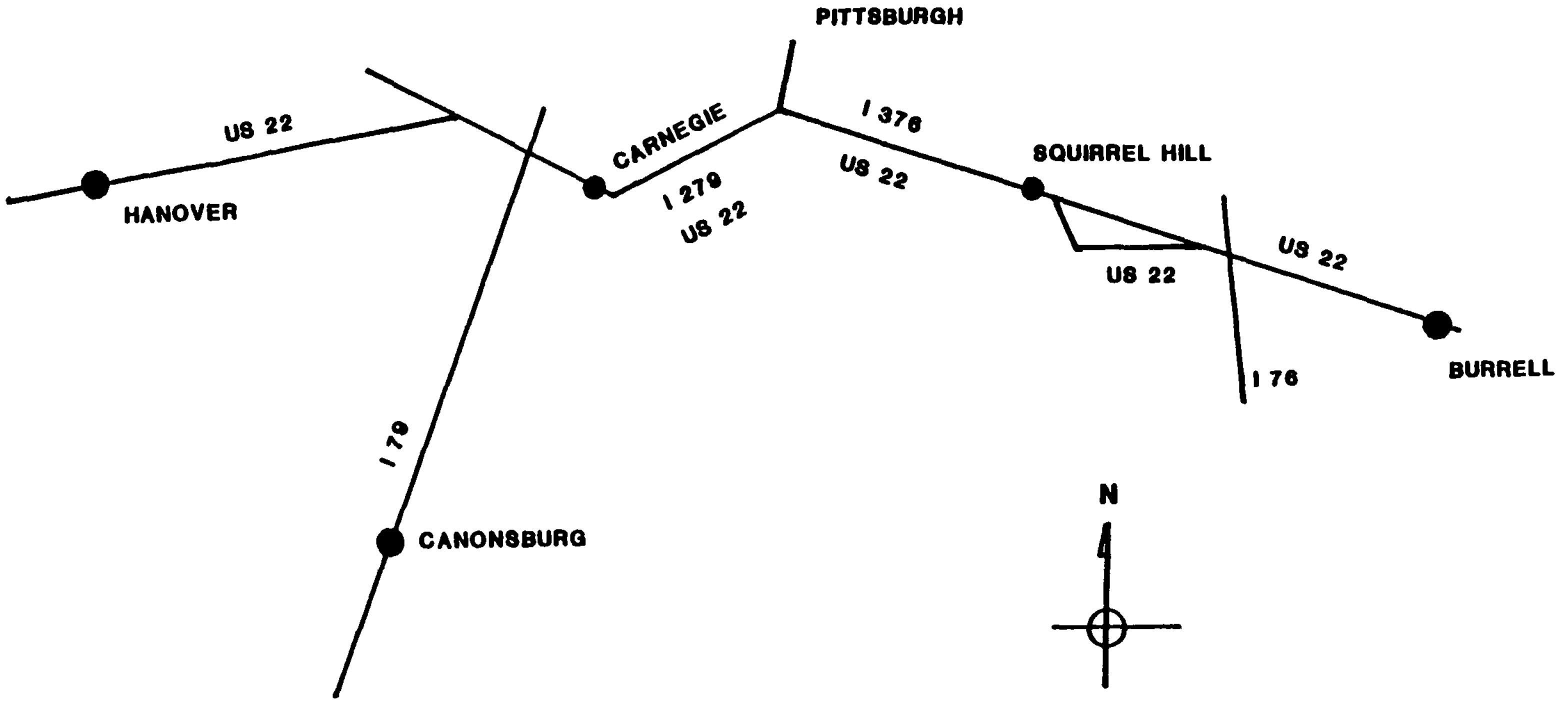
US 22 is essentially a three-lane, paved, unlimited-access highway for 26.5 miles providing a lane for each direction with the third (middle) lane designated for turning or passing as appropriate. Portions of this section are four-lane primarily at intersections with major cross roads. Most intersections are not grade-separated. The grades are moderate and the road is lined with commercial establishments with the density of occupation increasing close to Pittsburgh. The last three miles just prior to merging with I-376 is four-lane, heavily built-up, and congested.

I-376/US 22 is primarily a four-lane, paved, limited-access highway with at least two lanes in each direction for 15 miles. The grades are moderate and the route traverses a one mile tunnel at Squirrel Hill. Reconstruction of portions of this route are presently under way, permitting only one lane of traffic in each direction. This portion of the route passes through downtown Pittsburgh, generally following the north bank of the Monongahela River.

At the end of I-376/US 22, the route becomes I-279/US 22 and turns south over the Monongahela River and into the Fort Pitt tunnel. This section is a paved four-lane, limited-access highway with moderate grades for five miles to the junction with I-79. At this point the route designation is US 22/US 30. This section is a four-lane, paved, limited-access highway with moderate to heavy grades for 18 miles. Reconstruction is presently underway on portions of this section, allowing only one lane traffic in some stretches. This route ends at the grade-separated intersection with PA 18 which would be used for immediate access to the Hanover site.

This is a rather long route over roads that during the peak commutation periods are heavily utilized. Traffic in the downtown Pittsburgh area near the intersection of I-376 and I-279 can be heavy and congested even during off-peak periods. Truck hauls on this route would be limited to two round trips per eight-hour day with the probability of operation back to the starting site requiring more than an eight-hour day. See Exhibit III-1.

HIGHWAY NETWORK DIAGRAM



NOT TO SCALE

EXHIBIT III-1

Burrell to Canonsburg

The same route as previously described for Burrell to Hanover would be used except that, at the junction of I-79, traffic would turn onto I-79 south for 15 miles to PA 519. I-79 is a four-lane, paved, limited-access highway with flat to moderate grades. PA 519 would be used for immediate access to the Hanover site. This route is essentially the same length as the Burrell to Hanover route and truck operation would be limited to two trips per eight-hour day with the probability of a frequent occurrence of operation beyond eight hours. See Exhibit III-1.

Canonsburg to Hanover

Essentially there are three available routes between Canonsburg and Hanover, as shown in Exhibit III-2.

CANONSBURG-HANOVER ROUTE NETWORK

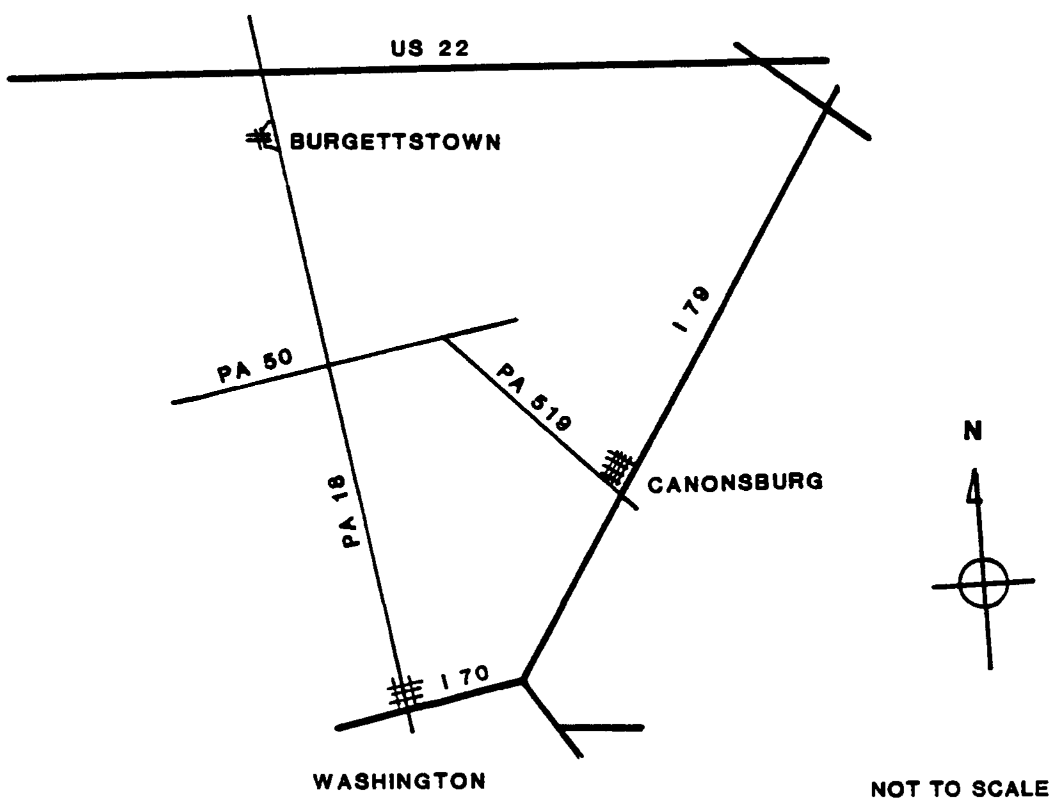


EXHIBIT III-2

Route 1 - via I-79 and US 22. This is a paved, four-lane, limited-access highway route of 33 miles and offers the best route from the standpoints of capacity, grades, and avoidance of populated areas.

Route 2 - via PA 519, PA 50, and PA 18. This is a paved, two-lane, unlimited-access highway route of 19 miles with moderate grades and limited capacity and it traverses several built up areas including the Borough of Houston and the small towns of Westland, Hickory, and Atlasburg; it bypasses the outskirts of Burgettstown on a limited-access, four-lane bypass.

Route 3 - via I-79, I-70, and PA 18. This is a paved route with six miles of four-lane Interstate and 24 miles of two-lane PA 18 with moderate grades, limited capacity, and traversing two built up areas including downtown Washington which resembles West Pike Street in Canonsburg.

EQUIPMENT

For highway transport of the wastes, two types of dump trucks can be considered: Triaxle trucks which can handle 16 to 18 cubic yards and tractor trailer types with dump bodies which can handle 18 to 20 cubic yards while remaining within gross highway load limits of 73,280 lbs. The movement of such vehicles on the routes previously discussed should present no operating or weight problems.

The cleanup project will require dedication of a fleet of trucks to haul both wastes and fill. Two contractors in the Pittsburgh area, (D. Tesone - 412-781-4551 and Sciaretti - 412-462-1233) appear capable of meeting project requirements, with heavy fleets of 96 to 150 trucks. Also, at least one is familiar with hazardous waste hauling regulations of the U.S. DOT and state Department of Environmental Resources.

COST

Based on discussions with two trucking companies in the area the following round-trip truck transportation rates are provided based on the one-way distances shown and assuming 18 cubic yards per truckload:

10 miles	$43.20	- $2.40/cubic yard
20 miles	$75.60	- $4.20/cubic yard
50 miles	$135.00	- $7.50/cubic yard
70 miles	$156.60	- $8.70/cubic yard

The above rates do not include cost for excavating and loading nor do they include the cost for the fill material.

Cost for fill material can vary from $1 to $6 per cubic yard depending on the quality of soil and the owners need to get rid of the material.

Based on the rates shown above the over the road truck transportation costs are estimated below:

Contaminated Material

Burrell to Hanover
80,000 cubic yards - $696,000

Burrell to Canonsburg
80,000 cubic yards - $696,000

Canonsburg to Hanover
250,000 cubic yards - $1,050,000

Fill Material (with borrow pits assumed to be within 10 miles)

At Burrell (Alternatives 2 and 4)
16,000 cubic yards - $38,500

At Burrell (Alternatives 3 and 5)
72,000 cubic yards - $172,800

At Canonsburg (Alternatives 3, 4, and 5)
251,000 cubic yards - $602,600

At Canonsburg (Alternative 2)
256,000 cubic yards - $614,300

At Hanover (Alternative 4)
204,000 cubic yards - $481,600

At Hanover (Alternative 5)
170,000 cubic yards - $408,000

Discussion with the company that hauled clean fill for the Conrail chloroform spill at Midway, M&M Equipment Sales, indicated that the cost per cubic yard of fill for that job was about $19 which included a good grade of soil, excavation, loading and hauling on a 20 mile round trip.

IV DISCUSSION OF ALTERNATIVES

It is quite obvious from a cost standpoint that the use of trucks is the preferred method of transportation for all alternatives.

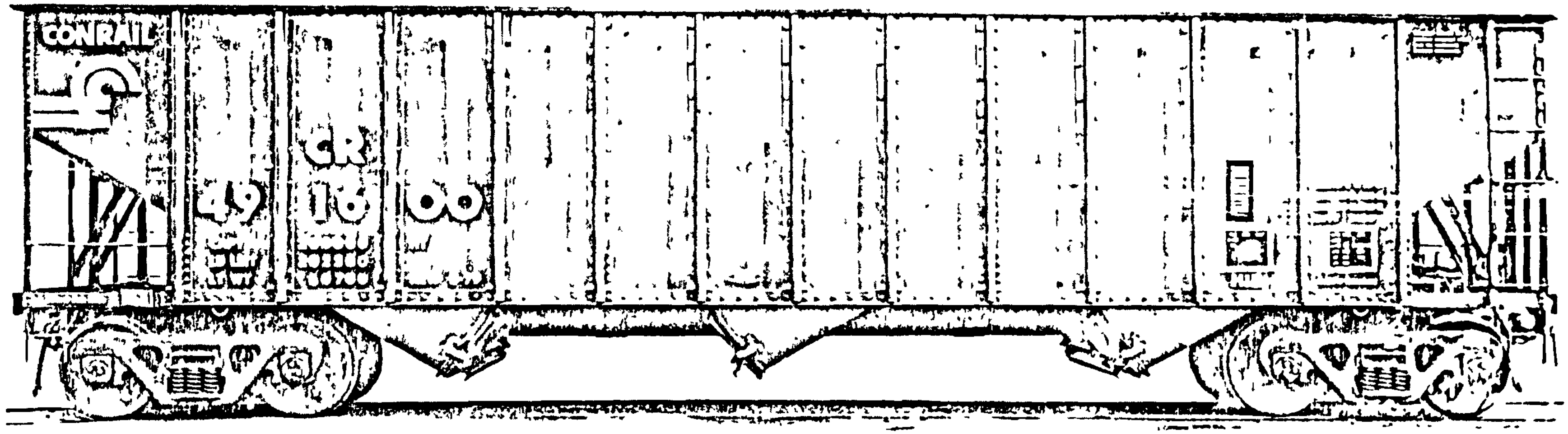
It appears that adequate trucks will be available to handle the quantities involved.

Based on the route reconnaissance conducted there are no unusual highway design or safety hazards which will preclude the use of trucks, except those specifically pointed out in the discussion of site access.

The only potential problems associated with the use ot trucks are the length of haul from the Burrell Township site and the exposure of this traffic between Squirrel Hill and Carnegie, in the downtown Pittsburgh area.

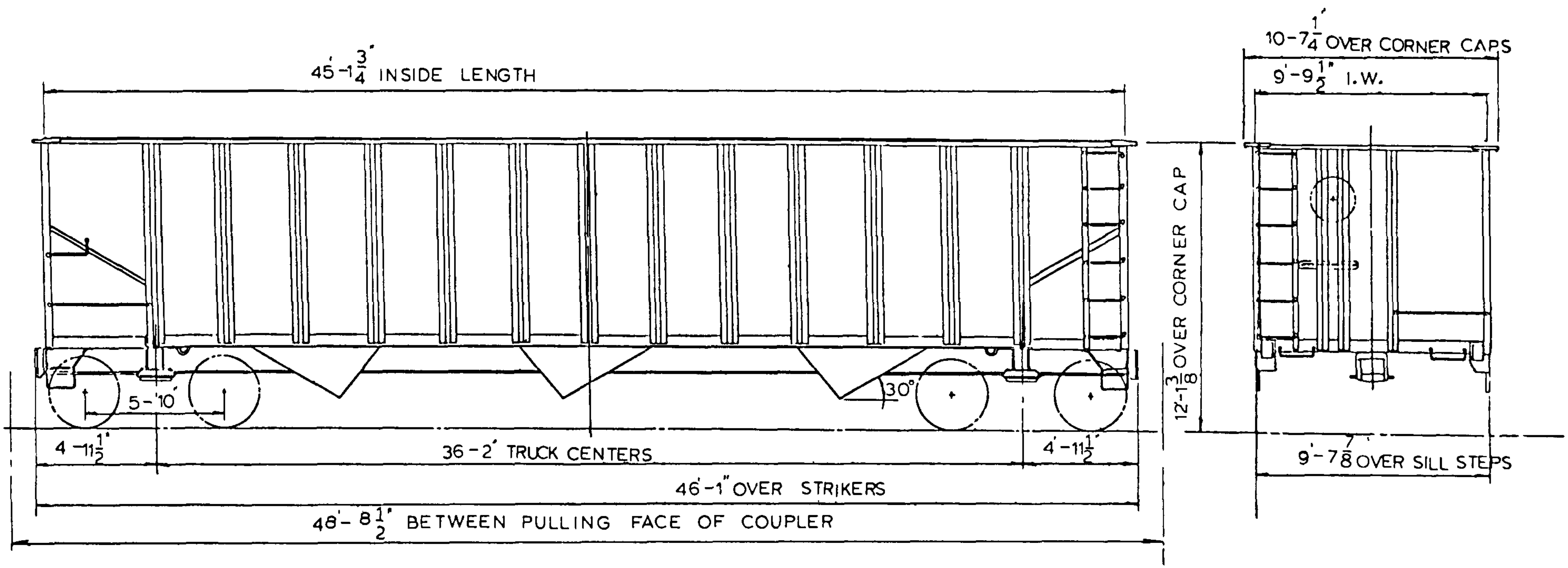
APPENDIX A

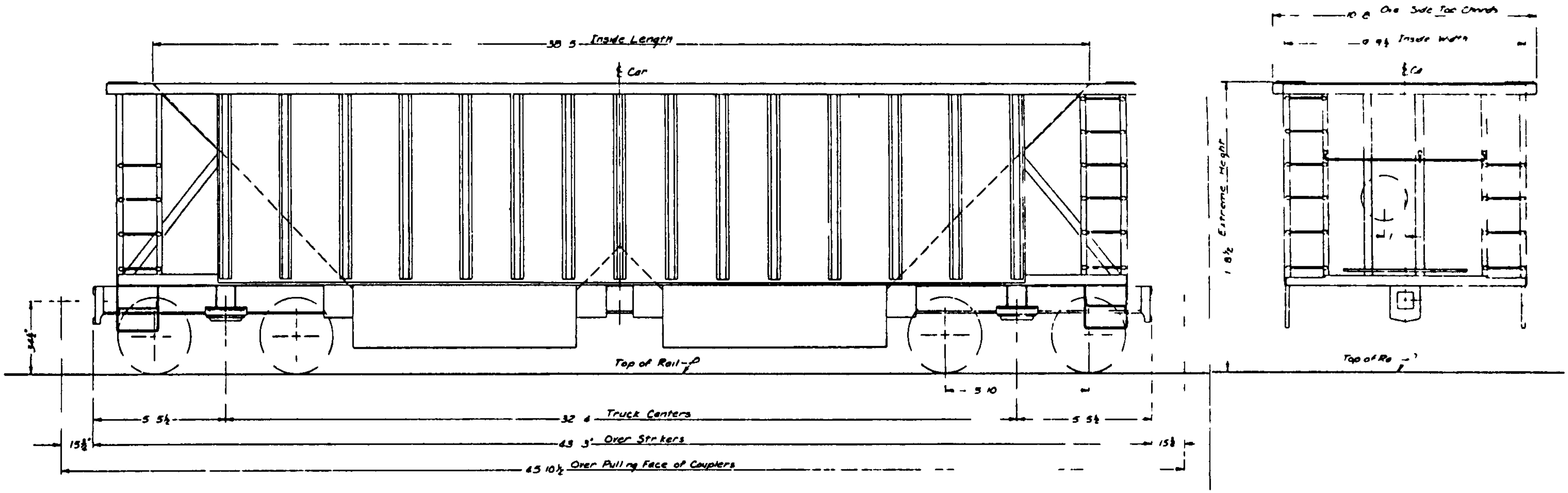
RAIL CAR DESCRIPTIONS



Conrail 100-Ton Triple Hopper Car.
Inside length 45 ft. 2 in , inside width 9 ft 9 in., length over pulling face coupler 48 ft. 8 in. Extreme width 10 ft 7 in , extreme height 12 ft. 2 in., rated capacity 200,000 lbs. or 3420 cu ft. Built by Greenville Steel Car Co., 1979.

GREENVILLE STEEL CAR COMPANY

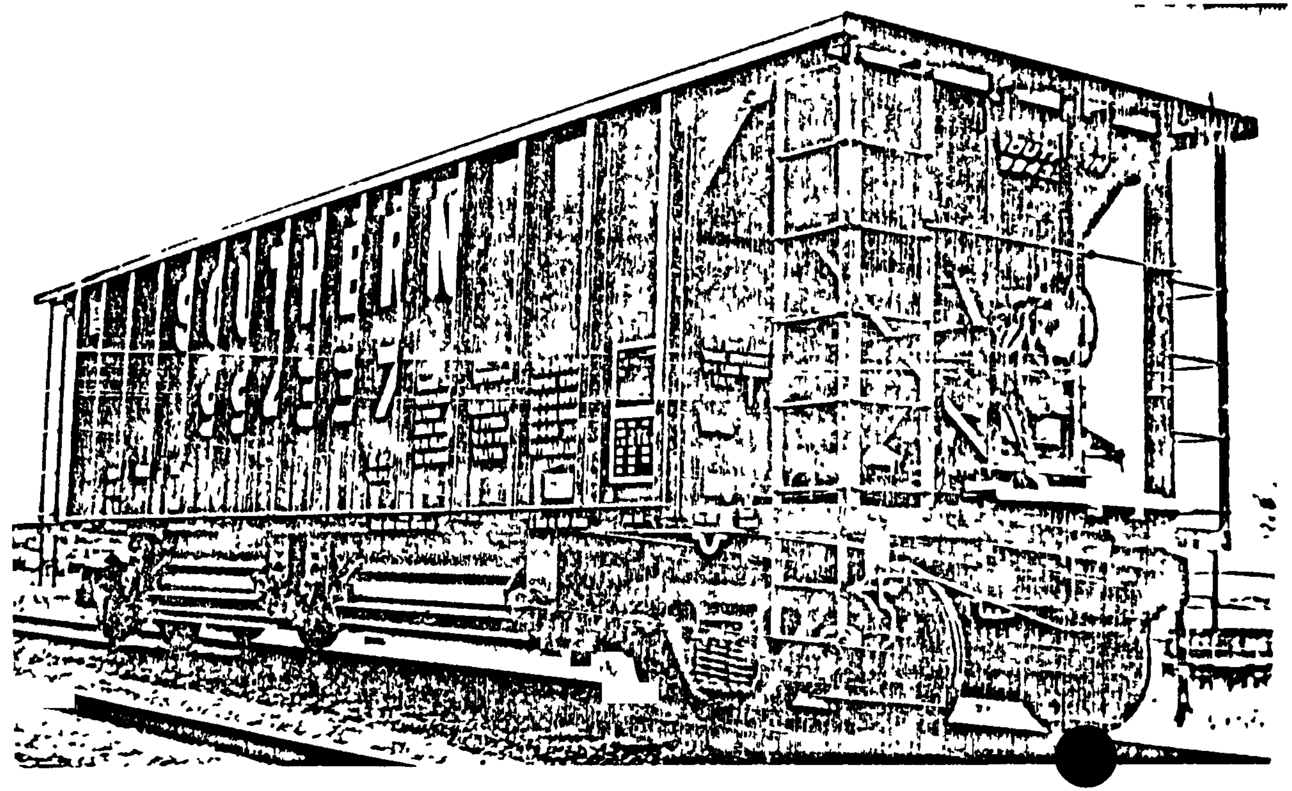


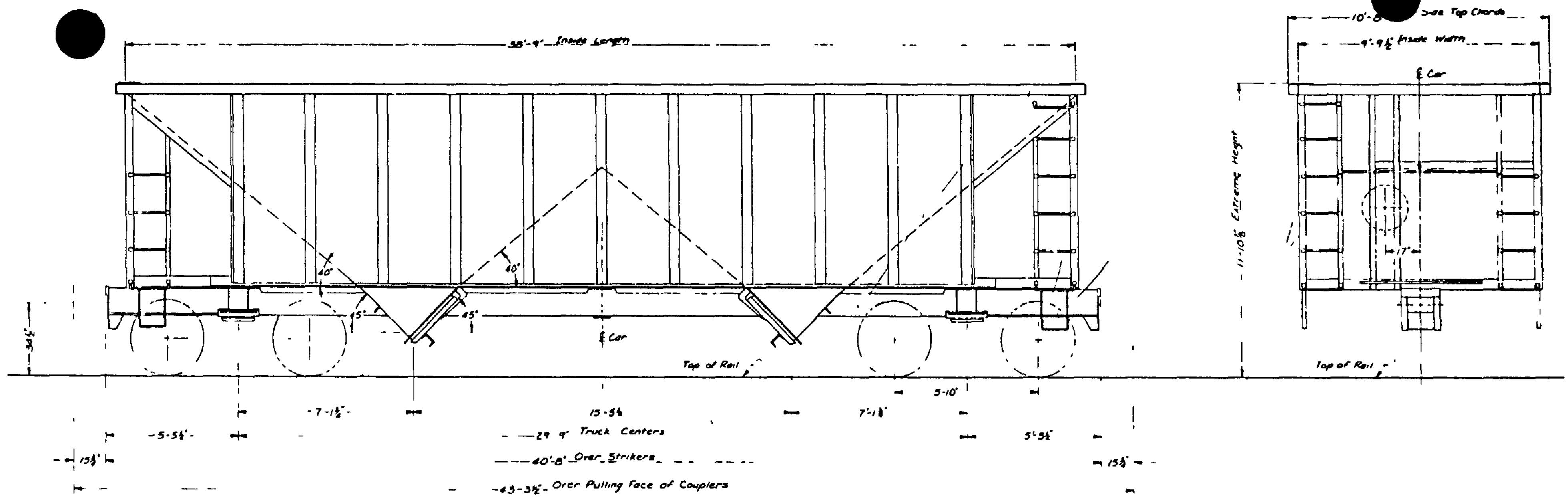


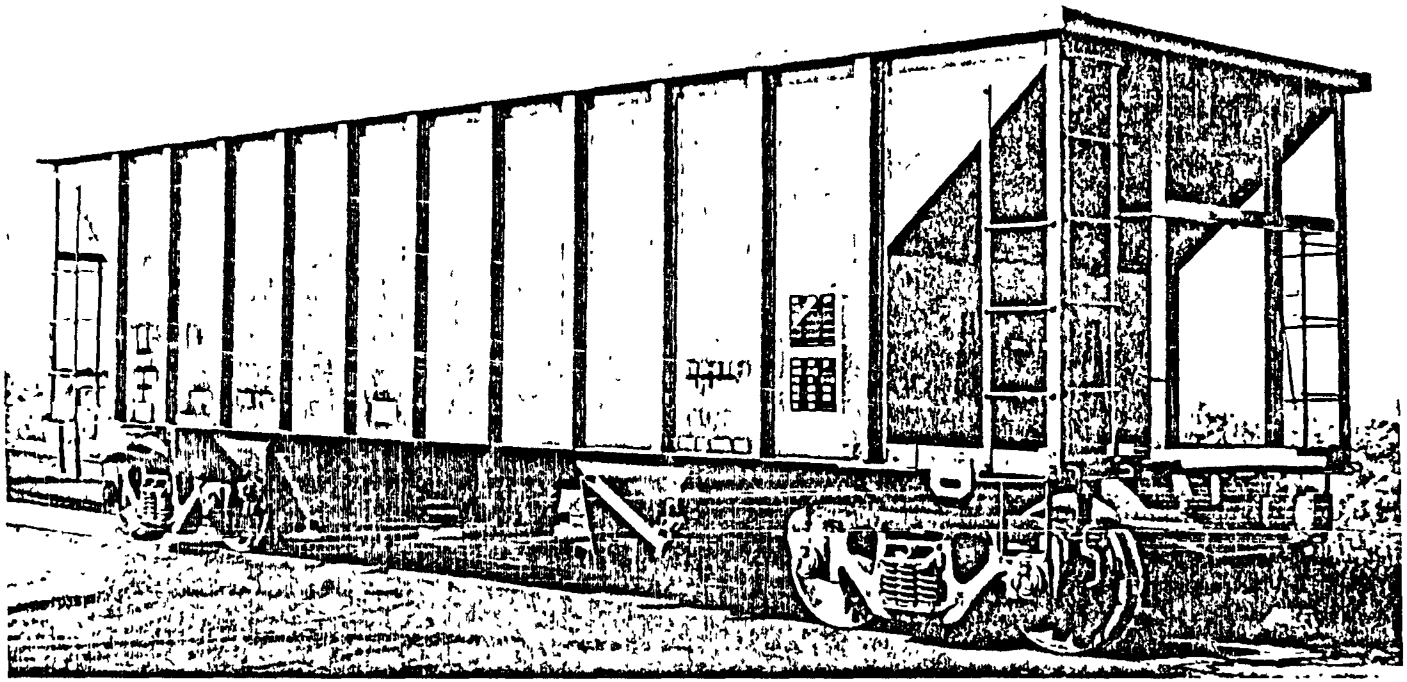
H-770804
Southern 100-Ton Ballast Car

Rated capacity is 192,000 lbs or 2400 cubic feet End floor slope sheets are 45° Built by PORTEC, INC , Railcar Division, 1979.

Portec inc Railcar Division



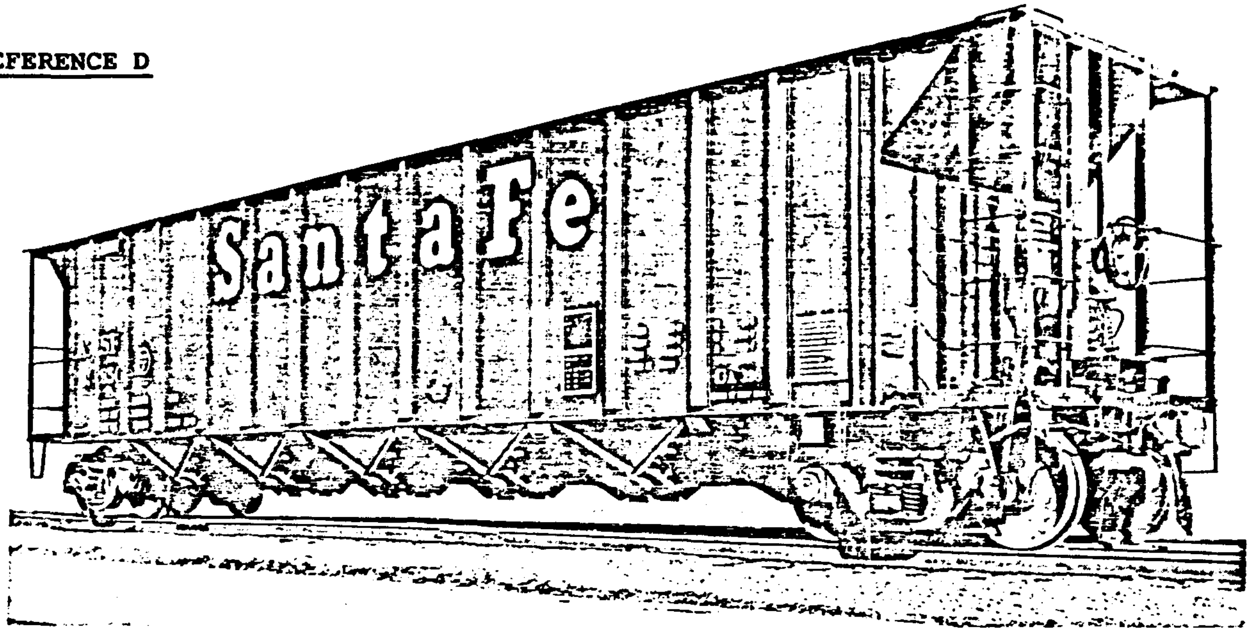




H-780717 100-Ton Open Top Hopper Car

It has a rated capacity of 200,000 lbs. or 2,000 cubic feet. Built by PORTEC, INC., Railcar Division, 1979.

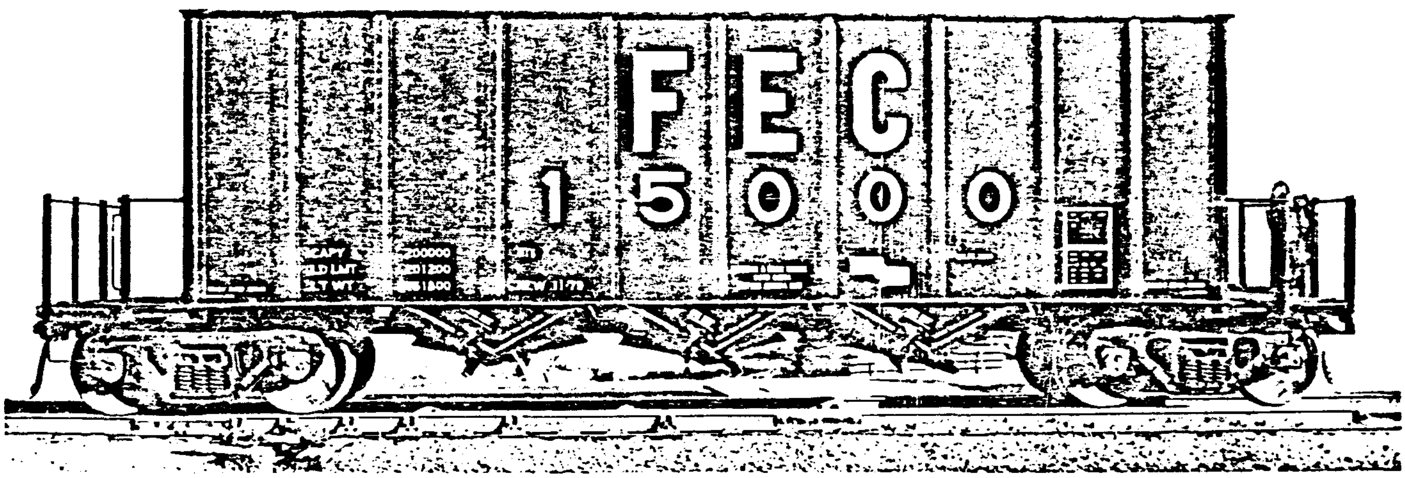
Portec inc. Railcar Division



SANTA FE RAILROAD RAPID DISCHARGE® CAR. BUILT BY ORTNER FREIGHT CAR CO.

Five-pocket, fully-automated 100-ton Rapid Discharge® coal car. Cars are used in shuttle train operations in Arizona and New Mexico.

Coupled length	57'7" 17.53 meters
Length between truck centers	45'1" 13.72 meters
Inside length	49'11" 15.24 meters
Inside width	9'10" 2.97 meters

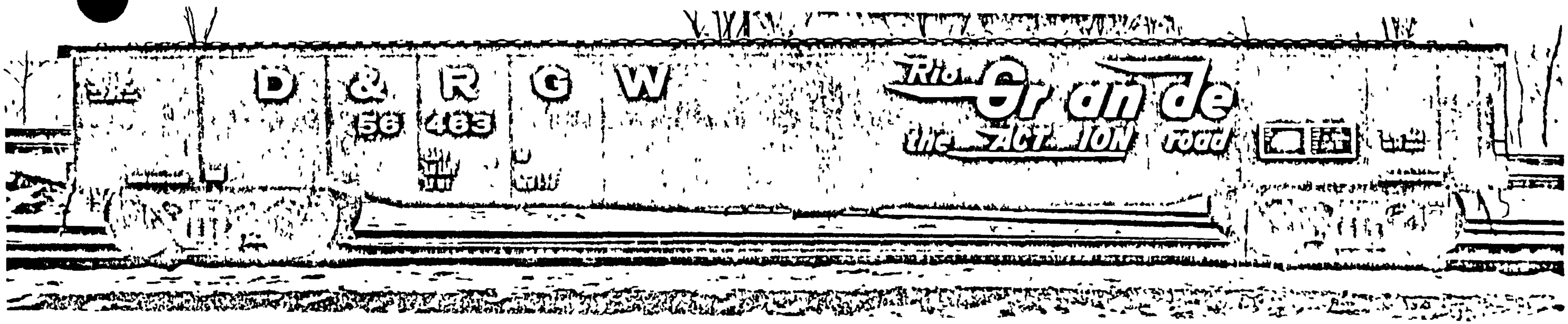


FLORIDA EAST COAST RAILROAD RAPID DISCHARGE® AGGREGATE CAR. BUILT BY ORTNER FREIGHT CAR CO.

This three-pocket, 100-ton aggregate car was built in 1979. These cars are being used to haul limestone out of the Miami area.

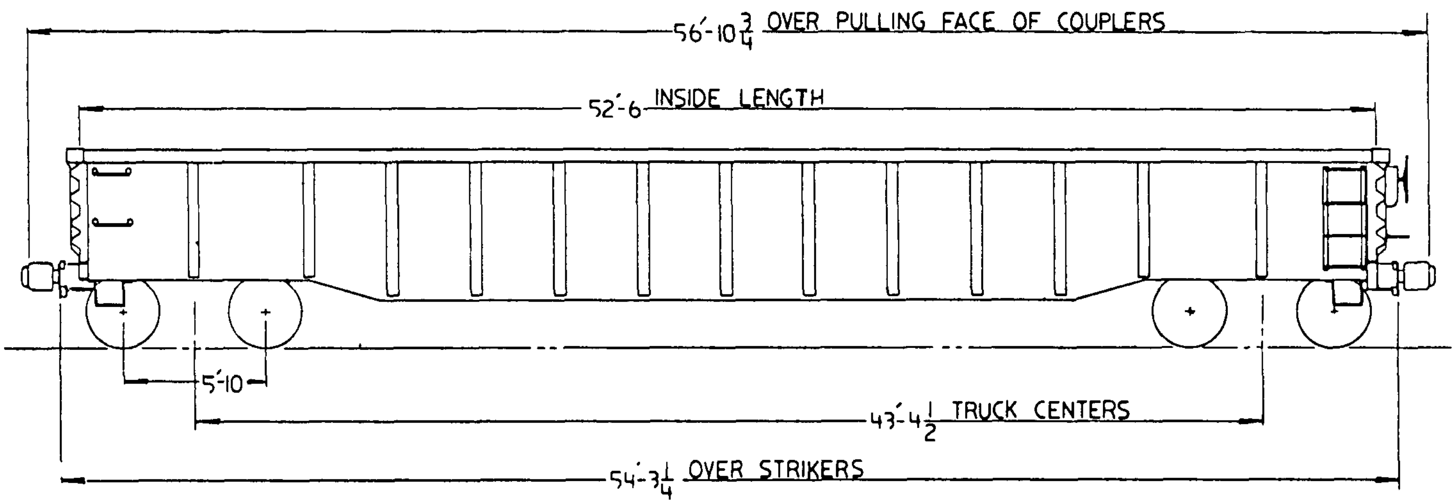
Cubic Capacity	2200 cu. ft. 62.3 cu. meters
Length over truck centers	31'3½" 9.54 meters
Inside length	29'3" 8.91 meters
Inside width	9'10" 3 meters

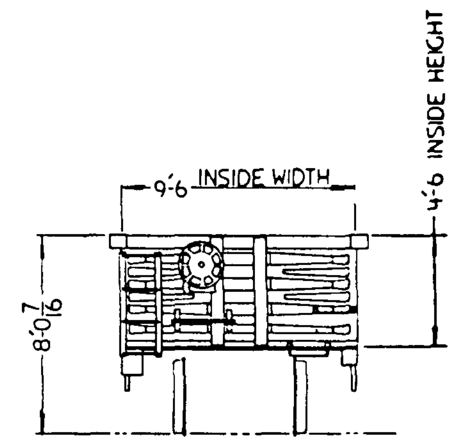
ORTNER FREIGHT CAR CO.



Denver & Rio Grande Gondola.
Solid Bottom Gondola Car.
Class GS.
52'6" Inside Length.
4'6" Inside Height.
100-Ton Capacity.
Continuous Bar Type Lading Band Anchors.
Collapsible Stake Pockets.
Used in Steel Service.
Built by International Car Co., 1978.

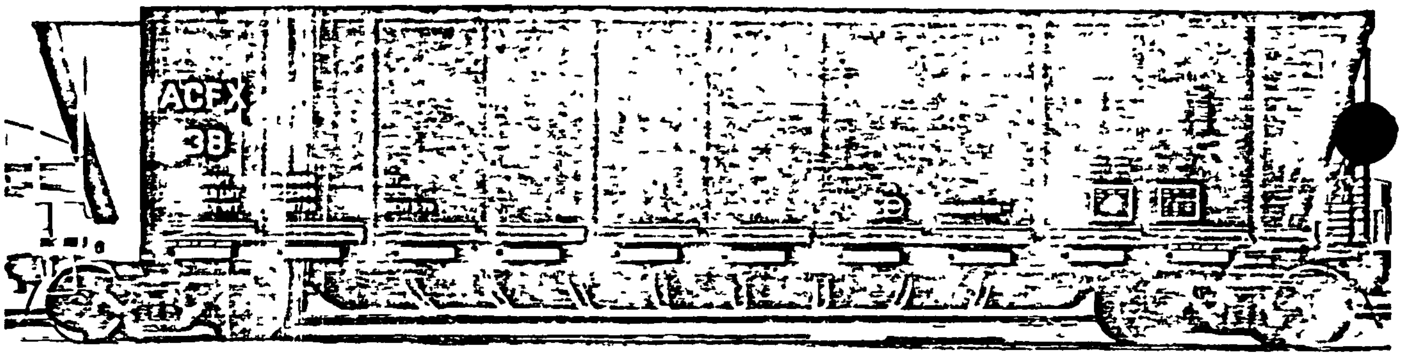
PACIFIC CAR AND FOUNDRY COMPANY

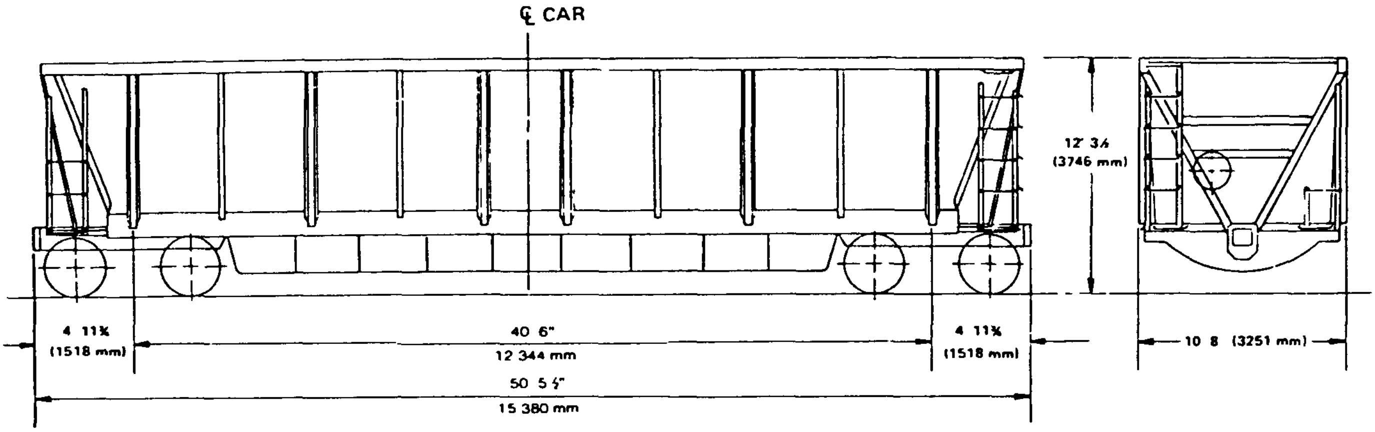


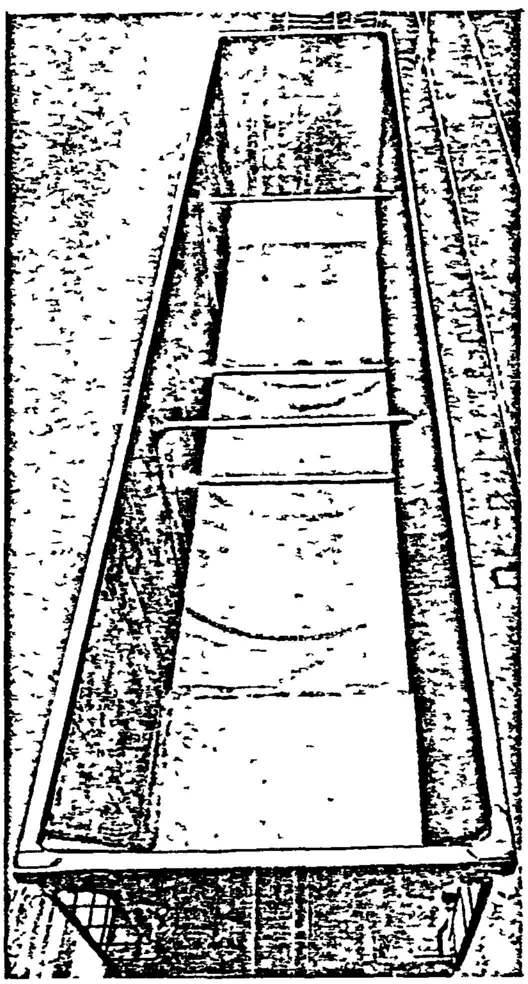


$(52.5)(9.5)(4.5) = 2244\ ft^3$

$83\ yd^3$





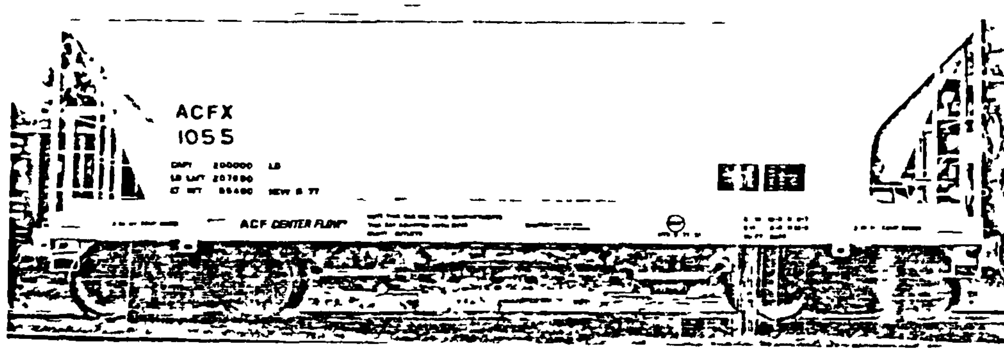


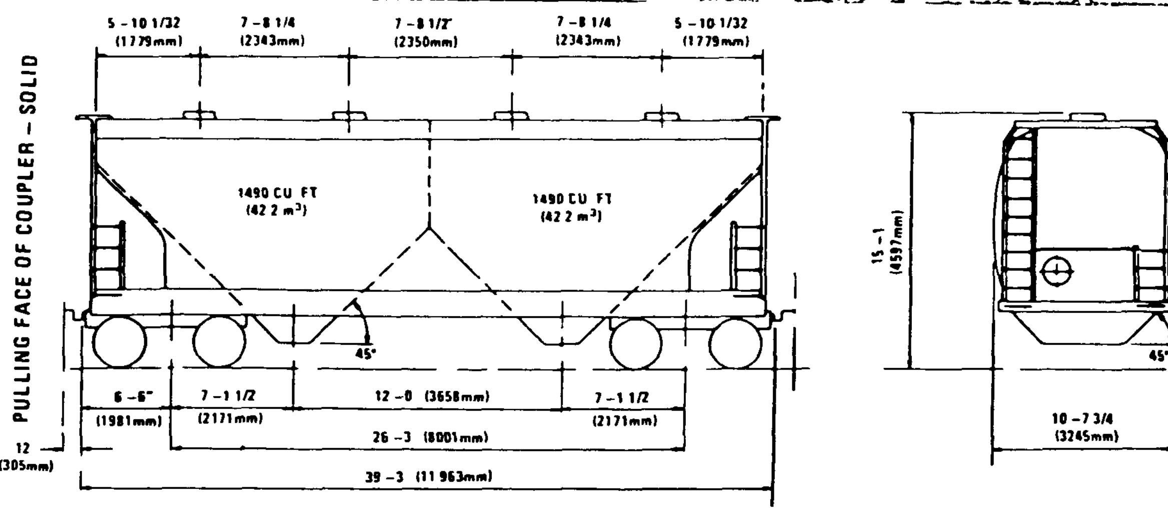
100-Ton Coalveyor™ Gondola built by ACF Industries

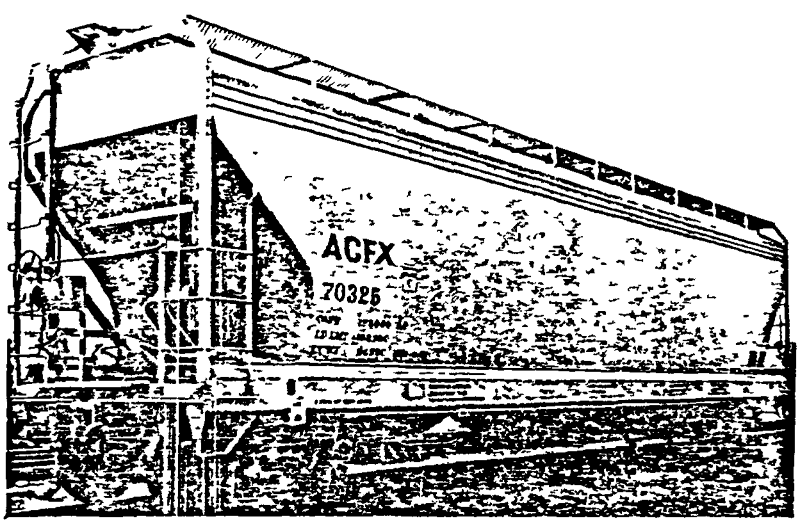
The car's basic reinforced circular bottom configuration provides a lighter car weight dramatically increasing coal payload It can carry more than 106 tons of coal per car Inside length 48 ft 0 in, capacity 4240 cu ft, lightweight 50 700 lbs, load limit 212,300 lbs

Two-Compartment 2980 CENTER FLOW 100-Ton Covered Hopper

Designed to transport very high density dry bulk ladings (70 to over 100 lbs per cu ft) Inside length 38 ft Rated capacity is 2980 cu ft or 208,000 lbs Built in 1977 by ACF

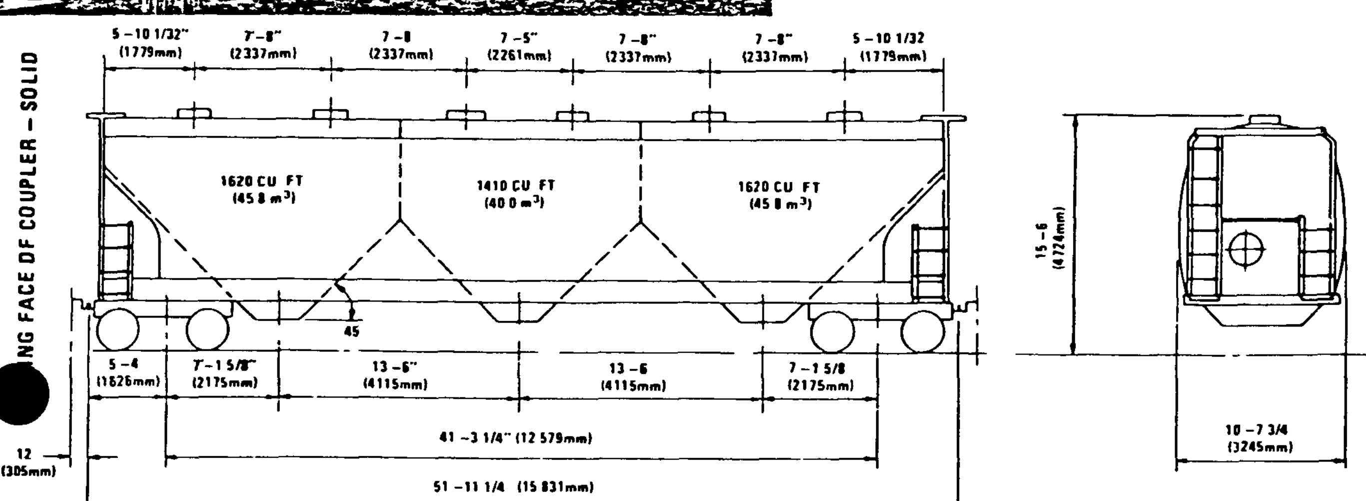


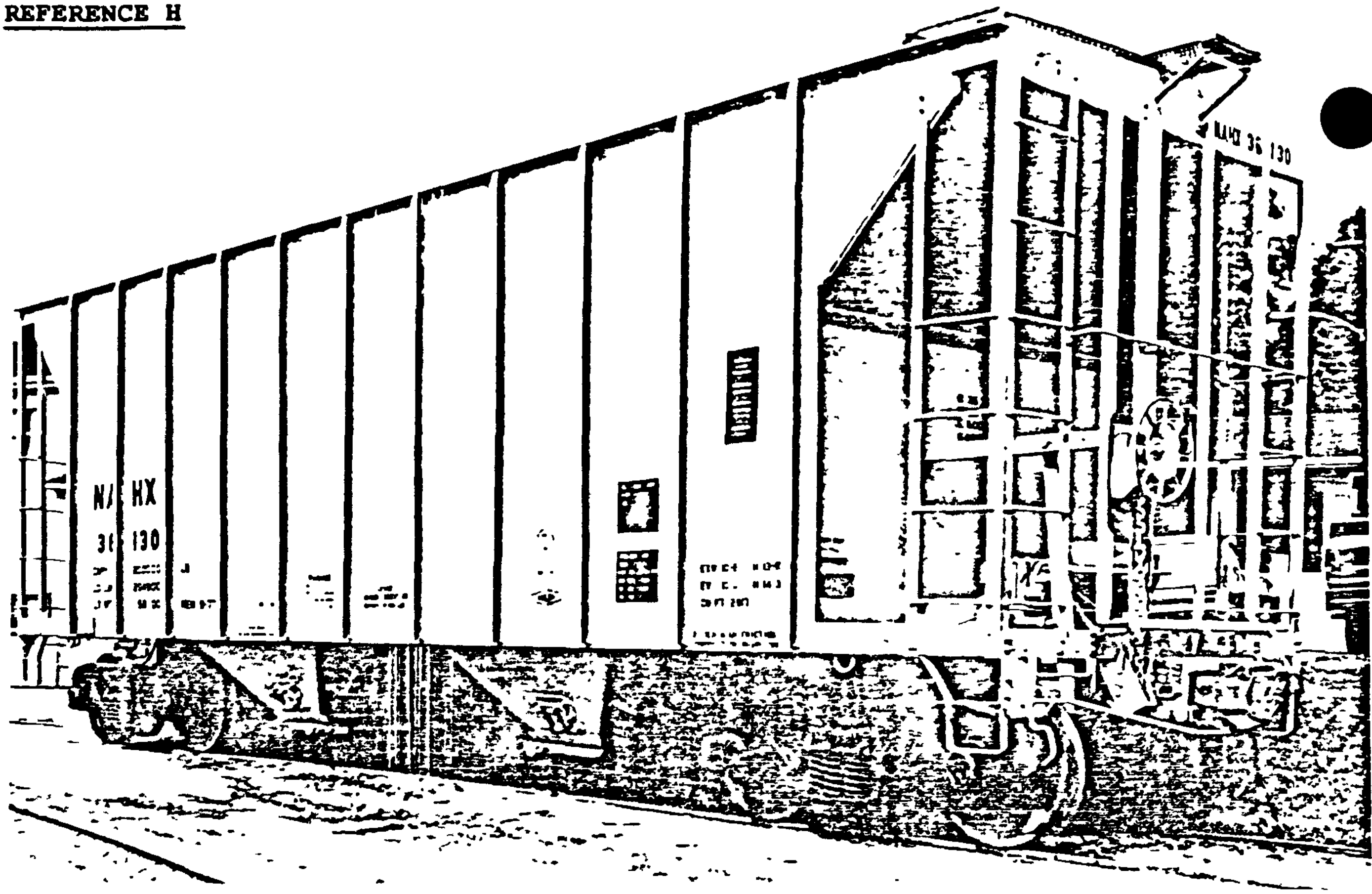




Three-Compartment 4650 CENTER FLOW 100-Ton Covered Hopper

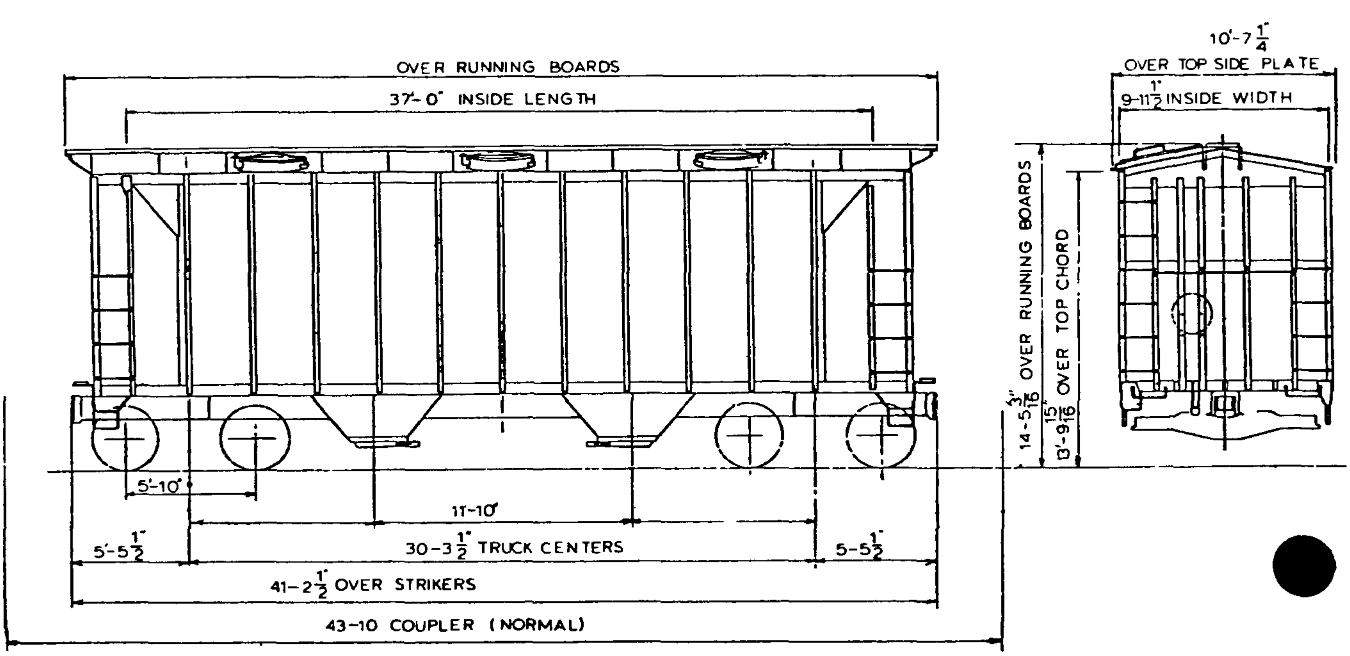
Designed to transport intermediate weight dry bulk ladings (42 to 50 lbs per cu ft) Inside length 48 ft 9 in Rated capacity is 4650 cu ft or 198,000 lbs Built in 1979 by ACF





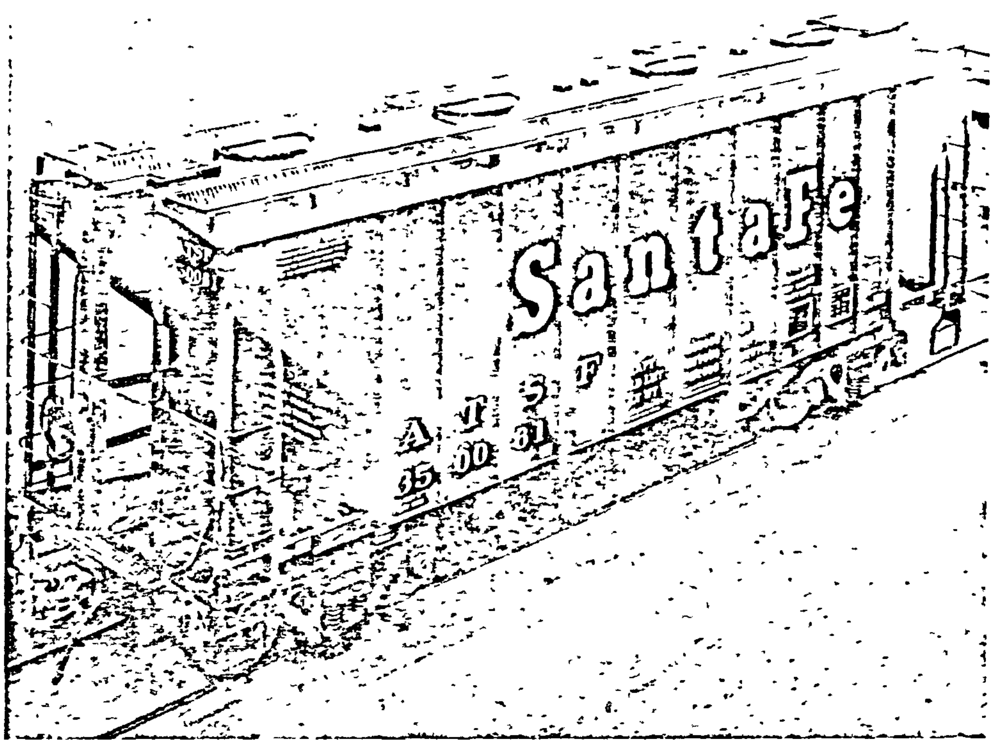
North American Car 100-Ton Twin Covered Hopper Car.
Inside length 37 ft., inside width 9 ft 11 in, extreme width 10 ft 8 in, extreme height 14 ft 9 in, length between pulling face coupler 43 ft. 10 in Rated capacity 200,000 lbs or 2917 cu. ft. Equipped with six 2 ft 6 in dia loading hatches and four 13 in x 24 in sliding type discharge doors Built by Greenville Steel Car Co., 1977.

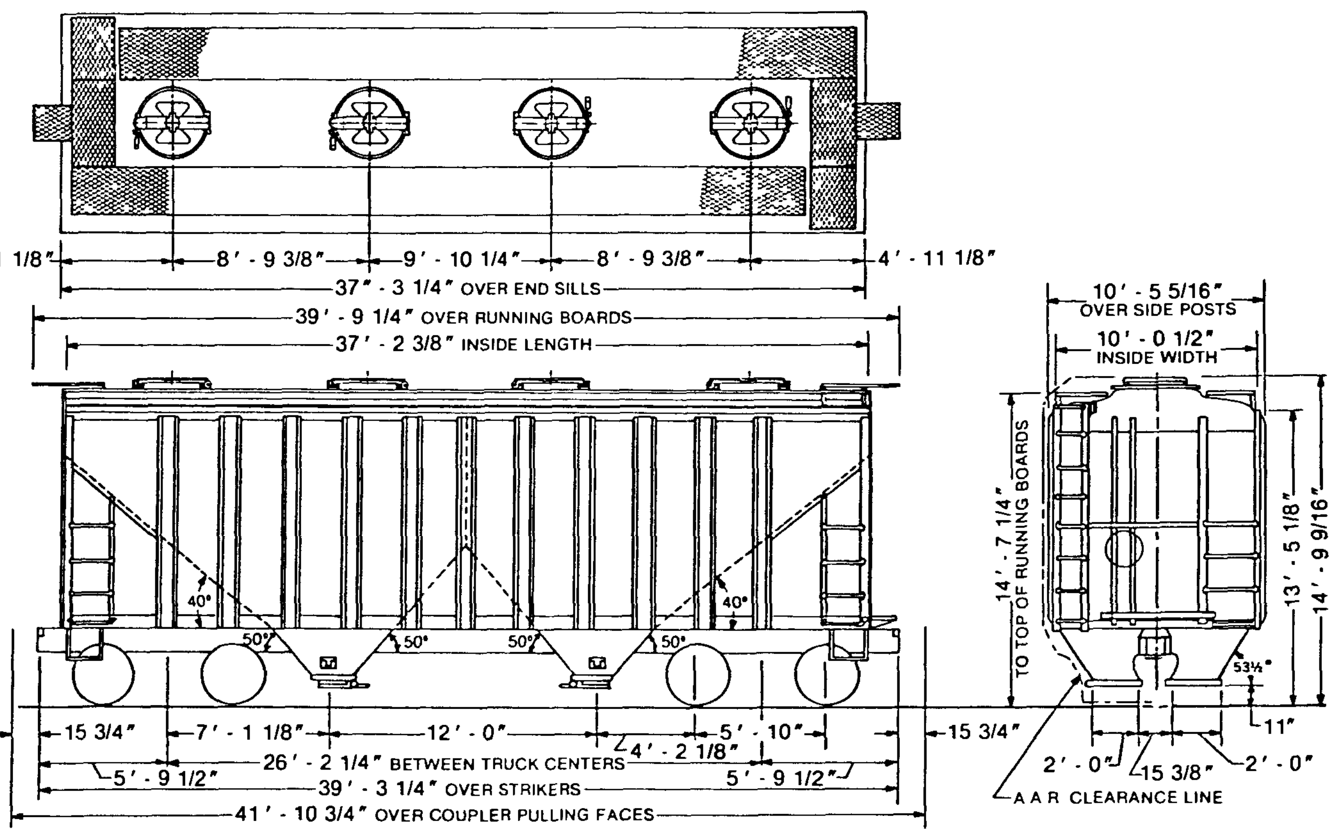
GREENVILLE STEEL CAR COMPANY



Santa Fe Covered Hopper Car. Capacity 208,000 lbs , cubic capacity 3000 cu ft Twin hoppers and gravity, side discharge arrangement Equipped with 30" round hatches Built for cement service or other heavy bulk commodity lading See general arrangement diagram for dimensions Built by Pullman Standard, 1978

PULLMAN STANDARD





Pullman Standard 3000 cu ft. Covered Hopper Car.

REFERENCE J

AUTO PARTS CAR

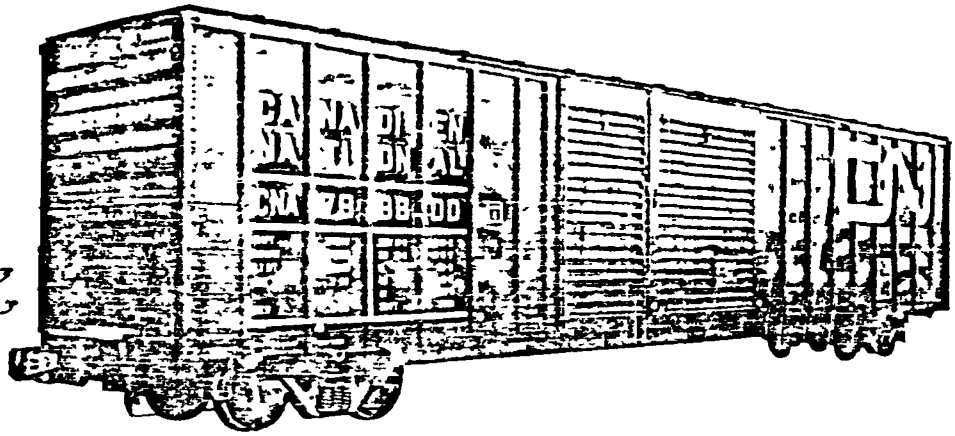
• 100 Ton Box Car XL • Built By FGE Co 1980 • 60 9 Inside Length • 9 6¼" Inside Width • 11'4" Inside Height • Nominal Lt Wt 85 000 lbs • 16 4 Clear Door Opening

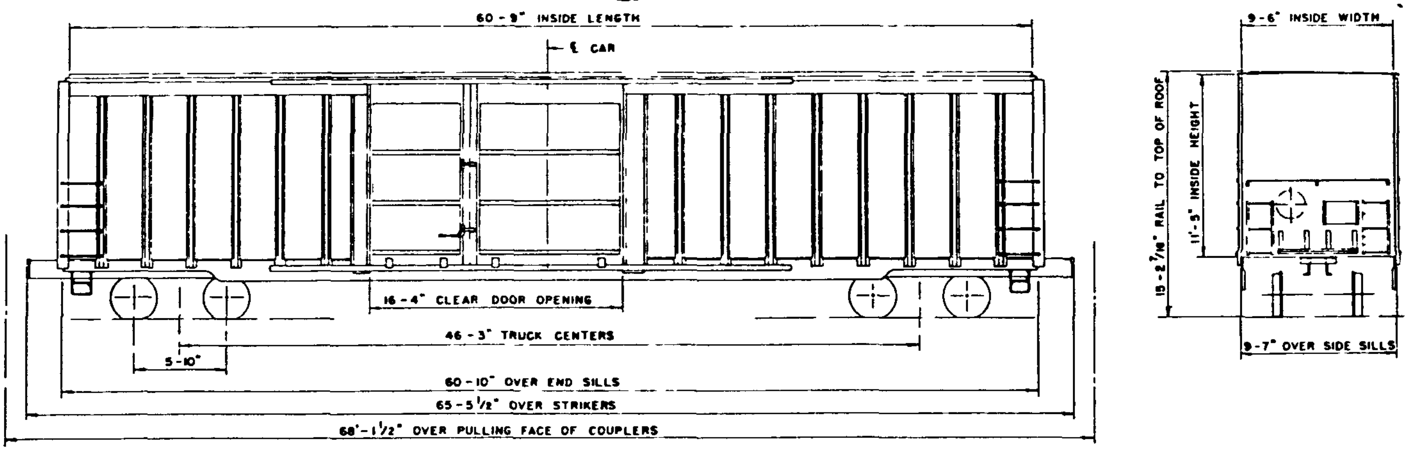
20 Travel Sliding Sill • 1¾" Nailable Steel Floor • 12 Belt Rails • 3 Steel Rub Rails Full Length

$(60.75)(9.5)(11.33) = 6540\,ft^3$

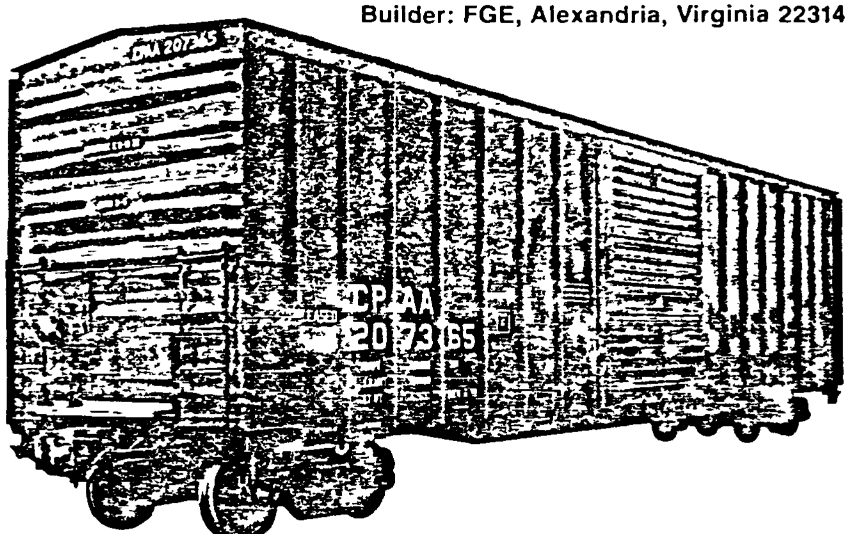
$242\,yd^3$

263 000
85 000
178 000 MAX LD





Builder: FGE, Alexandria, Virginia 22314



REFERENCE K

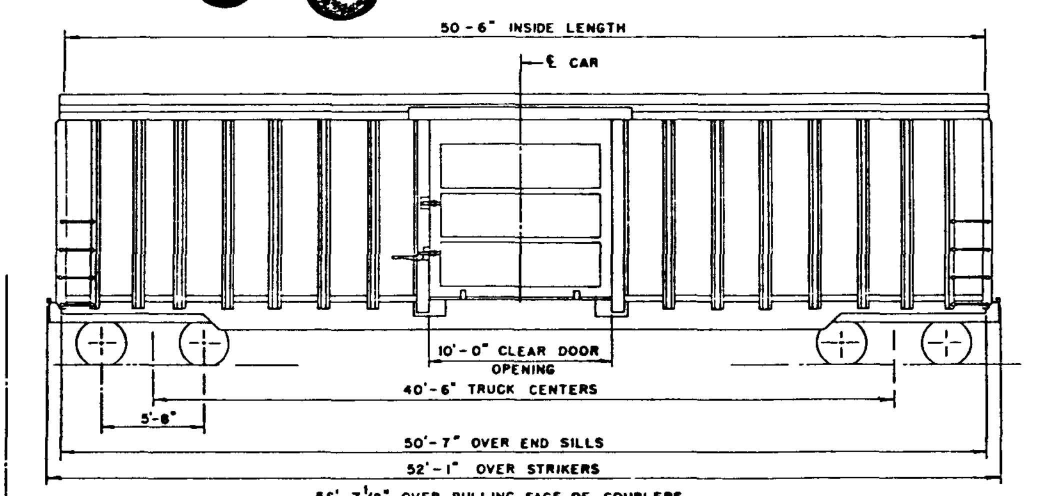
GENERAL PURPOSE CAR

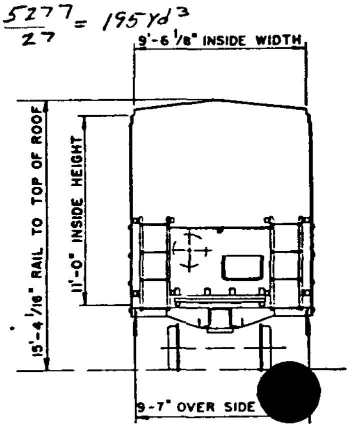
• 70 Ton Box Car XF • Built By FGE Co 1979 • 50'6" Inside Length • 9 6⅛" Inside Width • 11'0" Inside Height • Nominal Lt Wt 62,600 • 10 0" Clear Door Opening

• 10" EOC Hydraulic Cushioning • 1¾" Nailable Steel Floors • FDA White Epoxy Interior

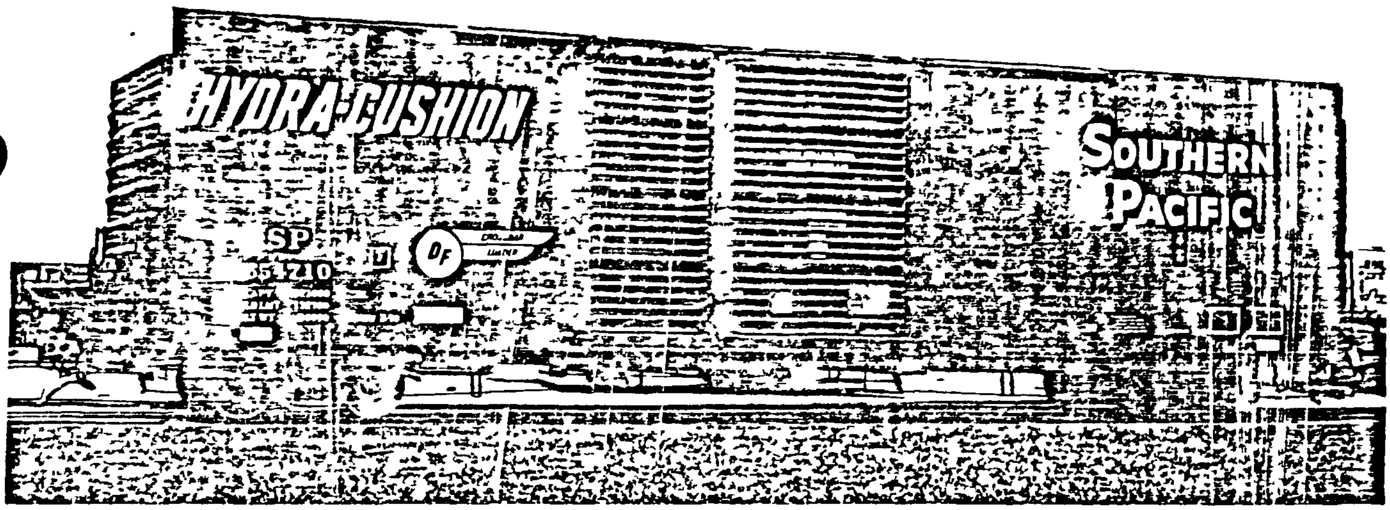
$\frac{157400}{(50.5)(9.5)(11.0)} = 29.3$

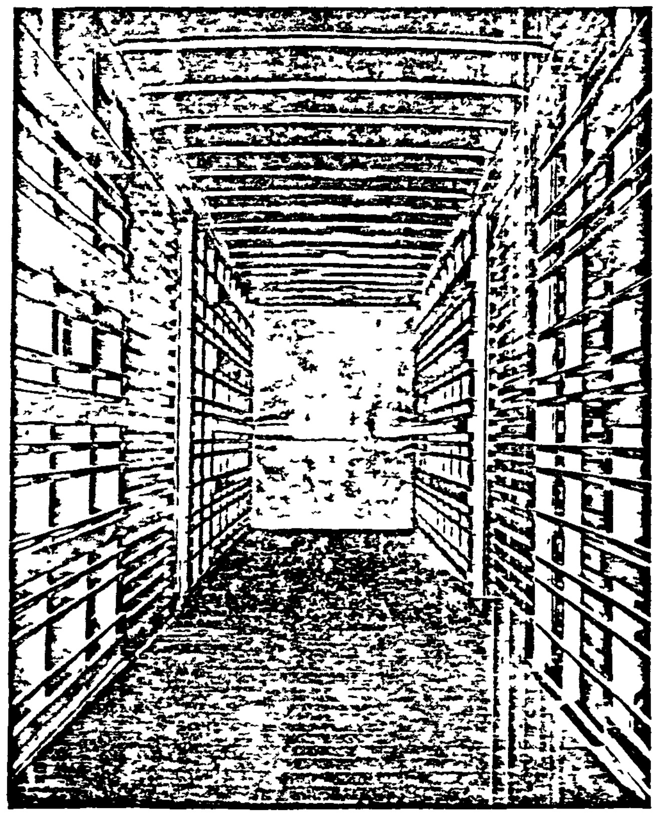
$\frac{5277}{27} = 195\,yd^3$





Builder: FGE, Alexandria, Virginia 22314



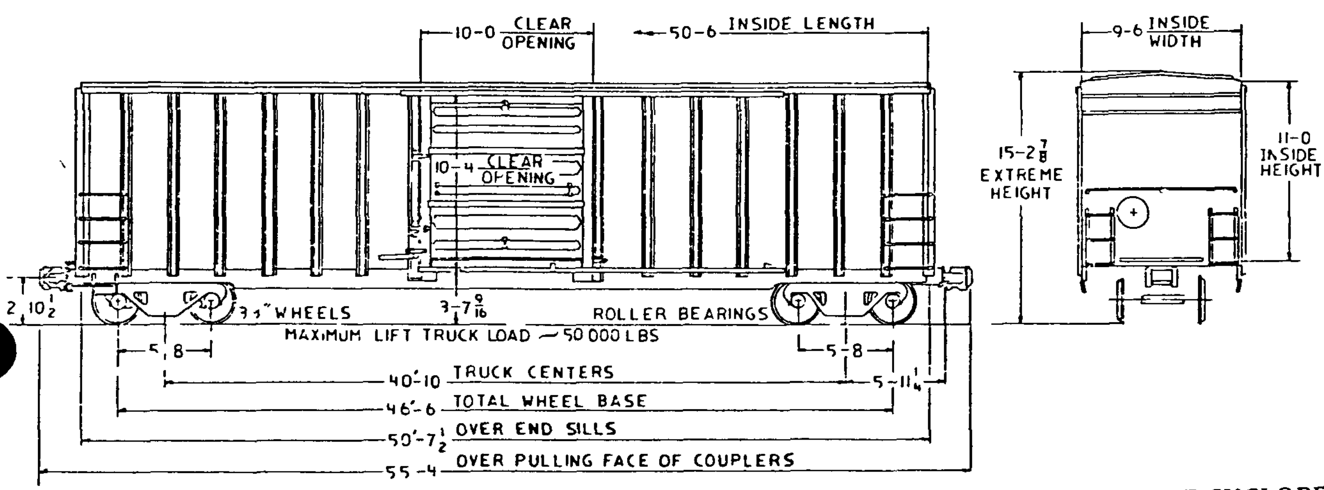


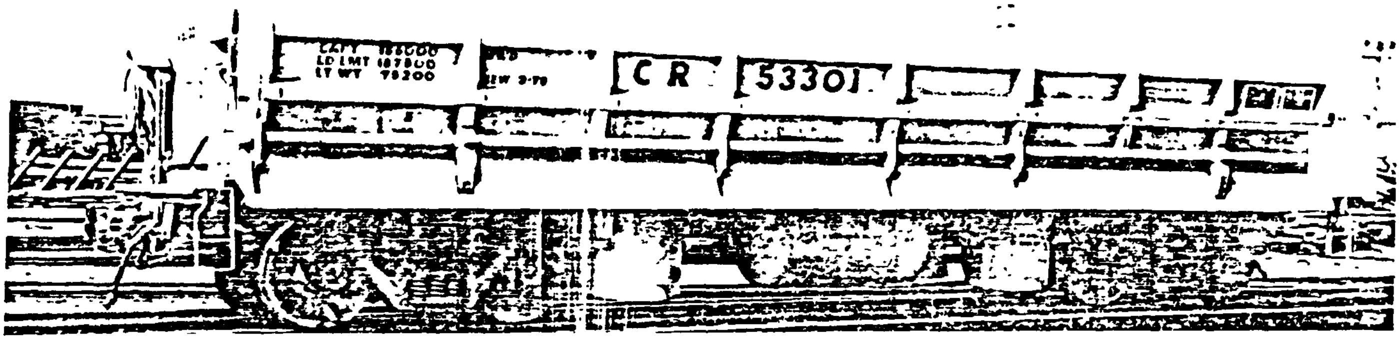
Southern Pacific Box Car.
Steel sheath box car
Class XL
60'11" inside length.
13'1" inside height
100 ton capacity
Cross bar type loader side rails
20" travel sliding sill underframe
Used in auto parts service
Built by Pacific Car and Foundry Co , 1978

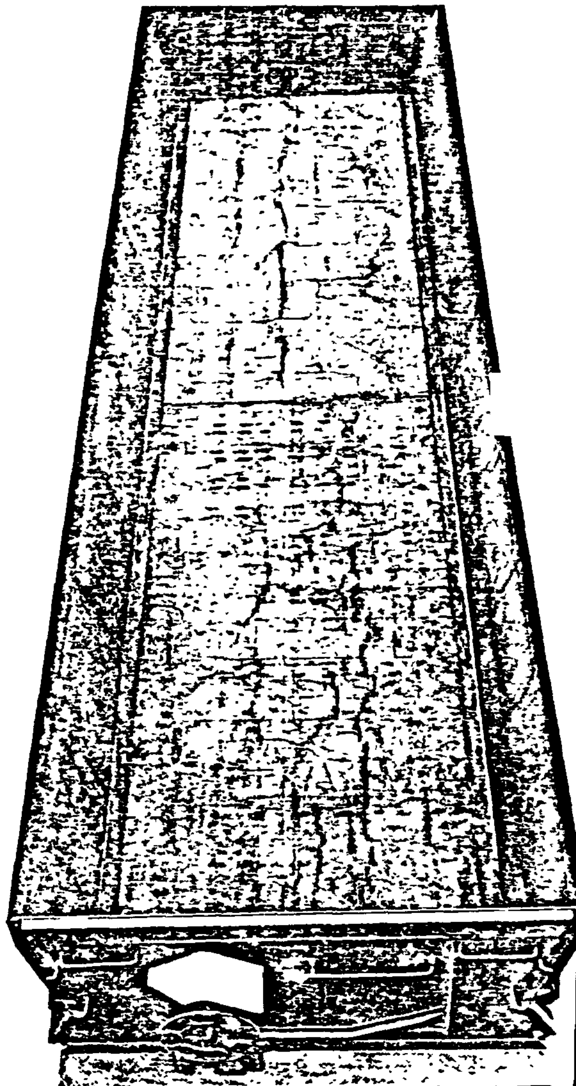
$(50.5)(9.5)(11.0) = 5277\ ft^3$
$195\ yd^3$

172 700 max wt =

PACIFIC CAR AND FOUNDRY COMPANY







Consolidated Rail Maintenance of Way Car.
Air side dump.
Class M.W.D.
38'1" inside length.
3'9" inside height.
100 ton capacity. ? $55\ yd^3$ NOMINAL
Built by Pacific Car and Foundry Co., 1978.

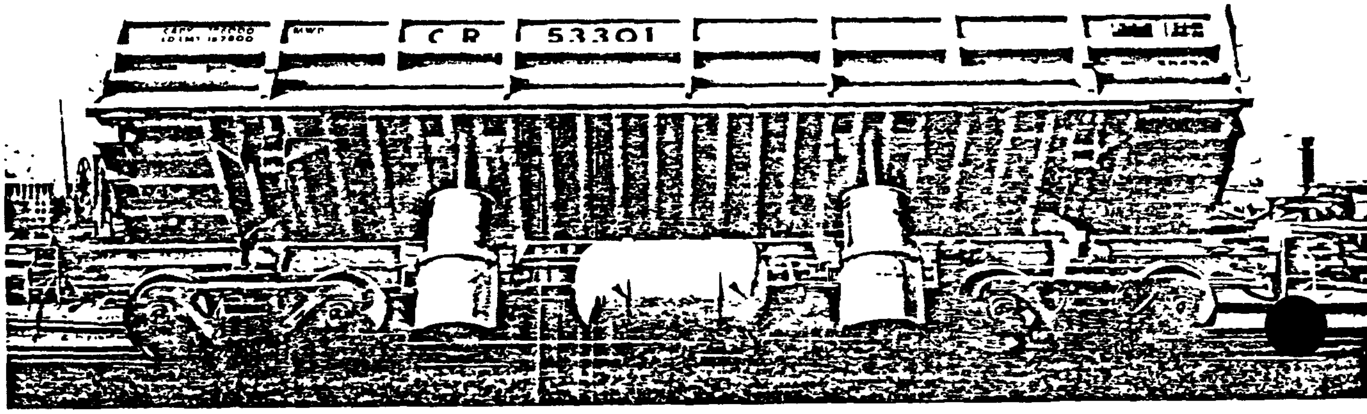
STENCILLED
187,800 LB
LD LMT

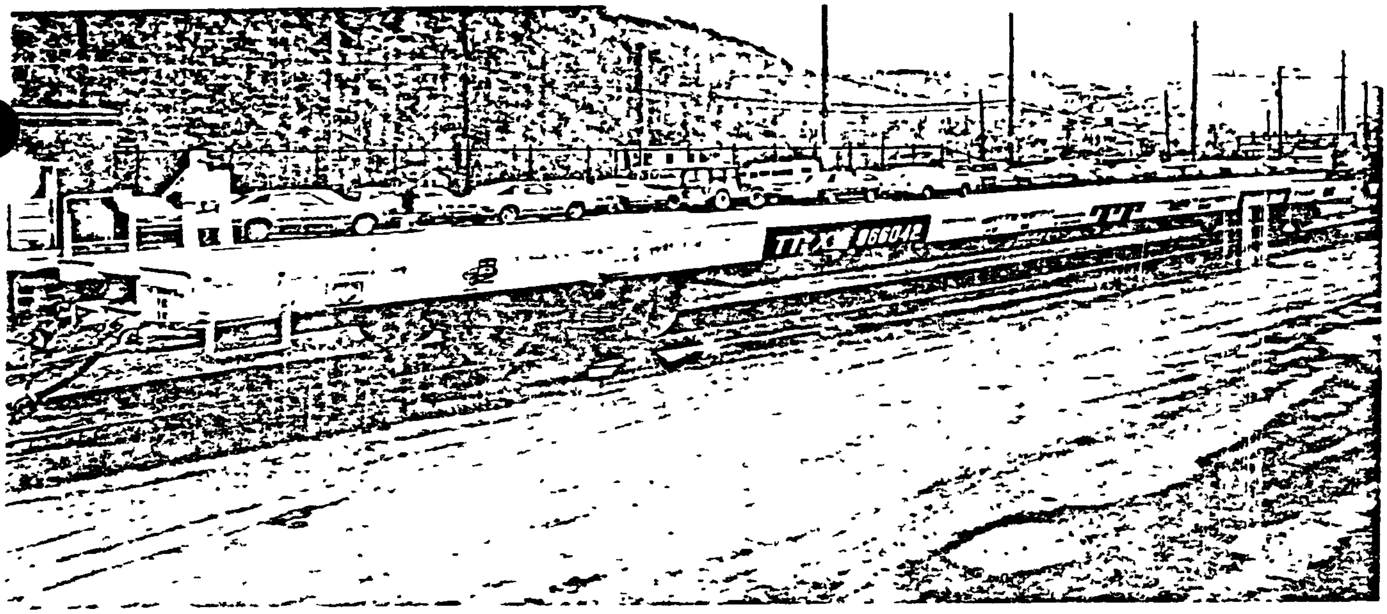
$$\frac{187,800}{(50)(27)} = 140\ lb/ft^3 \text{ max}$$

$$\frac{200\,000}{(54.2)(27)} = 137\ lb/ft^3$$

$$\frac{187\,800}{(2000)(1.21)} = 77.6\ yd^3 \text{ heaped}$$

PACIFIC CAR AND FOUNDRY COMPANY





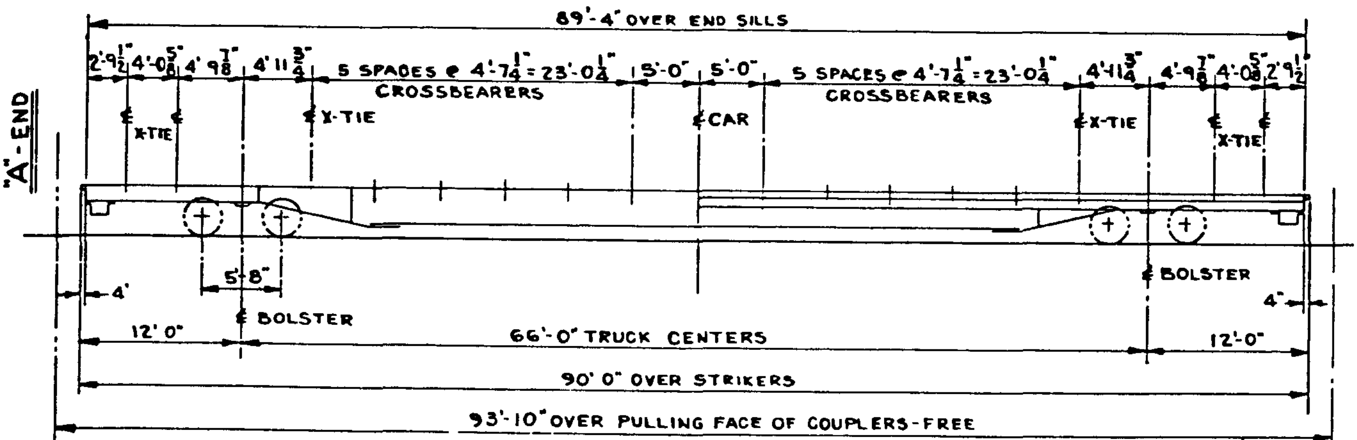
GENERAL SPECIFICATION

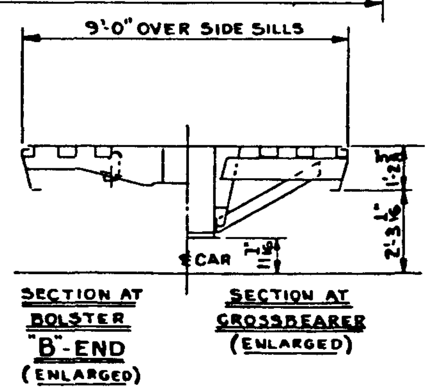
FOR

89' – 4" STANDARD DECK FLAT CARS

GENERAL DIMENSIONS

Length Over End Sills	89' - 4"
Over Strikers	90' - 0"
Over Pulling Faces of Free Couplers	93' - 10"
Truck Centers	66' - 0"
Center of Truck to Striker Face	12' - 0"
Width Over Side Sill	9' - 0"
Height Rail to Top of Side Sill	3' - 5-1/16"
Rail to Top of Floor	3' - 5-7/16"
Rail to Centerline of Coupler	2' - 10-1/2"
Side Bearing Centers	4' - 2"





BETHLEHEM STEEL CORPORATION

APPENDIX B

ABSTRACTED HAZARDOUS MATERIALS REGULATIONS FOR WASTE TRANSPORT

Ala P S C No 17	P S C Md No 34	Pa P U C No 33	
A C C No 15	M D P U No 19	R I P U A No 18	
⊕Ark T C No 22	M P S C No 22	P U C S D No 16	
C T C No 20	Minn P S C No 18	R C T No 18	**I. C. C. No. BOE—6000-A**
Conn P U C No 19	Miss P S C No 11	P S C U No 11	Cancels I C C No BOE—6000
F P S C No 11	Mont R C No 18	Vt P S B No 18	
I P U C No 18	N P S C No 16	V C C No 18	**F. M. C. F. No. 29**
Ia C C No 16	P U C N J No 18	P S C W Va No 18	Cancels F M C F No 28
Ill C C No 8	N M S C C No 11	⊕P S C Wis No 16	
I R C No 18	D O T-N Y No 15	Wyo P S C No 16	
P S C I No TR-16	D O T-N Y MT No 15		
K R C No 18	P U C O No 18		

⊕Applicable except where it conflicts with State statutes

Bureau of Explosives'

(Thomas A Phemister, Agent)
(Elizabeth P Rabben, Alternate Agent)

TARIFF No. BOE—6000-A

(Cancels Tariff No. BOE—6000)

PUBLISHING

Hazardous Materials Regulations of the Department of Transportation

BY

AIR, RAIL, HIGHWAY, WATER

AND

MILITARY EXPLOSIVES BY WATER

INCLUDING

SPECIFICATIONS FOR SHIPPING CONTAINERS

(Regulations for Transportation of Explosives and Other Dangerous Articles in Rail Express and Rail Baggage services are also included herein for information)

Prescribed under the Act of September 6, 1970 (74 Stat 808 18 U S C 831-835)

AND RESTRICTIONS COVERING THE ACCEPTANCE AND TRANSPORTATION OF EXPLOSIVES AND OTHER DANGEROUS ARTICLES BY CARRIERS PARTIES TO THIS TARIFF

ISSUED November 18, 1980 EFFECTIVE December 18, 1980

Rule 1 of Tariff Circular waived I C C Permission No SP 78-3113
Published under authority of Federal Maritime Commission Special Permission No 6177

Issued by Thomas A Phemister, Agent
Elizabeth P Rabben, Alternate Agent
Association of American Railroads
Bureau of Explosives
1920 "L" St N W,
Washington, D C 20036
Telephone 202-293-4048

The provisions published herein will, if effective, not result in an effect on the quality of the human environment

Element[1]	Radionuclide[3]	I	II	III	IV	V	VI	VII
Radium (88)	Ra 223		X					
	Ra-224		X					
	Ra-226	X						
	Ra 228	X						
Radon (86)	Rn-220				X			
	Rn 222		X					
Rhenium (75)	Re-183				X			
	Re-186				X			
	Re-187				X			
	Re-188				X			
	Re Natural				X			
Rhodium (45)	Rh-103m				X			
	Rh-105				X			
Rubidium (37)	Rb-86				X			
	Rb-87				X			
	Rb Natural				X			
Ruthenium (44)	Ru-97				X			
	Ru-103				X			
	Ru-105				X			
	Ru-106			X				
Samarium (62)	Sm-145			X				
	Sm-147			X				
	Sm-151				X			
	Sm-153				X			
Scandium (21)	Sc-46			X				
	Sc-47				X			
	Sc-48				X			
Selenium (34)	Se-75				X			
Silicon (14)	Si-31				X			
Silver (47)	Ag-105				X			
	Ag-110m			X				
	Ag-111				X			
Sodium (11)	Na-22			X				
	Na-24				X			
Strontium (38)	Sr-85m				X			
	Sr-85				X			
	Sr-89			X				
	Sr-90		X					
	Sr-91			X				
	Sr-92				X			
Sulphur (16)	S-35				X			
Tantalum (73)	Ta-182			X				
Technetium (43)	Tc 96m				X			
	Tc-96				X			
	Tc-97m				X			
	Tc-97				X			
	Tc-99m				X			
	Tc-99				X			
Tellurium (52)	Te-125m				X			
	Te-127m				X			
	Te-127				X			
	Te-129m			X				
	Te-129				X			
	Te-131m			X				
	Te-132				X			
Terbium (65)	Tb-160			X				
Thallium (81)	Tl-200				X			
	Tl-201				X			
	Tl-202				X			
	Tl-204			X				
Thorium (90)	Th-227		X					
	Th-228	X						
	Th-230	X						
	Th-231	X						
	Th-232			X				
	Th-234		X					
	Th Natural			X				
Thulium (69)	Tm-168			X				
	Tm-170			X				
	Tm-171				X			
Tin (50)	Sn-113				X			
	Sn-117m			X				
	Sn-121			X				
	Sn-125				X			
Tritium (1)	H-3				X			
	H-3 (as a gas as luminous paint or absorbed on solid material)							X
Tungsten (74)	W-181				X			
	W-185				X			
	W 187				X			
Uranium (92)	U-230		X					
	U 232	X						
	U-233[4]		X					
	U-234		X					
	U-235[4]			X				
	U-236		X					
	U-238			X				
	U Natural			X				
	U Enriched[4]			X				
	U Depleted			X				
Vanadium (23)	V-48				X			
	V-49			X				

Notes See footnotes at end of tables

Element[1]	Radionuclide[3]	I	II	III	IV	V	VI	VII
Xenon (54)	Xe-125			X				
	Xe-131m			X				
	Xe-131m (uncompressed)[2]					X		
	Xe-133			X				
	Xe-133 (uncompressed)[2]						X	
	Xe-135		X					
	Xe-135 (uncompressed)[2]					X		
Ytterbium (70)	Yb-175				X			
Yttrium (39)	Y-88			X				
	Y-90				X			
	Y 91m			X				
	Y 91			X				
	Y 92				X			
	Y 93				X			
Zinc (30)	Zn-65				X			
	Zn-69m				X			
	Zn 69				X			
Zirconium (40)	Zr 93				X			
	Zr 95			X				
	Zr 97				X			

[1] Atomic number shown in parentheses
[2] Uncompressed means at a pressure not exceeding 14 7 p s i (absolute)
[3] Atomic weight shown after the radionuclide symbol
[4] Fissile radioactive material

(b) Any radionuclide not listed in the above table shall be assigned to one of the groups in accordance with the following table

Radionuclide	Radioactive half-life: 0-1,000 days	1,000 days to 10^6 years	Over 10^6 years
Atomic number 1-81	Group III	Group II	Group III
Atomic number 82 and over	Group I	Group I	Group III

Note 1 No unlisted radionuclides shall be assigned to Groups IV V VI or VII

(c) For mixtures of radionuclides the following shall apply

(1) If the identity and respective activity of each radionuclide are known, the permissible activity of each radionuclide shall be such that the sum, for all groups present of the ratio between the total activity for each group to the permissible activity for each group will not be greater than unity

(2) If the groups of the radionuclides are known but the amount in each group cannot be reasonably determined, the mixture shall be assigned to the most restrictive group present

(3) If the identity of all or some of the radionuclides cannot be reasonably determined, each of those unidentified radionuclides shall be considered as belonging to the most restrictive group which cannot be positively excluded

(4) Mixtures consisting of a single radioactivity decay chain where the radionuclides are in the naturally occurring proportions shall be considered as consisting of a single radionuclide The group and activity shall be that of the first member present in the chain, except if a radionuclide "x" has a half-life longer than that of that first member and an activity greater than that of any other member including the first at any time during transportation, in that case, the transport group of the nuclide "x" and the activity of the mixture shall be the maximum activity of that nuclide "x" during transportation

§ 173.391 Limited quantities of radioactive materials and radioactive devices. **(a)** Limited quantities of radioactive materials in normal form not exceeding 0 01 millicurie of Group I radionuclides, 0 1 millicurie of Group II radionuclides, 1 millicurie of Groups III, IV, V, or VI radionuclides, 25 curies of Group VII radionuclides, tritium oxide in aqueous solution with a concentration not exceeding 0 5 millicuries per milliliter and with a total activity per package of not more than 3 curies, or 1 millicurie of radioactive material in special form, and not containing more than 15 grams of uranium-235 are excepted from specification packaging, marking, and labeling and are excepted from the provisions of § 173 393, if the following conditions are met

(1) The materials are packaged in strong tight packages such that there will be no leakage of radioactive materials under conditions normally incident to transportation

(2) The package must be such that the radiation dose rate at any point on the external surface of the package does not exceed 0 5 millirem per hour

(3) There must be no significant removable radioactive surface contamination on the exterior of the package (see § 173 397)

(4) The outside of the inner container must bear the marking "Radioactive "

(b) Manufactured acticles such as instruments, clocks, electronic tubes or apparatus, or other similar devices, having limited quant[illegible] radioactive materials (other than liquids) in a nondispersible fo[illegible] component part, are excepted from specification packaging, marking, and labeling, and are excepted from the provisions of § 173 393, if the following conditions are met

Note 1 For radioactive gases the requirement for the radioactive material to be in a nondispersible form does not apply

(1) Radioactive materials are securely contained within the devices or are securely packaged in strong tight packages so that there will be no leakage of radioactive materials under conditions normally incident to transportation

(2) The radiation dose rate at four inches from any unpackaged device does not exceed 10 millirem per hour

(3) The radiation dose rate at any point on the external surface of the outside of the package may not exceed 0 5 millirem per hour However, for exclusive use shipments only the radiation at the external surface of the package or the item may exceed 0 5 millirem per hour but must not exceed 2 millirem per hour

(4) There must be no significant removable radioactive surface contamination on the exterior of the package (see § 173 397)

(5) The total radioactivity content of a package containing radioactive devices must not exceed the quantities shown in the following table

Transport group	Quantity in curies	
	Per device	Per package
I	0 0001	0 001
II	0 001	0 05
III	0 01	3
IV	0 05	3
V or VI	1	1
VII	25	200
Special form	0 05	20

(6) No package may contain more than 15 grams of fissile material

(c) A manufactured article other than a reactor fuel element in which the only radioactive material is metallic natural or depleted uranium or natural thorium or alloys thereof, is excepted from specification packaging marking and labeling, and is excepted from the provisions of § 173 393, if the following conditions are met

(1) The radiation dose rate at any point on the external surface of the outside container does not exceed 0 5 millirem per hour

(2) There must be no significant radioactive surface contamination on the exterior of the package To determine whether "significant," the standard in § 173 397 must be used

(3) The total radioactivity content of each article must not exceed 3 curies

(4) The outer surface of the uranium or thorium is enclosed in a non-radio-active, sealed, metallic sheath

Note Such articles may be packagings for the transportation of radioactive materials

(d) Shipments made under this section for transportation are not subject to Subpart F of Part 172 of this subchapter, to Part 174 of this subchapter except § 174 24 and to Part 177 of this subchapter except § 177 817

§ 173.392 Low specific activity radioactive material. (a) Low specific activity (LSA) radioactive materials, other than materials consigned as exclusive use, are exempt from the provisions of § 173 393(a) through (e) and (g) However, they must be packaged in accordance with the requirements of § 173 395 and must be marked and labeled as required in §§ 172 300 and 172 400 of this subchapter

(b) LSA radioactive materials which are transported in a transport vehicle (except aircraft) and consigned as exclusive use are exempt from specification packaging, marking, and labeling provided the shipment meets the requirements of paragraph (c) or (d) of this section

(c) Packaged shipments of low specific activity materials transported in transport vehicles (except aircraft) assigned for the sole use of that consignor must comply with the following

(1) Materials must be packaged in strong, tight packages so that there will be no leakage of radioactive material under conditions normally incident to transportation

(2) Packages must not have significant removable surface contamination (see § 173 397)

(3) External radiation levels must comply with § 173 393(j)

(4) Shipments must be loaded by consignor and unloaded by consignee from the transport vehicle in which originally loaded

(5) There must be no loose radioactive material in the car or vehicle

(6) Shipment must be braced so as to prevent leakage or shift of lading under conditions normally incident to transportation

(7) Except for shipments of uranium or thorium ores, unconcentrated, the transport vehicle must be placarded with the placards prescribed in accordance with § 172 500 of this subchapter, as appropriate

(8) The outside of each outside package must be stencilled or otherwise marked "Radioactive—LSA "

(9) Specific instructions for maintenance of exclusive use (sole use) shipment controls must be provided by the shipper to the carrier Such ctions must be included with the shipping paper information

Unpackaged (bulk) shipments of low specific activity materials orted in closed transport vehicles (except aircraft) assigned for the sole use of that consignor must comply with the following

(1) Authorized materials are limited to the following

(i) Uranium or thorium ores and physical or chemical concentrates of those ores

(ii) Uranium metal or natural thorium metal, or alloys of these materials or

(iii) Materials of low radioactive concentration, if the average estimated radioactivity concentration dose not exceed 0 001 millicurie per gram and the contribution from Group I material does not exceed one percent of the total radioactivity

(iv) Objects of nonradioactive material externally contaminated with radioactive material, if the radioactive material is not readily dispersible and the surface contamination, when averaged over one square meter, does not exceed 0 0001 millicurie per square centimeter of Group I radionuclides or 0 001 millicurie per square centimeter of other radionuclides Such objects must be suitably wrapped or enclosed

(2) Bulk liquids must be transported in the following

(i) Specification 103CW, 111A60W7 (§§ 179 200 179 201, 179 202 of this subchapter) tank cars Bottom openings in tanks prohibited

(ii) Spec MC 310 MC 311, MC 312, or MC 331 (§ 178 330, § 178 331, § 178 337, or § 178 343 of this subchapter) cargo tanks Authorized only where the radioactivity concentration does not exceed 10 percent of the specified low specific activity levels (see § 173 389(c)) The requirements of § 173 393(g) do not apply to these cargo tanks Bottom fittings and valves are not authorized Trailer-on-flat-car service is not authorized

(3) External radiation levels must comply with subparagraphs (2), (3), and (4) of § 173 393(j)

(4) Shipments must be loaded by the consignor, and unloaded by the consignee from the transport vehicles in which originally loaded

(5) Except for shipments of uranium or thorium ores unconcentrated, the transport vehicle must be placarded with the placards prescribed in accordance with § 172 500 of this subchapter, as appropriate

(6) There must be no leakage of radioactive materials from the vehicle

(7) Specific instructions for maintenance of exclusive use (sole use) shipment controls must be provided by the shipper to the carrier Such instructions must be included with the shipping paper information

§ 173.393 General packaging and shipment requirements. (a) Unless otherwise specified, all shipments of radioactive materials must meet all requirements of this section, and must be packaged as prescribed in §§ 173 391 through 173 396

(b) The outside of each package must incorporate a feature such as a seal, which is not readily breakable and which, while intact, will be evidence that the package has not been illicitly opened

(c) The smallest outside dimension of any package must be 4 inches or greater

(d) Each radioactive material must be packaged in a packaging which has been designed to maintain shielding efficiency and leak tightness, so that, under conditions normally incident to transportation, there will be no release of radioactive material If necessary, additional suitable inside packaging must be used Each package must be capable of meeting the standards in §§ 173 398(b) and 173 24

(1) Internal bracing or cushioning, where used, must be adequate to assure that, under the conditions normally incident to transportation, the distance from the inner container or radioactive material to the outside wall of the package remains within the limits for which the package design was based and the radiation dose rate external to the package does not exceed the transport index number shown on the label Inner shield closures must be positively secured to prevent loss of the contents

(e) The packaging must be designed, constructed, and loaded so that during transport

(1) The heat generated within the package because of the radioactive materials present will not, at any time during transportation, affect the efficiency of the package under the conditions normally incident to transportation, and

(2) The temperature of the accessible external surfaces of the package will not exceed 122° F in the shade when fully loaded, assuming still air at ambient temperature If the package is transported in a transport vehicle consigned for the sole use of the consignor, the maximum accessible external surface temperature shall be 180° F

(f) Pyrophoric materials, in addition to the packaging prescribed in this subpart, must also meet the packaging requirements of § 173 134 or § 173 154 Pyrophoric radioactive liquids may not be shipped by air

(g) Liquid radioactive material in Type A quantities must be packaged in or within a leak-resistant and corrosion-resistant inner containment vessel In addition

(1) The packaging must be adequate to prevent loss or dispersal of the radioactive contents from the inner containment vessel if the package were subjected to the 9 meter (30-foot) drop test prescribed in § 173 398(c)(2)(i), and either

(2) Enough absorbent material must be provided to absorb at least twice the volume of radioactive liquid contents The absorbent material may be located outside the radiation shield only if it can be shown that

if the radioactive liquid contents were taken up by the absorbent material the resultant dose rate at the surface of the package would not exceed 1,000 millirem per hour, or

(3) A secondary leak-resistant and corrosion-resistant containment vessel must be provided to retain the radioactive contents under the normal conditions of transport as prescribed in § 173 398(b), assuming the failure of the inner primary containment vessel

(h) There must be no significant removable radioactive surface contamination on the exterior of the package (see § 173 397)

(i) Except for shipments described in paragraph (j) of this section, all radioactive materials must be packaged in suitable packaging (shielded, if necessary) so that at any time during the normal conditions incident to transportation the radiation dose rate does not exceed 200 millirem per hour at any point on the external surface of the package, and the transport index does not exceed 10

(j) Packages for which the radiation dose rate exceeds the limits specified in paragraph (i) of this section, but does not exceed at any time during transportation any of the limits specified in paragraphs (j)(1) through (4) of this section may be transported in a transport vehicle which has been consigned as exclusive use (except aircraft) Specific instructions for maintenance of the exclusive use (sole use) shipment controls must be provided by the shipper to the carrier Such instructions must be included with the shipping paper information

(1) 1,000 millirem per hour at 3 feet from the external surface of the package (closed transport vehicle only),

N/A **(2)** 200 millirem per hour at any point on the external surface of the car or vehicle (closed transport vehicle only),

(3) Ten millirem per hour at any point 2 meters (six feet) from the vertical planes projected by the outer lateral surface of the car or vehicle, or if the load is transported in an open transport vehicle, at any point 2 meters (six feet) from the vertical planes projected from the outer edges of the vehicle

(4) 2 millirem per hour in any normally occupied position in the car or vehicle, except that this provision does not apply to private motor carriers

(k) [Reserved]

(l) Packages consigned for export are also subject to the regulations of the foreign governments involved in the shipment See §§ 173 8, 173 9, and 173 393b (The regulations of the International Atomic Energy Agency (IAEA) are used by most foreign governments)

(m) Prior to the first shipment of any package, the shipper shall determine by examination or appropriate test that

(1) The packaging meets the specified quality of design and construction, and

(2) The effectiveness of the shielding and containment, and, where necessary, the heat transfer characteristics of the package are within the limits applicable to or specified for the package design

(n) Prior to each shipment of any package, the shipper shall insure by examination or appropriate test that

(1) The package is proper for the contents to be shipped,

(2) The packaging is in unimpaired physical condition except for superficial marks,

(3) Each closure device of the packaging, including any required gasket, is properly installed and secured and free of defects,

(4) For a fissile material, any moderator and neutron absorber, if required, is present in proper condition,

(5) Any special instructions for filling, closing, and preparation of the package for shipment have been followed,

(6) Each closure, valve, and any other opening of the containment system through which the radioactive content might escape is properly closed and sealed,

(7) Each package containing liquid in excess of a Type A quantity and destined for air shipment is tested to demonstrate that it is leak tight under an ambient atmospheric pressure differential of at least 0 5 atmosphere (absolute) (7 3 p s i a or 0 5 kg /cm ^{2}), the test may be conducted on the entire containment system or on any receptacle or vessel within the containment system, as appropriate to determine compliance with the requirement,

(8) If the maximum normal operating pressure of a package is likely to exceed 0 35 kg /cm ^{2} (gage), the internal pressure of the containment system will not exceed the design pressure during transportation, and

(9) External radiation and contamination levels are within the allowable limits

(o) No person may offer for transportation a package of radioactive materials until the temperature of the packaging system has reached equilibrium (see also paragraph (e) of this section) unless, for the specific contents, he has ascertained that the maximum applicable surface temperature limits cannot be exceeded

(p) No person may offer for transportation aboard a passenger carrying aircraft any radioactive material unless that material is intended for use in, or incident to, research, or medical diagnosis or treatment, or is excepted under the provisions of § 175 10 of this subchapter

(q) No person may offer for transportation aboard a passenger-carrying aircraft any single package with a transport index greater than 3 0 nor an overpack with a transport index greater than 3 0

(r) If an overpack is used to consolidate individual packages of radioactive materials, the packages must comply with the packaging, marking, and labeling requirements of this subchapter, and the following conditions must be met

(1) The overpack must be labeled as prescribed in § 172 403 of this subchapter except as follows

(i) The "contents" entry on the label may state "mixed" unless each inside package contains the same radionuclide(s)

(ii) The "number of curies" entry on the label must be determined by adding together the number of curies of the radioactive materials packages contained therein

(iii) For a non-rigid overpack, the required label together with required package markings must be affixed to the overpack by means of a securely attached, durable tag The transport index must be determined by adding together the transport indexes of the radioactive materials packages contained therein

(iv) For a rigid overpack, the transport index must be determined by—

(A) Adding together the transport indexes of the radioactive materials packages contained in the overpack, or

(B) Except for fissile radioactive materials, direct measurements as prescribed in § 173 389(i)(1) which have been taken by the person initially offering the packages contained within the overpack for shipment

(2) The overpack must be marked as prescribed in Subpart D of Part 172 of this subchapter and § 173 25(a)

(3) The transport index of the overpack may not exceed 3 0 for passenger-carrying aircraft shipments, nor 10 0 for cargo-only aircraft shipments

§ 173.393a U.S. Atomic Energy Commission approved packages; standard requirements and conditions. **(a)** In addition to the applicable requirements of the USAEC approval and Parts 170-189 of this subchapter, each shipper of a package containing radioactive material, which has been approved by the U S Atomic Energy Commission in accordance with § 173 394(b)(3), (c)(2), § 173 395(b)(2), (c)(2), § 173 396(b)(4), or § 173 396(c)(3), also shall comply with the following

(1) Before the first shipment in a package approved by the U S Atomic Energy Commission for use by another person, each shipper shall register in writing with the USAEC, Division of Materials Licensing, his name and address, the name of the person to whom the USAEC approval was issued, and the approval number assigned to the package Each shipper shall have a copy of the USAEC approval and the document referred to in the approval in his possession Each shipment must be made in compliance with the terms and conditions of the approval

(2) The outside of each package must be durably and legibly marked with the package identification marking indicated in the USAEC approval,

(3) Each shipping paper related to the shipment of this package must bear a notation of the package identification marking indicated in the USAEC approval,

(4) Before the first export shipment of the package, the shipper shall submit a copy of the applicable competent authority certificate applying to that package design to the competent national authority of each country into or through which the package will be transported, unless a copy has already been furnished to this party by another person (Detailed requirements for the issuance and content of competent authority certificates are provided in marginal C-6 of the IAEA "Regulations for the Safe Transport of Radioactive Materials, safety series No 6, 1967 edition," hereinafter referred to as the "IAEA Regulations " A list of the national competent authorities of each country is published annually by the IAEA),

(5) Each package of fissile radioactive material must be marked with the numerical value for the transport index if the shipment is fissile class II Any vehicle limitation indicated in the USAEC approval applies if the shipment is fissile class III, and

(6) For a fissile class III shipment the statement prescribed in § 172 203(d)(1)(vi) of this subchapter must be included with the shipping papers

§ 173.393b International shipments and foreign-made packages; standard requirements and conditions. **(a)** In addition to the other applicable requirements of Parts 170-189 of this subchapter, each shipper of a package containing radioactive material, for which a foreign competent authority certificate has been issued and revalidated pursuant to the IAEA regulations and § 173 394(b)(4), § 173 394(c)(3), § 173 395(b)(3), § 173 395(c)(3), § 173 396(b)(5), or § 173 396(c)(4), also shall comply with the following

(1) Before the first shipment of the package, each shipper shall register in writing his identity and type of package with the Office of Hazardous Materials Regulation, U S Department of Transportation, Washington, D C 20590 furnishing a copy of the foreign certificate or revalidation thereof which is applicable to that package, unless a copy has already been furnished by another person,

SUBPART J

DETAILED REQUIREMENTS FOR POISONOUS MATERIALS

§ **174.600 Special handling requirements for Poison A materials.** A tank car containing Poison A may not be transported by rail unless it is originally consigned or subsequently reconsigned to a party having a private track on which it is to be delivered and unloaded (see § 171 8) or to a party using railroad siding facilities which are equipped for piping the liquid or gas from the tank car to permanent storage tanks or sufficient capacity to receive the entire contents of the car

§ **174.615 Cleaning cars.** **(a)** A rail car which has contained arsenic arsenate of lead, sodium arsenate, calcium arsenate, Paris green calcium cyanide, potassium cyanide, sodium cyanide or other poisonous materials which show any evidence of leakage from packages must be thoroughly cleaned after unloading before the car is returned to service

(b) After poisonous materials are unloaded from a rail car, that car must be thoroughly cleaned unless the car is used exclusively in the carriage of poisonous materials

§ **174.680 Poisons with foodstuffs.** A carrier may not transport any package of material bearing a poison label in the same car with material which is marked as or known to be foodstuffs feed or any other edible material intended for consumption by humans or animals

SUBPART K

DETAILED REQUIREMENTS FOR RADIOACTIVE MATERIALS

§ **174.700 Special handling requirements for radioactive materials.** **(a)** Each rail shipment of low specific activity materials as defined in § 173 389(c) of this subchapter must be loaded so as to avoid spillage and scattering of loose material Loading restrictions are prescribed in § 173 392 of this subchapter

(b) The number of packages of radioactive materials that may be transported in any rail car or stored at any single location is limited to that number which does not make a total transport index number (as defined in § 173 389(j) of this subchapter, and determined by adding together the transport index numbers on the labels of the individual packages) of more than 50 This provision does not apply to exclusive use shipments as described in §§ 173 389(o) and 173 392, 173 393(j), or 173 396(f)

(c) Each package of radioactive material bearing **RADIOACTIVE YELLOW-II** or **RADIOACTIVE YELLOW-III** labels when being placed in a rail car, depot, or other place may not be placed closer than three feet to an area (or dividing partition between areas) which may be continuously occupied by any passenger, rail employee, or shipment of animals, nor closer than 15 feet to any package containing undeveloped film (if so marked) If more than one package of radioactive materials is present, the distance must be computed from the table below on the basis of the total transport index number (determined by adding together the transport index numbers on the labels of the individual packages) of packages in the car or storeroom

Total transport index	Minimum separation distance in feet to nearest undeveloped film [1]	Minimum distance in feet to area of persons, or minimum distance in feet from dividing partition of a combination car [2]
None	0	0
0 1 to 10 0	15	3
10 1 to 20 0	22	4
20 1 to 30 0	29	5
30 1 to 40 0	33	6
40 1 to 50 0	36	7

[1] In feet to nearest undeveloped film

[2] In feet to area of persons or minimum distance in feet from dividing partition of a combination car

Note —The distance in the table must be measured from the nearest point on the packages of radioactive materials

(d) Each fissile Class III radioactive material shipment (as defined in § 173 389(a)(3) of this subchapter) must be transported in accordance with one of the methods prescribed in § 173 396(g) of this subchapter The transport controls must be adequate to assure that no fissile Class III shipment is transported in the same rail car with any other fissile [radioac]tive material shipment In loading and storage areas each fissile Class III shipment must be segregated by a distance of at least 20 feet from other packages required to bear one of the "radioactive" labels described in Part 172 of this subchapter

(e) A flatcar may be used to transport radioactive materials in a container weighing 15 000 pounds or more A gondola car (other than a drop bottom car) may be used to transport any of the following

(1) Radioactive materials in containers weighing 5 000 pounds or more,

(2) Strong wooden boxes with inside containers of solid radioactive material, securely braced and cushioned, or

(3) Radioactive material in concrete-filled metal drums or in concrete vaults weighing 700 pounds or more

(f) A person may not remain unnecessarily in a rail car containing radioactive materials

§ **174.715 Cleanliness of cars after use.** **(a)** Each transport vehicle used for transporting radioactive materials as exclusive use as defined in § 173 389(e), must be surveyed with appropriate radiation detection instruments after each use A vehicle may not be returned to service until the radiation dose rate at any accessible surface is 0 5 millirem per hour or less, and there is no significant removable radioactive surface contamination, as defined in paragraph (a) of this section

(b) This section does not apply to any rail car used solely for transporting radioactive materials if a survey of the interior surface of the car shows that the radiation dose rate does not exceed 10 millirem per hour at the interior surface or 2 millirem per hour at 3 feet from any interior surface The car must be stenciled with the words **"FOR RADIOACTIVE MATERIALS USE ONLY"** in lettering at least 3 inches high in a conspicuous place on both sides of the exterior of the car and it must be kept closed at all times other than during loading and unloading

§ **174.750 Incidents involving leakage.** **(a)** In addition to the incident reporting requirements of §§ 171 15 and 171 16 of this subchapter, the carrier shall also notify the shipper at the earliest practicable amount following any incident in which there has been breakage, spillage, or suspected radioactive contamination involving radioactive materials shipments Vehicles, buildings, areas, or equipment in which radioactive materials have been spilled may not be again placed in service or routinely occupied until the radiation dose rate at any accessible surface is less than 0 5 millirem per hour and there is no significant removable radioactive surface contamination (see § 173 397 of this subchapter)

(b) The package or materials should be segregated as far as practicable from personnel contact If radiological advice or assistance is needed, the Energy Research and Development Administration (ERDA) should also be notified In case of obvious leakage, or if it appears likely that the inside container may have been damaged, care should be taken to avoid inhalation, ingestion, or contact with the radioactive material Any loose radioactive materials should be left in a segregated area and held pending disposal instructions, from qualified persons Information involving the handling of radioactive materials in the event of a wreck may be found in Bureau of Explosives Pamphlet No 1 and No 2 supports having clamps or securing bands capable of holding the cylinders upright when they are subjected to an acceleration of at least 2 "-" in any horizontal direction

The combined total of the hydrogen venting rates as marked on the cylinders on one motor vehicle must not exceed 60 standard cubic feet per hour

(ii) Motor vehicles loaded with cylinders containing liquefied hydrogen may not be driven through tunnels

(iii) Highway transportation is limited to private and contract motor carriers only and to direct movement from point of origin to destination

(b) Portable tank containers containing compressed gases shall be loaded on motor vehicles only as follows

(1) Onto a flat floor or platform of a motor vehicle

(2) Onto a suitable frame of a motor vehicle

(3) In either such case, such containers shall be safely and securely blocked or held down to prevent movement relative to each other or to the supporting structure when in transit, particularly during sudden starts and stops and changes of direction of the vehicle

(4) Requirements of subparagraphs (1) and (2) of this paragraph shall not be construed as prohibiting stacking of containers provided the provisions of subparagraph (3) of this paragraph are fully complied with

(c) [Reserved]

(d) ***Engine to be stopped in tank motor vehicles, except for transfer pump.*** No flammable compressed gas shall be loaded into or on or unloaded from any tank motor vehicle with the engine running unless the engine is used for the operation of the transfer pump of the vehicle Unless the delivery hose is equipped with a shut-off valve at its discharge end, the engine of the motor vehicle shall be stopped at the finish of such loading or unloading operation while the filling or discharge connections are disconnected

(e) Chlorine cargo tanks shall be shipped only when equipped (1) with a gas mask of a type approved by the U S Bureau of Mines for chlorine service, (2) with an emergency kit for controlling leaks in fittings on the dome cover plate

(f) No chlorine tank motor vehicle used for transportation of chlorine shall be moved coupled or uncoupled, when any loading or unloading c ections are attached to the vehicle nor shall any semi-trailer or t . be left without the power unit unless such semi-trailer or trailer be checked or equivalent means be provided to prevent motion

(g) Each liquid discharge valve on a cargo tank, other than an engine fuel line valve, must be closed during transportation except during loading and unloading

§ 177.841 Poisons. (See also § 177 834(a) to (k))

(a) Arsenical compounds in bulk. Care shall be exercised in the loading and unloading of "arsenical dust", "arsenic trioxide", and "sodium arsenate", allowable to be loaded into sift-proof, steel hopper-type or dump-type motor-vehicle bodies equipped with water-proof, dust-proof covers well secured in place on all openings, to accomplish such loading with the minimum spread of such compounds into the atmosphere by all means that are practicable, and no such loading or unloading shall be done near or adjacent to any place where there are or are likely to be, during the loading or unloading process assemblages of persons other than those engaged in the loading or unloading process, or upon any public highway or in any public place

(1) The motor vehicles must be marked in accordance with § 173 368(b) of this chapter

(2) Before any motor vehicle may be used for transporting any other articles, all detectable traces of arsenical materials must be removed therefrom by flushing with water, or by other appropriate method, and the marking removed

(b) No Class A or irritating materials in cargo tanks No poison, Class A, or irritating material may be loaded into or transported in any cargo tank

(c) Class A poisons or irritating materials. The transportation of a Class A poison or an irritating material is not permitted if there is any interconnection between packagings

(d) Poisons in cargo tanks. A person shall not drive a tank motor vehicle and a motor carrier shall not require or permit a person to drive a tank motor vehicle containing poisons (regardless of quantity) unless—

(1) All manhole closures on the cargo tank are closed and secured,

(2) All valves and other closures in liquid discharge systems are closed and free of leaks

(e) A carrier may not transport a package bearing a poison label in the same transport vehicle with material that is marked as or known to be foodstuff feed or any other edible material intended for consumption by humans or animals

§ 177.842 Radioactive material. (a) The number of packages of radioactive materials in any motor vehicle trailer, or storage location must be limited so that the total transport index number, as defined in § 173 389(i) of this subchapter and determined by adding together the transport index numbers on the labels of the individual packages, does not exceed 50 This provision does not apply to exclusive use shipm[ents] described in §§ 173 393(j), 173 396(f), or 173 392 of this subcha[pter]

(b) Packages of radioactive material bearing "radioactive yello[w-II]" or "radioactive yellow-III" labels must not be placed in a motor vehicle or in any other place closer than the distances shown in the following table to any area which may be continuously occupied by passengers, employees, or shipments of animals, nor closer than the distances shown in the table below to any package containing undeveloped film (if so marked) If more than one of these packages is present, the distance shall be computed from the following table on the basis of the total transport index number (determined by adding together the transport index numbers on the labels of the individual packages) or packages in the vehicle or storeroom Where more than one group of packages is present in any single storage location, a single group may not have a total transport index greater than 50 Each group of packages must be handled and stowed not closer than 6 meters (20 feet) (measured edge to edge) to any other group

(c) Shipments of low specific activity materials, as defined in § 173 391 of this subchapter, must be loaded so as to avoid spillage and scattering of loose materials Loading restrictions are set forth in § 173 397 of this subchapter

(d) Packages must be so blocked and braced that they cannot change position during conditions normally incident to transportation

Total transport index	Minimum separation distances in feet to nearest undeveloped film for various times of transit					Minimum distance in feet to area of persons, or minimum distance in feet from dividing partition of cargo compartments
	Up to 2 hours	2–4 hours	4–8 hours	8–12 hours	Over 12 hours	
None	0	0	0	0	0	0
0 1 to 1 0	1	2	3	4	5	1
1 1 to 5 0	3	4	6	8	11	2
5 1 to 10 0	4	6	9	11	15	3
10 1 to 20 0	5	8	12	16	22	4
20 1 to 30 0	7	10	15	20	29	5
30 1 to 40 0	8	11	17	22	33	6
40 1 to 50 0	9	12	19	24	36	7

Note 1 The distance in the table must be measured from the nearest point on the packages of radioactive materials

(e) Persons should not remain unnecessarily in a vehicle containing radioactive materials

(f) Each fissile class III radioactive material shipment (as defined in § 173 389(a)(3) of this subchapter) must be transported in accordance with one of the methods prescribed in § 173 396(g) of this subchapter The transport controls must be adequate to assure that no fissile class III shipment is transported in the same transport vehicle with any other fissile radioactive material shipment In loading and storage areas each fissile class III shipment must be segregated by a distance of at least 20 feet from other packages required to bear one of the "Radioactive" labels described in § 173 416 of this subchapter

§ 177.843 Contamination of vehicles. (a) Each motor vehicle used for transporting low specific activity radioactive materials in truckload lots under the provisions of § 173 392(d) of this subchapter must be surveyed with appropriate radiation detection instruments after each use Carriers must not return such vehicles to service until the radiation dose rate at any accessible surface is not more than 0 5 millirem per hour, and there is no significant removable radioactive surface contamination (see § 173 399 of this subchapter)

(b) This section does not apply to any vehicle used solely for transporting radioactive material if a survey of the interior surface shows that the radiation dose rate does not exceed 10 millirem per hour at the interior surface or 2 millirem per hour at 3 feet from any interior surface These vehicles must be stenciled with the words "For Radioactive Materials Use Only" in lettering at least 3 inches high in a conspicuous place, on both sides of the exterior of the vehicle These vehicles must be kept closed at all times other than loading and unloading

(c) In case of fire accident, breakage, or unusual delay involving shipments of radioactive material, see § 177 861

§ 177.844 Other regulated materials. Asbestos must be [loade]d, handled, and unloaded, and any asbestos contamination of transport vehicles removed in a manner that will minimize occupational exposure to airborne asbestos particles released incident to transportation (See § 173 1090 of this subchapter)

APPENDIX C

CONRAIL TARIFF CR4426-B

The provisions published herein will, if effective, not result in an effect on the quality of the human environment.
No change in Rates, except as indicated by Reference Mark "♠".
Subject (except as otherwise provided) to ICC TEA 9000 and ICC TEA RCCR X082, supplements thereto or successive issues thereof

CTPUC CR 4426-B	MDOT CR 4426-B	ICC CR 4426-B
ILL CC 97	NJDOT CR 4426-B	PAPUC CR 4426-B
INRC CR 4426-B	NYDOT CR 4426-B	RIPUC CR 4426-B
MDPSC CR 4426-B	OHPUC CR 4426-B	VCC CR 4426-B
MDPU CR 4426-B		PSC-WVA CR 4426-B

(see Page 2 for Cancellations)

Consolidated Rail Corporation

FREIGHT TARIFF CR 4426-B

(See Page 2 for Cancellation)

LOCAL AND PROPORTIONAL FREIGHT TARIFF
ON
RADIOACTIVE MATERIALS
AND
RADIOACTIVE MATERIAL SHIPPING CASKS OR CONTAINERS
AS DESCRIBED HEREIN

CARLOADS

FROM STATIONS ON	TO STATIONS ON
CONSOLIDATED RAIL CORPORATION	CONSOLIDATED RAIL CORPORATION

IN THE STATES OF:

CONNECTICUT	INDIANA	MISSOURI	PENNSYLVANIA
DELAWARE	KENTUCKY	NEW JERSEY	RHODE ISLAND
DISTRICT OF COLUMBIA	MARYLAND	NEW YORK	VIRGINIA
ILLINOIS	MASSACHUSETTS	OHIO	WEST VIRGINIA
	MICHIGAN		

– VIA –

CONSOLIDATED RAIL CORPORATION DIRECT

INTRASTATE APPLICATION OF TARIFF

This Tariff also applies on Intrastate Traffic in the States of:

CONNECTICUT	ILLINOIS	MICHIGAN	PENNSYLVANIA
DELAWARE	INDIANA	NEW JERSEY	RHODE ISLAND
DISTRICT OF COLUMBIA	MARYLAND	NEW YORK	VIRGINIA
	MASSACHUSETTS	OHIO	WEST VIRGINIA

RADIOACTIVE MATERIALS TARIFF

Governed, except as otherwise provided herein, by Uniform Classification, and by Exceptions to said Classification. (See Item 5).

ISSUED: FEBRUARY 2, 1982 **EFFECTIVE: FEBRUARY 25, 1982**

This publication filed on less than 20 days' notice under authority of Section 10762 of the Interstate Commerce Act.

Issued by:
H.A. TRAUTMANN, Jr.
Manager - Tariff Publications
30th Street Station Building
Philadelphia, Pa. 19104

♠ Reduction

Filed with ICC-CONN-ILL-IRC-MD-MDPU-MDOT-NJ-NY-OHIO-PA-RIPUC-VA-WVA
(JSS-821-DRB) (200) Printed in USA) (V8,N1)

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CANCELLATION NOTICE

This Tariff cancels the following Consolidated Rail Corporation Tariff in full:

ICC AND TARIFF	CTPUC	ILL CC	INRC	MDPSC	MDPU	MDOT	NJDOT	NYDOT	OHPUC	PAPUC	RIPUC	VCC	PSC-WVA
CR 4426-A	CR 4426-A	88	CR 4426-A	CR 4426-A	CR 4426-A	CR 4426-A	CR 4426-A	CR 4426-A	CR 4426-A	CR 4426-A	CR 4426-A	CR 4426-A	CR 4426-A

For Explanation of Abbreviations, see concluding page of this Tariff.

RULES AND OTHER GOVERNING PROVISIONS

GENERAL RULES AND REGULATIONS

ITEM	SUBJECT	APPLICATION
5	DESCRIPTION OF GOVERNING CLASSIFICATION AND EXCEPTIONS.	The terms "Uniform Classification" and "Exceptions to Uniform Classification" when used herein, mean respectively ICC UFC 6000 SERIES. Exceptions to Uniform Classification, ICC TEA 2009-Series.
10	STATION LIST AND CONDITIONS . . .	This tariff is governed by ICC OPSL 6000 Series, to the extent shown below PREPAY REQUIREMENTS AND STATION CONDITIONS (a) For additions and abandonments of stations and except as otherwise shown herein, for prepay requirements, changes in names of stations, restrictions as to acceptance or delivery of freight, and changes in station facilities When a station is abandoned as of a date specified in the above named tariff, the rates from and to such station as published in this tariff are unapplicable on and after that date. GEOGRAPHICAL LIST OF STATIONS (b) For geographical locations of stations referred to in this tariff by station numbers. STATION NUMBERS (c) For the identification of stations when stations are shown or referred to by numbers in this tariff.
20	REFERENCE TO TARIFFS, ITEMS, NOTES, RULES, ETC	(a) Where reference is made in this tariff to tariffs, items, notes, rules, etc., such references are continuous and include supplements to and successive issues of such tariffs and reissues of such items, notes, rules, etc. (b) Where reference is made in this tariff to another tariff by ICC number, such reference applies also to such tariff to the extent it may be applicable on intrastate traffic
25	TERMINAL OR TRANSIT PRIVILEGES OR SERVICES. . . .	Shipments made under the rates contained in this tariff are not entitled to terminal and transit services and privileges.
40	CONSECUTIVE NUMBERS	Where consecutive numbers are represented in this tariff by the first and last numbers connected by the word "to" or a hyphen, they will be understood to include both of the number shown. If the first number only bears a reference mark, such reference mark also applies to the last number shown and to all numbers between the first and last number.
45	CAPACITIES AND DIMENSIONS OF CARS.	For marked capacities, lengths, dimensions and cubical capacities of cars, see ICC RER 6410 Series Cars may not be loaded in excess of the load limit.
60	NATIONAL SERVICE ORDER TARIFF. . .	This tariff is subject to provisions of various Interstate Commerce Commission Service Orders and General Permits as shown in ICC NSO 6100 Series
75	METHOD OF CANCELLING ITEMS	As this tariff is supplemented, numbered items with letter suffixes cancel correspondingly numbered items in the original tariff or in a prior supplement. Letter suffixes will be used in alphabetical sequence starting with A. EXAMPLE:--Item 445-A cancels Item 445, and Item 365-B cancels Item 365-A in a prior supplement, which, in turn, cancelled Item 365.
100	METHOD OF DENOTING REISSUED MATTER IN SUPPLEMENTS.	Matter brought forward without change from one supplement to another, will be designated as "Reissued" by a reference mark in the form of a square enclosing a number, the number being that of the supplement in which the reissued matter first appeared in its currently effective form. To determine its original effective date, consult the supplement in which the reissued matter first became effective.

For Explanation of Abbreviations, see concluding page of this Tariff.

RULES AND OTHER GOVERNING PROVISIONS

SPECIAL RULES AND REGULATIONS - UNLIMITED

ITEM	SUBJECT	APPLICATION
200	APPLICATION OF SURCHARGES. . .	The rates and charges named in this tariff,as amended,are to be increased for the account of any individual carrier to the extent provided in any applicable surcharge tariff issued by such individual carrier and lawfully on file with the Interstate Commerce Commission. To determine the surcharge to be assessed,consult the applicable surcharge tariff separately published by such individual carrier. Rule 1300.4 (i) of 49 CFR 1300.0 waived; ICC Special Tariff Authority No. 81-4908 of June 16, 1981.
205	RULE 24 EXCEPTIONS,WAIVER OF TARIFF PUBLISHING RULES .	Where items or other provisions in this tariff now provide that rates are not subject to the provisions of Rule 24 of the Uniform Freight Classification, as described in Item 5,such rates will not be subject to "Exceptions to Rule 24" of Uniform Freight Classification, as described in Item 5.
210	RULES,REGULATIONS AND PACKING REQUIREMENTS. . .	The commodities for which carload rates are provided for in this tariff, will be subject to all rules,regulations and packing requirements of the Governing Classification and Exceptions thereto,as named in Item 5,unless otherwise specifically provided herein.
215	PACKAGING, LABELING,AND PLACARDING OF SHIPMENTS . . .	Shipments must be packaged,labelled,and placarded in accordance with Title 49,Code of Federal Regulations,Parts 171-179 inclusive,of Bureau of Explosives Tariff No. ICC BOE-6000 Series,supplements thereto or successive issues thereof. This item supersedes any packing requirements of Item 210 of this Tariff.
220	SHIPPING PAPERS.	Shipments must be described in accordance with regulations contained in Title 49,Code of Federal Regulations,Part 172. Commodity shall also be described as listed in Items 270-305 of this tariff for proper application of freight rates.
225	49 SERIES STANDARD TRANSPORTATION COMMODITY CODE (STCC) . .	The appropriate 49-series Standard Transportation Commodity Code from Section 3 of Standard Transportation Commodity Code Tariff ICC STCC 6001-Series, supplements thereto, or successive issues thereof, must be shown on the bill of lading.
230	LIABILITY. . . .	Shipments to which this tariff applies will not be received for transportation unless the shipper executes an agreement, endorsed upon or attached to the bill of lading in the following form: "In partial consideration for carrier's acceptance of this shipment for transportation, shipper agrees that the declared value of the property does not exceed 40 cents per pound and that carrier shall not be liable for loss of or damage to the property in excess of said amount".. Shipments of irradiated fuel elements and radioactive waste material will not be received for transportation unless the shipper executes a certificate, endorsed upon or attached to the bill of lading, reading as follows: "This is to certify that the articles named within or in the attached bill of lading are properly described, and are packed, marked and in proper condition for transportation according to the regulations prescribed by the U.S. Department of Transportation. The shipper is making the shipment described in such bill of lading (1) as contractor or licensee of the Nuclear Regulatory Commission under the provisions of the Atomic Energy Act of 1954, as amended by the "Price-Anderson Act", Public Law 85-256, as amended or (2) to such contractor or licensee; that there is now in full force and effect a contract between such contractor or licensee and such Commission under such Act, indemnifying such contractor or licensee and the carrier or carriers handling this shipment against public liability as defined in such Act, and (1) that there are no monetary, exclusions or limitations in such contract of indemnity, except as stated in such Act, or (2) that there is in full force and effect a policy or policies of insurance issued by an insurance company or companies licensed to do business in the State of New York or other adequate financial protection as provided by regulations of such Commission in an amount equal to that provided under such Act and regulations thereunder holding the carrier or carriers handling such shipment free and harmless of and from all public liability". If shipper fails or is unable to execute and furnish the above certificate the Consolidated Rail Corporation does not hold itself out as a common carrier to transport shipments of irradiated fuel elements and radioactive waste material.

For Explanation of Abbreviations, see concluding page of this Tariff.

RULES AND OTHER GOVERNING PROVISIONS

SPECIAL RULES AND REGULATIONS

UNLIMITED

ITEM	SUBJECT	APPLICATION
240	EQUIPMENT SUPPLY.	Furnishing of Nuclear Regulatory Commission licensed casks, or cask cars, or tank cars shall be the responsibility of the shipper. Originating carrier shall be responsible for furnishing box cars or gondolas.
245	MILEAGE ALLOWANCES	Applicable mileage allowances under Tariff ICC PHJ 6007 Series will be paid.
250	MOVEMENT OF SHIPMENTS IN SPECIAL TRAIN SERVICE	If shipper requests movement of commodities in special train service, special train charges published in CR Tariff ICC CR 9500 Series, supplements thereto, or successive issues thereof, will be assessed. These special train charges will be in addition to rates published in this tariff.
255	PHYSICAL SECURITY. . . .	Any physical security provided, either in compliance with NRC or DOT regulations, or at the request of the shipper, shall be at the expense of the shipper. It is not included in the rates.
260	ATTENDANTS . . .	Any attendants accompanying the shipment; either as physical security or technical personnel, will be transported in accordance with charges published in Tariff ICC WTL 9001-Series, supplements thereto, or successive issues thereof.
265	ROUTING OF SHIPMENTS . . .	Routing between Consolidated Rail Corporation stations or interchanges, shall be determined by Consolidated Rail Corporation. Any specific Consolidated Rail Corporation internal routing requested by shipper, either voluntarily or to comply with regulations of a local, county, state or federal government agency will cause the shipment to be billed at rates for the actual operating miles between intermediate stations for the routes utilized. These mileages are published in Conrail Tariff ICC CR 9516-Series.

SPECIAL RULES AND REGULATIONS

APPLICATION OF RATES

ITEM	COMMODITY	APPLICATION
270	Fuel elements, nuclear reactor, irradiated and requiring protective shielding, or irradiated parts or constituents - shipped in General Electric cask car (STCC 28 197 10)	Apply Table "A"
275	- shipped in NLI cask car (STCC 28 197 10)	Apply Table "B"

For Explanation of Abbreviations, see concluding page of this Tariff.

RULES AND OTHER GOVERNING PROVISIONS

SPECIAL RULES AND REGULATIONS

APPLICATION OF RATES

ITEM	COMMODITY	APPLICATION
280	Casks, radioactive material, shipping, steel and lead or steel and uranium metal combined, empty General Electric IF 300 Cask, empty (STCC 34 919 40)	Apply Table "A"
285	NLI 10/24 Cask, empty (STCC 34 919 40)	Apply Table "B"
290	Containers, radioactive material, shipping, steel and lead or steel and uranium metal combined, empty - shipped in gondola cars (STCC 34 919 40)	Apply Table "D"
295	Radioactive material or radioactive waste, low specific activity, having no reclamation value, in drums or packages - shipped in box cars (STCC 40 251 33)	Apply Table "C"
* 300	Radioactive waste, low specific activity, having no reclamation value - shipped in gondola cars - ♦shipped in flat cars (STCC 40 251 33)	Apply Table "D"
305	Radioactive waste, low specific activity, liquid, having no reclamation value - shipped in bulk, in tank cars (STCC 40 251 33)	Apply Table "E"
310	Fuel elements, nuclear reactor, irradiated and requiring protective shielding, or irradiated parts or constituents, in containers, shipped on a Government-owned DODX depressed center flat car. (STCC 28 197 10)	Apply Table "F"
315	Casks or containers, radioactive material shipping, empty, permanently mounted or shipped on a Government-owned DODX depressed center flat car, (STCC 34 919 40)	Apply Table "G"
320	Irradiated components, shipped on Government-owned DODX flat cars. (STCC 28 197 10)	Apply Table "H"

ITEM	
325	(Applicable only when specific reference is made to this Item) Rates will only apply on shipments moving between stations served by Consolidated Rail Corporation. To determine a rate from a given origin to a given destination, find the Rate Basis Number applicable from point of origin to point of destination in ICC TEA 1009 Series or ICC WTL 1002 Series, disregarding the letter suffix, if any, and then apply the rate provided for that Rate Basis Number in Tables "A", "B", "C", "D", "E", "F", "G", or "H", of this tariff. The rates published herein, from or to points for which Rate Basis Numbers are provided in tariffs, shown above, will also apply from or to points taking same rates as shown in ICC NRB 6000 Series.

♦ - Reduction.

For Explanation of Abbreviations, see concluding page of this Tariff.

RATE TABLE "A"

COMMODITIES AS DESCRIBED IN ITEMS 270 AND 280

(I)RATES IN CENTS PER 100 POUNDS (SEE ITEM 325)

RATE BASIS	CARLOAD MINIMUM WEIGHT				RATE BASIS	CARLOAD MINIMUM WEIGHT			
NOT OVER	144,000 Pounds	160,000 Pounds	170,000 Pounds	180,000 Pounds	NOT OVER	144,000 Pounds	160,000 Pounds	170,000 Pounds	180,000 Pounds
20	31	28	27	26	1020	241	229	224	217
40	35	32	31	30	1040	245	233	227	222
60	39	36	35	33	1060	249	237	231	226
80	44	40	38	37	1080	253	242	235	229
100	48	45	43	40	1100	258	246	239	233
120	52	48	47	46	1120	262	249	243	236
140	56	52	50	49	1140	266	253	247	241
160	61	56	54	52	1160	271	258	250	245
180	65	61	59	56	1180	275	262	255	248
200	69	64	62	60	1200	279	265	259	252
220	72	68	66	64	1220	283	269	262	256
240	77	72	70	68	1240	288	274	266	260
260	81	77	73	71	1260	292	278	271	264
280	85	81	78	76	1280	296	282	275	267
300	89	84	82	79	1300	300	285	278	272
320	94	88	85	83	1320	305	290	282	275
340	98	93	89	87	1340	309	294	286	279
360	102	97	94	91	1360	313	298	290	283
380	107	101	98	95	1380	317	301	294	286
400	111	104	101	99	1400	322	306	298	291
420	115	109	105	102	1420	325	310	301	295
440	119	113	110	107	1440	329	314	306	298
460	124	117	113	110	1460	333	318	310	302
480	128	120	117	114	1480	338	322	313	306
500	132	125	121	118	1500	342	326	317	310
520	136	129	125	121	1520	346	330	322	314
540	141	133	129	126	1540	350	334	325	317
560	145	137	133	129	1560	355	338	329	322
580	149	141	136	133	1580	359	342	333	325
600	153	145	141	137	1600	363	346	338	329
620	157	149	145	141	1620	367	350	341	353
640	161	153	148	145	1640	372	355	345	337
660	165	157	152	148	1660	376	358	349	341
680	169	161	157	152	1680	380	362	353	349
700	174	165	161	157	1700	384	366	357	348
720	178	169	164	160	1720	389	371	361	353
740	182	174	168	164	1740	393	374	364	356
760	186	177	173	167	1760	397	378	368	360
780	191	181	176	171	1780	402	382	373	363
800	195	185	180	176	1800	406	387	376	367
820	199	190	184	179	1820	409	391	380	372
840	203	193	187	183	1840	413	394	384	375
860	208	197	192	186	1860	417	398	388	379
880	212	201	196	191	1880	422	403	392	382
900	216	206	199	195	1900	426	407	396	387
920	220	210	203	198	1920	430	410	400	391
940	225	213	208	202	1940	435	414	404	394
960	229	217	211	207	1960	439	419	408	398
980	233	222	215	210	1980	443	423	412	403
1000	237	226	219	214	2000	447	427	415	406

(I) - Not subject to Sections 1 or 3 of ICC TEA 9000, as provided on Title Page.

For Explanation of Abbreviations, see concluding page of this Tariff.

RATE TABLE "B"

COMMODITIES AS DESCRIBED IN ITEMS 275 AND 285

(I) RATES IN CENTS PER 100 POUNDS (SEE ITEM 325)

RATE BASIS	CARLOAD MINIMUM WEIGHT			RATE BASIS	CARLOAD MINIMUM WEIGHT		
NOT OVER	200,000 Pounds	210,000 Pounds	220,000 Pounds	NOT OVER	200,000 Pounds	210,000 Pounds	220,000 Pounds
20	20	20	19	1020	208	202	198
40	24	23	22	1040	211	206	201
60	28	27	27	1060	215	210	204
80	32	31	30	1080	218	213	209
100	35	34	33	1100	223	217	212
120	39	38	37	1120	226	220	215
140	43	42	40	1140	230	224	219
160	47	46	44	1160	233	228	223
180	50	49	48	1180	237	231	226
200	54	52	51	1200	241	235	230
220	58	56	54	1220	245	239	233
240	62	60	59	1240	248	243	237
260	65	64	62	1260	252	246	241
280	69	67	65	1280	256	249	244
300	72	71	69	1300	260	253	248
320	77	75	72	1320	263	257	251
340	80	78	77	1340	267	261	255
360	84	82	80	1360	271	264	259
380	87	85	83	1380	275	268	262
400	92	89	87	1400	278	272	265
420	95	93	91	1420	282	275	269
440	99	97	94	1440	285	279	273
460	102	100	98	1460	290	282	276
480	107	103	101	1480	293	286	280
500	110	108	104	1500	297	290	283
520	114	111	109	1520	300	294	288
540	117	115	112	1540	305	297	291
560	121	118	115	1560	308	300	294
580	125	122	119	1580	312	305	298
600	129	126	122	1600	315	308	301
620	132	129	127	1620	320	312	305
640	136	133	130	1640	323	315	309
660	140	136	133	1660	327	320	312
680	144	141	137	1680	330	323	315
700	147	144	141	1700	334	326	320
720	151	147	144	1720	338	330	323
740	154	151	148	1740	342	333	326
760	159	154	151	1760	345	338	330
780	162	159	154	1780	349	341	333
800	166	162	159	1800	353	344	338
820	169	166	162	1820	357	348	341
840	174	169	165	1840	360	351	344
860	177	173	169	1860	364	356	348
880	181	177	173	1880	367	359	351
900	185	180	177	1900	372	363	355
920	189	184	180	1920	375	366	359
940	193	187	183	1940	379	370	362
960	196	192	187	1960	382	374	365
980	200	195	191	1980	387	377	370
1000	203	198	194	2000	390	381	373

(I) - Not subject to Sections 1 or 3 of ICC TEA 9000, as provided on Title Page.

For Explanation of Abbreviations, see concluding page of this Tariff.

RATE TABLE "C"

COMMODITIES AS DESCRIBED IN ITEM 295

(I) RATES IN CENTS PER 100 POUNDS (SEE Item 325)

RATE BASIS	CARLOAD MINIMUM WEIGHT					RATE BASIS	CARLOAD MINIMUM WEIGHT				
NOT OVER	60,000 Pounds	80,000 Pounds	100,000 Pounds	120,000 Pounds	140,000 Pounds	NOT OVER	60,000 Pounds	80,000 Pounds	100,000 Pounds	120,000 Pounds	140,000 Pounds
20	209	158	128	108	93	1020	1105	878	741	650	585
40	226	173	140	118	103	1040	1124	892	753	660	594
60	244	186	152	129	113	1060	1142	906	766	672	605
80	262	201	164	140	122	1080	1159	921	777	683	615
100	280	215	177	151	132	1100	1177	935	790	693	624
120	298	230	189	162	143	1120	1195	950	802	704	634
140	316	244	201	173	152	1140	1213	964	815	715	644
160	334	259	213	183	162	1160	1231	979	826	726	654
180	351	273	226	194	171	1180	1249	993	839	737	663
200	370	288	237	206	181	1200	1266	1007	851	748	673
220	388	301	250	216	192	1220	1284	1021	864	758	684
240	406	316	263	227	201	1240	1302	1036	875	769	693
260	424	330	275	237	211	1260	1321	1050	888	781	703
280	442	345	288	248	230	1280	1339	1065	901	791	712
300	459	359	299	260	231	1300	1357	1079	913	802	722
320	477	374	312	271	241	1320	1375	1094	925	813	733
340	495	388	324	281	250	1340	1391	1108	937	823	742
360	513	403	337	292	260	1360	1410	1123	950	834	752
380	531	417	348	302	271	1380	1428	1136	962	846	761
400	550	431	361	313	280	1400	1446	1151	974	856	772
420	567	446	373	325	290	1420	1464	1165	986	867	782
440	585	460	386	335	299	1440	1482	1180	999	878	791
460	603	475	397	346	310	1460	1500	1194	1011	888	801
480	621	489	410	357	320	1480	1518	1209	1023	900	812
500	639	504	422	367	329	1500	1536	1223	1035	911	821
520	657	518	435	379	339	1520	1554	1238	995	921	831
540	675	533	446	390	348	1540	1572	1251	1060	932	840
560	692	546	459	400	359	1560	1590	1266	1072	943	851
580	710	561	471	411	368	1580	1607	1280	1084	954	861
600	728	575	484	422	378	1600	1625	1295	1097	965	870
620	747	590	495	433	388	1620	1643	1310	1109	976	880
640	765	604	508	444	398	1640	1661	1324	1121	986	890
660	783	619	520	455	408	1660	1680	1339	1133	997	900
680	800	633	533	465	417	1680	1698	1353	1146	1007	910
700	818	648	544	476	427	1700	1716	1367	1158	1019	919
720	836	661	557	487	438	1720	1733	1381	1170	1030	929
740	854	676	570	498	447	1740	1751	1396	1182	1041	939
760	872	690	581	509	457	1760	1769	1410	1195	1051	949
780	890	705	594	520	466	1780	1787	1425	1207	1062	959
800	908	719	606	530	477	1800	1805	1439	1219	1074	968
820	925	734	619	541	487	1820	1823	1454	1232	1084	979
840	944	748	630	553	496	1840	1840	1468	1244	1095	988
860	962	763	643	563	506	1860	1858	1482	1257	1105	998
880	980	776	655	574	517	1880	1877	1496	1268	1116	1007
900	998	791	668	585	526	1900	1895	1511	1281	1128	1018
920	1016	805	679	595	536	1920	1913	1525	1293	1138	1028
940	1033	820	692	607	545	1940	1931	1540	1306	1149	1037
960	1051	834	704	618	555	1960	1949	1554	1317	1160	1047
980	1069	849	717	628	566	1980	1966	1569	1330	1170	1058
1000	1087	864	728	639	575	2000	1984	1583	1342	1181	1067

(I) - Not subject to Sections 1 or 3 of ICC TEA 9000, as provided on Title Page.

For Explanation of Abbreviations, see concluding page of this Tariff.

RATE TABLE "D" *

COMMODITIES AS DESCRIBED IN ITEMS 290 AND 300

(I) RATES IN CENTS PER 100 POUNDS (SEE ITEM 325)

RATE BASIS	CARLOAD MINIMUM WEIGHT					RATE BASIS	CARLOAD MINIMUM WEIGHT				
NOT OVER (MILES)	100,000 Pounds	120,000 Pounds	140,000 Pounds	160,000 Pounds	180,000 Pounds	NOT OVER	100,000 Pounds	120,000 Pounds	140,000 Pounds	160,000 Pounds	180,000 Pounds
20	126	105	92	81	72	1020	803	702	629	575	534
40	138	117	102	91	82	1040	817	714	640	586	542
60	152	129	113	100	91	1060	830	725	651	595	552
80	166	142	124	111	100	1080	843	738	661	605	561
100	179	153	134	120	110	1100	857	750	673	615	570
120	193	165	145	130	118	1120	871	761	684	625	579
140	207	177	155	141	128	1140	873	773	694	635	589
160	220	189	167	150	137	1160	898	785	705	644	597
180	233	201	178	160	146	1180	912	798	716	655	607
200	247	213	189	169	155	1200	919	809	726	665	617
220	261	225	199	180	165	1220	938	821	737	674	625
240	275	236	210	190	174	1240	952	833	748	684	635
260	288	248	220	199	183	1260	966	845	758	694	644
280	301	261	231	210	193	1280	979	857	770	704	653
300	315	273	242	219	201	1300	993	869	781	714	662
320	328	284	252	229	211	1320	1006	881	791	724	672
340	342	296	264	240	220	1340	1019	892	802	734	681
360	356	308	275	249	229	1360	1033	904	813	743	690
380	370	321	285	260	239	1380	1047	917	823	754	700
400	382	332	296	268	248	1400	1061	929	834	764	708
420	396	344	307	279	257	1420	1074	940	845	773	718
440	410	356	317	289	268	1440	1087	952	855	783	726
460	424	367	328	298	276	1460	1101	964	867	793	736
480	437	380	339	309	284	1480	1115	977	878	803	746
500	450	392	349	318	294	1500	1128	988	888	813	754
520	464	404	360	328	302	1520	1142	1000	899	823	764
540	477	415	372	338	312	1540	1156	1012	910	833	773
560	491	427	382	348	322	1560	1168	1023	920	842	782
580	505	440	393	358	330	1580	1182	1036	931	852	791
600	519	452	404	367	340	1600	1196	1048	941	863	801
620	531	463	414	378	349	1620	1240	1060	952	872	809
640	545	475	425	388	358	1640	1233	1071	963	882	819
660	559	487	436	397	367	1660	1236	1083	974	892	829
680	573	499	446	407	377	1680	1250	1096	985	902	837
700	586	511	457	417	386	1700	1264	1108	996	912	847
720	600	523	469	427	395	1720	1277	1119	1006	921	856
740	613	535	479	437	405	1740	1291	1131	1017	932	865
760	626	546	490	447	413	1760	1205	1143	1006	941	885
780	640	559	501	457	423	1780	1317	1102	1038	951	884
800	654	571	511	466	432	1800	1331	1167	996	962	892
820	668	583	522	476	441	1820	1345	1179	1060	971	902
840	681	594	533	487	450	1840	1359	1191	1071	981	912
860	694	606	543	496	460	1860	1372	1202	1082	990	920
880	708	619	554	506	469	1880	1386	1214	1093	1001	930
900	722	630	566	517	478	1900	1398	1227	1103	1011	949
920	735	642	576	526	488	1920	1413	1239	1114	1020	948
940	749	654	587	536	496	1940	1426	1250	1125	1031	957
960	763	666	597	545	506	1960	1440	1262	1135	1041	966
980	775	678	688	556	514	1980	1454	1274	1146	1050	976
1000	789	690	619	566	524	2000	1467	1287	1157	1060	985

(I) - Not subject to Sections 1 or 3 of ICC TEA 9000, as provided on Title Page.

For Explanation of Abbreviations, see concluding page of this Tariff.

* + 4.7% INCR EFF 1/1/82 THRU 1/1/83

RATE TABLE "E"

COMMODITIES AS DESCRIBED IN ITEM 305

(I)RATES IN CENTS PER 100 POUNDS (SEE ITEM 325)

RATE BASIS	CARLOAD MINIMUM WEIGHT		RATE BASIS	CARLOAD MINIMUM WEIGHT	
NOT OVER	160,000 Pounds	180,000 Pounds	NOT OVER	160,000 Pounds	180,000 Pounds
20	59	52	1020	730	671
40	71	65	1040	743	684
60	85	78	1060	756	695
80	99	89	1080	770	708
100	112	102	1100	784	720
120	126	115	1120	797	733
140	138	127	1140	810	746
160	152	140	1160	823	757
180	166	151	1180	837	770
200	179	164	1200	851	782
220	193	177	1220	864	794
240	207	186	1240	878	807
260	219	201	1260	891	819
280	233	213	1280	904	832
300	246	226	1300	918	843
320	260	239	1320	931	856
340	274	250	1340	945	869
360	286	263	1360	959	881
380	300	275	1380	971	894
400	313	288	1400	985	906
420	327	300	1420	998	918
440	341	312	1440	1012	931
460	354	325	1460	1026	943
480	367	337	1480	1038	955
500	380	349	1500	1052	968
520	394	362	1520	1065	980
540	408	374	1540	1079	993
560	421	387	1560	1093	1004
580	435	399	1580	1105	1017
600	447	411	1600	1119	1030
620	461	424	1620	1132	1042
640	475	436	1640	1146	1054
660	488	448	1660	1160	1066
680	502	461	1680	1173	1079
700	515	473	1700	1186	1092
720	518	486	1720	1200	1103
740	542	497	1740	1213	1116
760	555	510	1760	1227	1128
780	569	523	1780	1240	1141
800	583	535	1800	1254	1153
820	595	547	1820	1267	1165
840	609	559	1840	1280	1178
860	622	572	1860	1294	1198
880	636	585	1880	1307	1202
900	650	596	1900	1321	1215
920	662	609	1920	1334	1227
940	676	621	1940	1347	1240
960	689	634	1960	1361	1252
980	703	646	1980	1374	1264
1000	717	658	2000	1388	1277

(I) - Not subject to Sections 1 or 3 of ICC TEA 9000, as provided on Title Page.

For Explanation of Abbreviations, see concluding page of this Tariff.

RATE TABLE "F"

COMMODITIES AS DESCRIBED IN ITEM 310

(I)RATES IN CENTS PER 100 POUNDS (SEE ITEM 325)

RATE BASIS	CARLOAD MINIMUM WEIGHT		RATE BASIS	CARLOAD MINIMUM WEIGHT	
NOT OVER	231,000 Pounds	300,000 Pounds	NOT OVER	231,000 Pounds	300,000 Pounds
20	13	11	1020	107	104
40	15	13	1040	109	107
60	17	15	1060	110	108
80	18	16	1080	112	110
100	20	18	1100	114	112
120	22	20	1120	116	114
140	24	22	1140	118	115
160	27	23	1160	119	117
180	28	26	1180	121	119
200	30	28	1200	124	121
220	32	30	1220	126	122
240	34	31	1240	127	125
260	35	33	1260	129	127
280	37	35	1280	131	129
300	39	37	1300	133	130
320	42	38	1320	134	132
340	43	40	1340	136	134
360	45	43	1360	138	136
380	47	45	1380	141	137
400	49	46	1400	142	140
420	50	48	1420	144	142
440	52	50	1440	146	144
460	54	52	1460	148	146
480	56	53	1480	149	147
500	58	55	1500	151	149
520	60	58	1520	153	151
540	62	60	1540	155	153
560	64	62	1560	157	154
580	65	63	1580	159	157
600	67	65	1600	161	159
620	69	67	1620	163	161
640	71	69	1640	164	162
660	72	70	1660	166	164
680	75	72	1680	168	166
700	77	75	1700	170	168
720	79	77	1720	171	169
740	80	78	1740	174	171
760	82	80	1760	176	174
780	84	82	1780	178	176
800	86	84	1800	179	177
820	87	85	1820	181	179
840	89	87	1840	183	181
860	92	89	1860	185	183
880	94	92	1880	186	184
900	95	93	1900	189	186
920	97	95	1920	191	189
940	99	97	1940	193	191
960	101	99	1960	194	192
980	102	100	1980	196	194
1000	104	102	2000	198	196

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For Explanation of Abbreviations, see concluding page of this Tariff.

RATE TABLE "G"

COMMODITIES AS DESCRIBED IN ITEM 315

(I)RATES IN CENTS PER 100 POUNDS (SEE ITEM 325)

RATE BASIS	CARLOAD MINIMUM WEIGHT			RATE BASIS	CARLOAD MINIMUM WEIGHT		
NOT OVER	142,000 Pounds	218,000 Pounds	245,000 Pounds	NOT OVER	142,000 Pounds	218,000 Pounds	245,000 Pounds
20	25	14	13	1020	144	108	105
40	27	16	14	1040	146	109	108
60	29	17	16	1060	148	111	110
80	32	19	18	1080	150	113	112
100	34	21	20	1100	153	115	113
120	36	23	21	1120	155	116	115
140	38	24	23	1140	158	118	117
160	40	27	26	1160	160	120	119
180	44	29	28	1180	163	122	121
200	46	31	29	1200	165	124	122
220	48	32	31	1220	167	126	125
240	50	34	33	1240	169	128	127
260	53	36	35	1260	173	130	129
280	55	38	37	1280	175	131	130
300	58	39	38	1300	177	133	132
320	60	42	40	1320	179	135	134
340	63	44	43	1340	182	137	136
360	65	46	45	1360	184	138	137
380	67	47	46	1380	186	141	140
400	69	49	48	1400	189	143	142
420	72	51	50	1420	191	145	144
440	75	53	52	1440	194	146	145
460	77	54	53	1460	196	148	147
480	79	56	55	1480	198	150	149
500	82	59	58	1500	200	152	151
520	84	61	60	1520	203	153	152
540	86	62	61	1540	206	155	154
560	88	64	63	1560	208	158	157
580	91	66	65	1580	210	160	159
600	94	68	67	1600	213	161	160
620	96	69	68	1620	215	163	162
640	98	71	70	1640	217	165	164
660	100	73	72	1660	219	167	166
680	103	76	75	1680	223	168	167
700	105	77	76	1700	225	170	169
720	108	79	78	1720	227	173	171
740	110	81	80	1740	229	175	174
760	113	83	82	1760	231	176	175
780	115	84	83	1780	234	178	177
800	117	86	85	1800	236	180	179
820	119	88	87	1820	239	182	181
840	122	91	89	1840	241	183	182
860	125	92	91	1860	244	185	184
880	127	94	93	1880	246	187	186
900	129	96	95	1900	248	190	189
920	132	98	97	1920	250	192	190
940	134	100	98	1940	253	193	192
960	136	101	100	1960	256	195	194
980	138	103	102	1980	258	197	196
1000	141	105	104	2000	260	199	197

(I) - Not subject to Sections 1 or 3 of ICC TEA 9000, as provided on Title Page.

For Explanation of Abbreviations, see concluding page of this Tariff.

RATE TABLE "H"

COMMODITIES AS DESCRIBED IN ITEM 320

(I)RATES IN CENTS PER 100 POUNDS (SEE ITEM 325)

RATE BASIS	CARLOAD MINIMUM WEIGHT			RATE BASIS	CARLOAD MINIMUM WEIGHT		
NOT OVER	96,000 Pounds	135,000 Pounds	180,000 Pounds	NOT OVER	96,000 Pounds	135,000 Pounds	180,000 Pounds
20	46	33	24	1020	460	323	246
40	54	38	29	1040	469	328	250
60	63	45	34	1060	427	334	255
80	71	50	38	1080	486	340	259
100	80	56	43	1100	494	346	263
120	87	62	47	1120	502	351	267
140	96	67	51	1140	510	357	273
160	104	73	55	1160	519	363	277
180	113	79	60	1180	527	368	281
200	120	85	65	1200	535	375	285
220	129	91	69	1220	543	380	290
240	137	97	73	1240	552	387	294
260	146	102	78	1260	560	392	298
280	154	109	82	1280	569	398	304
300	162	114	86	1300	576	404	308
320	170	119	91	1320	585	409	312
340	179	126	96	1340	593	415	316
360	187	131	100	1360	602	421	321
380	196	137	104	1380	609	427	325
400	203	143	109	1400	618	432	329
420	212	149	113	1420	626	439	334
440	220	154	117	1440	635	444	339
460	229	161	121	1460	643	450	343
480	236	166	127	1480	651	456	347
500	245	171	131	1500	659	461	351
520	253	178	135	1520	668	468	356
540	262	183	140	1540	676	473	361
560	271	190	144	1560	684	479	365
580	278	195	148	1580	692	485	370
600	286	201	153	1600	701	491	374
620	295	207	158	1620	709	496	378
640	301	212	162	1640	718	502	382
660	311	218	166	1660	725	508	387
680	320	224	170	1680	734	513	392
700	328	230	175	1700	742	520	396
720	337	235	179	1720	751	525	400
740	345	242	184	1740	758	531	405
760	353	247	189	1760	767	537	409
780	361	253	193	1780	775	543	413
800	370	259	197	1800	784	548	417
820	378	264	201	1820	792	554	423
840	386	271	206	1840	800	560	427
860	394	276	210	1860	808	566	431
880	403	282	215	1880	817	572	436
900	411	288	219	1900	825	577	440
920	420	294	224	1920	833	584	444
940	427	299	228	1940	841	589	448
960	436	306	232	1960	850	595	454
980	444	311	236	1980	858	601	458
1000	453	316	241	2000	867	606	462

(I) - Not subject to Sections 1 or 3 of ICC TEA 9000, as provided on Title Page.

For Explanation of Abbreviations, see concluding page of this Tariff.

EXPLANATION OF ABBREVIATIONS

BOE - - - - Bureau of Explosives, Thomas A. Phemister, Agent.

CONRAIL - - Consolidated Rail Corporation.

CR- - - - - Consolidated Rail Corporation.

CT PUC- - - Connecticut Public Utilities Commission.

DOT - - - - Department of Transportation.

ICC - - - - Interstate Commerce Commission.

ILLCC - - - Illinois Commerce Commission.

INRC - - - Public Service Commission of Indiana.

MDOT- - - - Michigan Department of Transportation.

MD PSC- - - Public Service Commission of Maryland.

NJ DOT- - - New Jersey - Department of Transportation.

NRB - - - - National Rate Basis (Western Trunk Line Committee, Agent).

NRC - - - - Nuclear Regulatory Commission.

NSO - - - - National Service Order.

NY DOT- - - New York - Department of Transportation.

OH PUC- - - Public Utilities Commission of Ohio.

OPSL- - - - Official List of Open and Prepay Stations (Station List Publishing Company, Agent).

PAPUC - - - Pennsylvania Public Utility Commission.

PHJ - - - - H. J. Positano, Agent.

RCCR- - - - Rail Cost Recovery Tariff (Traffic Executive Association-Eastern Railroads, Agent).

RIPUC - - - Rhode Island Division of Public Utilities and Carriers.

STCC- - - - Standard Transportation Commodity Code (Traffic Executive Association-Eastern Railroads, Agent).

TEA - - - - Traffic Executive Association - Eastern Railroads, Agent.

UFC - - - - Uniform Freight Classification (Uniform Classification Committee, Agent).

VCC - - - - Commonwealth of Virginia State Corporation Commission.

PSCWVA- - - West Virginia Public Service Commission.

WTL - - - - Western Trunk Lines (Western Trunk Line Committee, Agent).

Appendix J

FLOOD-PLAIN ASSESSMENT

Appendix J

FLOOD-PLAIN ASSESSMENT

J.1 EXPANDED CANONSBURG SITE

J.1.1 Project description

At the present time, residual radioactive materials and associated radioactively contaminated materials from the prior operations of the Vitro Rare Metals Plant exist in the 100- and 500-year flood plains of Chartiers Creek, as shown on Figures A.1-1 and D.1-1, and as described in Sections 2.1 and subsections 4.2.1 and 4.3.3.

The principal feature of the proposed remedial action would be the consolidation of the more radioactively contaminated materials (Figure A.1-1) into a lined encapsulation cell (Figures A.1-2 through A.1-4) located in Areas A and B of the Canonsburg site above the 100-year flood level (Section 3.1, Appendix A.1). The location of the encapsulation cell, as shown on Figure A.1-2, was chosen for the following reasons. First, it is preferable to locate the encapsulation cell on the Canonsburg site to prevent the spread of radioactively contaminated materials (via construction activity) to nonradioactively contaminated areas of the expanded Canonsburg site. This restriction limits the encapsulation cell location to a more centralized area to allow for ease of construction and material movement on a small site (the Canonsburg site encompasses about 18 acres) in a residential district. It is also preferable to design the encapsulation cell so that it blends with the surrounding topography. Therefore, to encapsulate the estimated 85,000 cubic yards of radioactively contaminated materials, limit cell height, and allow for expeditious construction sequencing, the only practicable location for the encapsulation cell would be in Areas A and B of the Canonsburg site. This location would require fill in a low-lying area along Ward Avenue.

In addition to encapsulation, the radioactively contaminated materials remaining on the Canonsburg site would be stabilized in place using a thick, compacted cover. Some of these radioactively contaminated materials in Areas B and C would remain within the 100-year flood plain.

This proposed action would require the following major construction activities, which to a great extent, would occur within the 100-year flood plain.

1. Preparation of the expanded Canonsburg site, including construction of a flood-control berm and construction of a waste-water sedimentation basin to prevent the release of contaminants from the expanded Canonsburg site during construction.

2. Construction of drainage-control measures to direct all generated waste and storm-water runoff to the sedimentation basin during construction activities.

3. Removal and relocation of onsite surface and subsurface utilities to prevent the need for human intrusion.

4. Excavation and handling of radioactively contaminated materials during their relocation and encapsulation.

5. Dewatering of soils within Area C to facilitate excavation of the radioactively contaminated materials from this area.

6. Installation and operation of a waste-water treatment facility to prevent contamination of surface waters during construction.

7. Removal of Chartiers Creek bank materials above the ordinary high water mark at the northeast corner of Area B (i.e., the Canonsburg Street railway terminus).

8. Placement of fill in low-lying areas (within the 100-year flood plain) for construction of the encapsulation cell liner above the 100-year flood level.

9. Emplacement of radioactively contaminated materials in the encapsulation cell to control radon exhalation and protect ground water (not in the 100-year flood plain).

10. Decontamination (if necessary), demolition, and disposal of all buildings and railroad spur lines on the expanded Canonsburg site.

11. Construction of the final cover system over the encapsulation cell to exhibit water infiltration and radon exhalation (not in the 100-year flood plain).

12. Emplacement of a soil cover over the remainder of the Canonsburg site with final grading to provide suitable drainage control.

13. Emplacement of topsoil and erosion protection on the encapsulation cell and the remainder of the Canonsburg site.

14. Revegetation of all disturbed areas to mitigate erosion.

15. Installation of temporary and permanent fencing to discourage human intrusion.

16. Reconstruction of Strabane Avenue.

Additional details can be found in Section 3.1 and Appendix A.1 of this Canonsburg FEIS.

J.1.2 Flood-plain effects

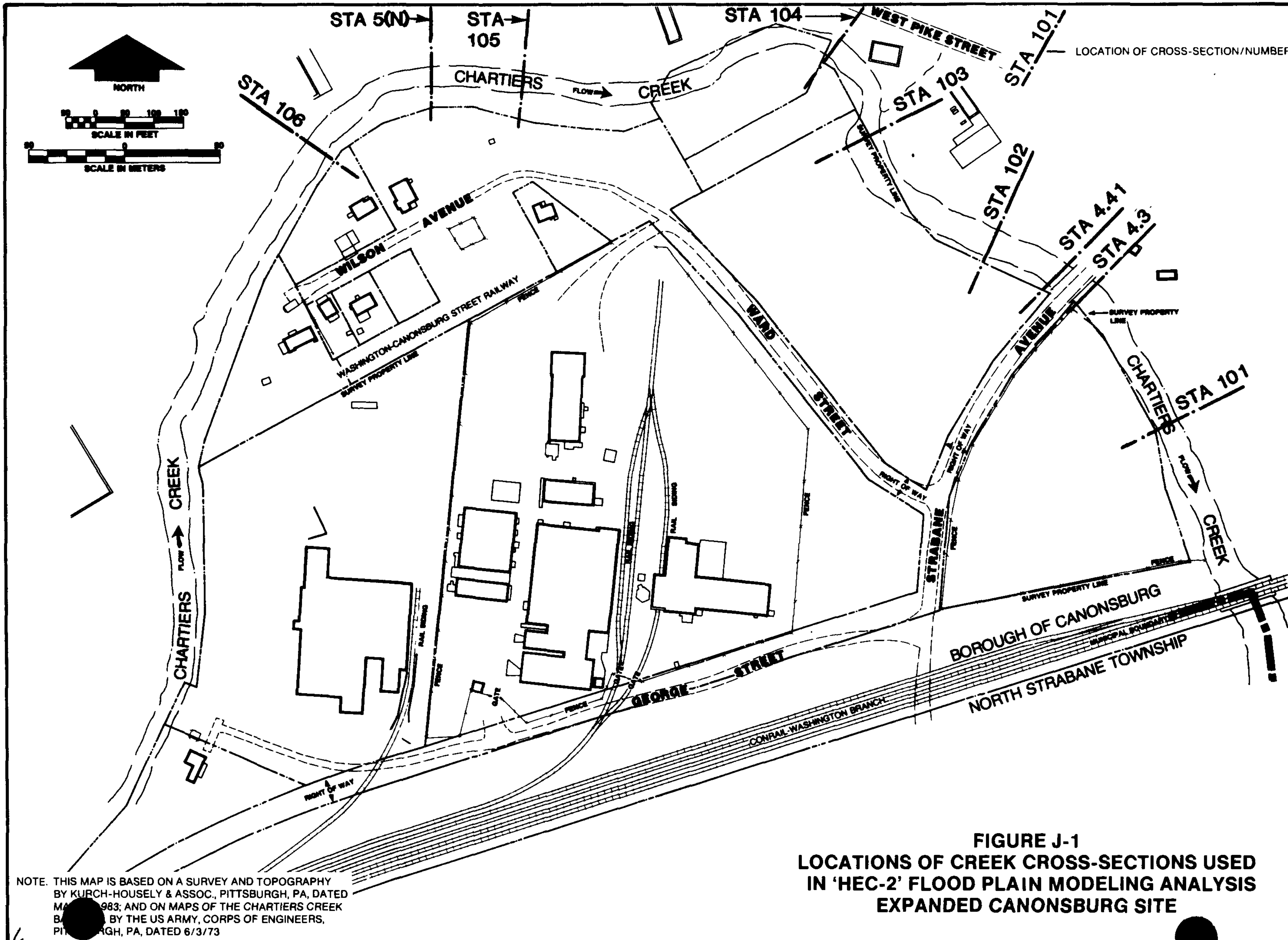
Alteration of the flood plain during and after the remedial action is a prime concern because of the potential for changes in creek elevations during flood events and resulting flood impacts on nearby properties and structures. Other impacts, such as increased erosion and sedimentation, loss or alteration of riparian and aquatic habitat, and changes in water quality, are major concerns during the remedial action. These latter temporary impacts, which are discussed in subsections 5.2.1 and 5.6.1 and Section 5.7 of this Canonsburg FEIS, are of lesser significance. After remedial action, long-term impacts on ground-water quality and flow, and ultimately, surface-water quality and use, would result from the disposal of the radioactively contaminated materials on the Canonsburg site. These long-term impacts are discussed in subsections 5.6.1 and 5.6.2 of the Canonsburg FEIS. Mitigation measures to address short- and long-term impacts are contained in the proposed remedial-action description (Appendix A.1 and Section 5.21) in the Canonsburg FEIS. This assessment primarily addresses the potential for flooding of the final expanded Canonsburg site and nearby property.

The Federal Emergency Management Agency (FEMA) flood insurance study HEC-2 model (FEMA, 1979) was used to predict the changes in the flood elevations and resulting velocities that could occur during construction and after completion of the remedial action. This model was modified to reflect the physical topography of the expanded Canonsburg site for three phases: existing conditions, construction, and post-remedial-action. For each phase the HEC-2 model was used to predict the resulting 100-year flood-plain water-surface elevations. For the post-remedial action phase, flood elevations and velocities during the 1000-year and probable maximum flood (PMF) were also predicted. (A PMF is a flood in Chartiers Creek adjacent to the expanded Canonsburg site that could result from probable maximum precipitation on the drainage basin upstream from the expanded Canonsburg site.) The following paragraphs contain brief descriptions of each model run:

1. Existing flood plain -- The HEC-2 model was modified to be more site specific by adding six cross-sections in the vicinity of the expanded Canonsburg site (Figure J-1). The resulting flood elevations are slightly different from the elevations predicted in the flood insurance study, but are more accurate due to the increased definition of the topography. This represents the baseline flood-plain conditions.

2. Construction flood plain -- The cross-sections in the vicinity of the flood berm were modified to reflect the change in topography due to the berm. The model was executed to predict the impact of the berm on the 100-year flood-plain elevations.

3. Post-remedial-action flood plain -- The cross-sections in the vicinity of the expanded Canonsburg site were modified to reflect the proposed topography changes. The model was executed to predict the impact the topography changes would have on the 100-year, 1000-year, and PMF flood-plain elevations and creek velocities.



NOTE. THIS MAP IS BASED ON A SURVEY AND TOPOGRAPHY BY KURCH-HOUSELY & ASSOC., PITTSBURGH, PA, DATED MA 983; AND ON MAPS OF THE CHARTIERS CREEK BA BY THE US ARMY, CORPS OF ENGINEERS, PI RGH, PA, DATED 6/3/73

FIGURE J-1
LOCATIONS OF CREEK CROSS-SECTIONS USED IN 'HEC-2' FLOOD PLAIN MODELING ANALYSIS EXPANDED CANONSBURG SITE

J.1.2.1 During remedial action

The principal short-term effect on water levels would result from the construction of the flood-control berm and associated construction activities (see Appendix A.1). The results of the HEC-2 analysis indicate that the berm would cause a slight increase in the water-surface elevation in the vicinity of and upstream of the expanded Canonsburg site (Table J-1). The greatest increase (3.2 inches) would occur at the terminus of the abandoned railway berm (cross-section 104). Downstream of this area, elevations would be expected to remain unchanged or slightly reduced (a function of increased velocity). Given the predicted change in creek elevations (± 3-4 inches), no impacts on offsite properties or structures would occur during a 100-year storm event.

Table J-1. Flood-plain elevations

	100-year flood-plain elevations[a]	
Cross-section	Baseline	During remedial action
101	943.07	943.07
4.3	949.08	949.08
4.41	949.36	949.35
102[b]	949.31	949.00
103	949.97	949.85
104	949.62	949.89
105	951.02	951.22
5 (N)	951.74	951.91
106	951.22	951.39

[a]Based on the use of the FEMA HEC-2 model (FEMA, 1979).

[b]Cell is located between cross-sections 102 and 103.

J.1.2.2 After remedial action

The primary long-term effect on creek elevations and velocities would be a function of the final expanded Canonsburg site conditions. As described in Appendix A.1 and in Section J.1, the main final expanded Canonsburg site conditions impacting the 100-year flood plain (Figure D.1-1) include the following:

1. Location of fill in the 100-year flood plain along Ward Street to support the encapsulation cell (Figure A.1-2).

2. Removal of Chartiers Creek bank materials (cross-section 104, Figure J-1).

The HEC-2 analysis indicates that a maximum increase in creek elevation of about 10 inches would occur at cross-section 104 after remedial action (Table J-2). The HEC-2 analysis indicates only slight increases in creek elevations would occur along the remainder of the expanded Canonsburg site. Therefore, incremental offsite impacts to property and structures during a 100-year storm event are expected to be minimal.

Table J-2. Post-remedial action flood-plain elevations

Cross-section	Baseline	100 year	1000 year	PMF
101	943.07	943.04	949.79	970.88
4.3	949.08	949.12	---	---
4.41	939.36	949.39	954.63	973.23
102[a]	949.31	949.30	954.29	971.23
103	949.97	950.00	955.12	973.17
104	949.62	950.47	955.54	974.73
105	951.02	950.38	955.42	975.54
5 (N)	951.74	951.28	956.56	976.72
106	951.22	950.77	955.21	977.25

[a]Cell is located between cross-sections 102 and 103.

Given the long-term hazards of the radioactively contaminated materials and the EPA longevity standard (40 CFR 192) for safe disposal (200 to 1000 years), it is important to assess the impacts on the expanded Canonsburg site from extreme storm events and from possible creek intrusion. Therefore, post-remedial action flow velocities and flood levels have been calculated for three flood events: a 100-year flood, a 1000-year flood, and a probable maximum flood (PMF) (Tables J-2 and J-3), and the potential for creek intrusion has been evaluated.

As indicated on Figure A.1-3 and in Table J-2, the bottom of the encapsulation cell would be placed above the 100-year flood plain (approximate elevation would be 950 feet); encapsulated radioactively contaminated materials would be above the 500-year flood-plain elevation (approximate elevation would be 952 feet). The location of the encapsulation cell would be such that even during a 1000-year flood (approximate elevation would be 954.5 feet), the encapsulation cell would not be subjected to erosive water velocities (about 1.0 foot per second) (Table J-3). Regardless, the encapsulation cell would have additional rock protection to above the 1000-year flood level. The analyses also indicate that most of the encapsulation cell would be inundated during the PMF; however, the velocities along the toe of the encapsulation cell would be too low to affect cell integrity.

In addition, the expanded Canonsburg site is located on alluvial fill along Chartiers Creek and therefore has a slight possibility of being subject to creek meander. Based on drill logs and visual inspection, the creek bank adjacent to the western, northwestern, and northern boundaries of the expanded Canonsburg site consists of bedrock and is not likely to erode and allow the creek to encroach on the expanded Canonsburg site in the forseeable future. Along the northeastern and eastern sides of the expanded Canonsburg site, the creek bank consists of alluvial fill and is subject to a slight potential encroachment into the expanded Canonsburg site.

To further protect the expanded Canonsburg site, those areas of the expanded Canonsburg site potentially subject to creek encroachment would be protected with a buried rock structure (Figure A.1-3). This rock structure is designed to preclude lateral creek migration and to withstand creek flows that could encroach toward the radioactively contaminated materials.

Table J-3. Post-remedial action flood velocities (feet/second)

Location	Cross-section	100 year	1000 year	PMF
Toe of cell	102[a]	---	1.6	4.0
	103	---	0.6	3.1
Flood plain adjacent to cell	102	1.6	2.7	6.8
	103	1.6	2.1	6.2
Center of creek	102	9.5	11.1	24.4
	103	7.3	8.3	18.8
Riprap wall[b]	---	8.2	9.4	21.0

[a]Cell is located between cross-sections 102 and 103.

[b]Velocities based on weighted average between the cross-sectional areas of 102 and 103.

J.1.3 Alternatives

The alternatives to the proposed remedial action are described in Section 3.1. The impacts of these alternatives are presented in subsections 5.2.1 and 5.6.1 and Section 5.7, and are summarized in Table 1-3. Mitigation measures that are likely to be employed are described in subsection 5.2.1.

Alternative 1, no action, entails leaving the Canonsburg site in its present condition. As such, no impacts other than those at present would occur. The UMTRCA, however, requires the cleanup of the Canonsburg site.

For the other alternatives (Alternatives 2, 4, and 5) the construction activities, and hence, the short-term impacts as discussed in subsection J.1.2, would still occur. The mitigation measures described for the proposed remedial action would also apply for Alternatives 2, 4, and 5.

The long-term impacts identified for the proposed remedial action would not occur after completion of the remedial action for Alternatives 4 and 5. The topography of the Canonsburg site (i.e., flood plain) would be restored to its preconstruction configuration and all radioactively contaminated materials would be disposed of at the Hanover site.

J.2 BURRELL SITE

The part of the Burrell site that would require remedial action lies within the U.S. Army Corps of Engineers flood easement area for the Conemaugh Dam. The actions proposed at this location are either to stabilize the existing radioactively contaminated materials in place with a minimum of disturbance and to place additional cover on the radioactively contaminated area (Alternatives 3 and 5), or to excavate up to 80,000 cubic yards of radioactively contaminated materials from the landfill and consolidate it with the major body of the radioactively contaminated materials at either the Canonsburg or Hanover site (Alternatives 2 and 4). The concept of the proposed remedial action (Alternative 3) is given in Appendix A.2. All remedial-action alternatives (Alternatives 2 through 5) would be conducted in areas that are outside the estimated 1000-year flood plain. A 1000-year flood is believed to have occurred at the Burrell site during Hurricane Agnes in 1972. The only action at the Burrell site anticipated within the flood plain would be the removal of the very low dam that forms the onsite ponds at the western end of the Burrell site. These actions would be reviewed by the U.S. Army Corps of Engineers personnel before enactment.

REFERENCES FOR APPENDIX J

FEMA (Federal Emergency Management Agency), Federal Insurance Administration, 1979. Flood Insurance Study, Borough of Canonsburg, Pennsylvania, Washington County, Community No. 420849, Washington, DC.