

FILE COPY

File Copy

FINAL

Environmental Impact Statement

COPY

FILE

**Incineration Facility for
Radioactively Contaminated
Polychlorinated Biphenyls and
Other Wastes**

**Oak Ridge Gaseous Diffusion Plant
Oak Ridge, Tennessee**



June 1982

U. S. Department of Energy

**Assistant Secretary for Nuclear Energy
Office of Uranium Enrichment and Assessment**

FILE COPY

Cover Sheet

FINAL ENVIRONMENTAL IMPACT STATEMENT

INCINERATION FACILITY FOR RADIOACTIVELY CONTAMINATED
POLYCHLORINATED BIPHENYLS AND OTHER WASTES
OAK RIDGE GASEOUS DIFFUSION PLANT
OAK RIDGE, TENNESSEE

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

(b) Proposed Action: Construction and operation of an incineration facility at the Oak Ridge Gaseous Diffusion Plant in Oak Ridge, Tennessee for the purpose of disposing of wastes containing radioactively contaminated polychlorinated biphenyls (PCBs) and other hazardous organic materials from the Portsmouth, Paducah, and Oak Ridge Gaseous Diffusion Plants and other DOE facilities at Oak Ridge.

(c) For Further Information Contact: (1) Mr. J. F. Wing, Chief, Environmental Protection Branch, Oak Ridge Operations, Department of Energy, P.O. Box E, Oak Ridge, Tennessee 37830, Ph: 615-576-0845; (2) Dr. Robert J. Stern, Acting Director, Office of Environmental Compliance, Office of the Assistant Secretary for Environmental Protection, Safety, and Emergency Preparedness, Room 4G-064, Forrestal Building, 1000 Independence Avenue SW, Washington, D.C. 20585, Ph: 202-252-4600; or (3) Mr. Stephen H. Greenleigh, Esq., Assistant General Counsel for Environment, Room 6D-033, Forrestal Building, Washington, D.C. 20585, Ph: 202-252-6947.

For Copies of the EIS Contact: Mr. J. F. Wing at the address above.

(d) Designation: FINAL EIS

(e) Abstract: The statement assesses the environmental impacts associated with the construction of an incineration facility and related support facilities for the disposal of hazardous organic waste materials (including PCBs) which are contaminated with trace quantities of low-assay enriched uranium. The proposed action includes the incineration facility at Oak Ridge, Tennessee and storage, packaging, and shipping facilities at the Gaseous Diffusion Plants in Paducah, KY, and Portsmouth, OH; hazardous organic wastes from these plants and from the Y-12 Plant and Oak Ridge National Laboratories would be shipped to the proposed incineration facility. Impacts assessed include the effects of the project on air and water quality, on socioeconomic conditions, on public and occupational health and safety, and on ecology. Additionally, the statement presents an assessment of the potential impacts from accidents at the incineration facility or during transportation of the waste materials to the facility. The major impact identified was the potential for short-term occupational exposure to high concentrations of PCBs in smoke during the worst credible accident; mitigation of this impact will be addressed during the final design of the proposed facility. Alternatives which were assessed include no action, chemical destruction processes, and alternative transportation routes; all would have greater adverse impact or would increase the risk of an accident with the potential for adverse impact. The alternatives of commercial disposal, alternative sites, multiple incinerators, and alternative modes were eliminated from detailed analysis either because they are not feasible or because preliminary analysis showed that they would have clearly more adverse impact upon the environment than the proposed action.

(f) A Record of Decision will be issued no earlier than thirty days after the FEIS notice of availability is published in the Federal Register.

THIS PAGE IS INTENTIONALLY BLANK

FINAL
Environmental Impact Statement

**Incineration Facility for
Radioactively Contaminated
Polychlorinated Biphenyls and
Other Wastes**

**Oak Ridge Gaseous Diffusion Plant
Oak Ridge, Tennessee**



June 1982

U. S. Department of Energy
Assistant Secretary for Nuclear Energy
Office of Uranium Enrichment and Assessment

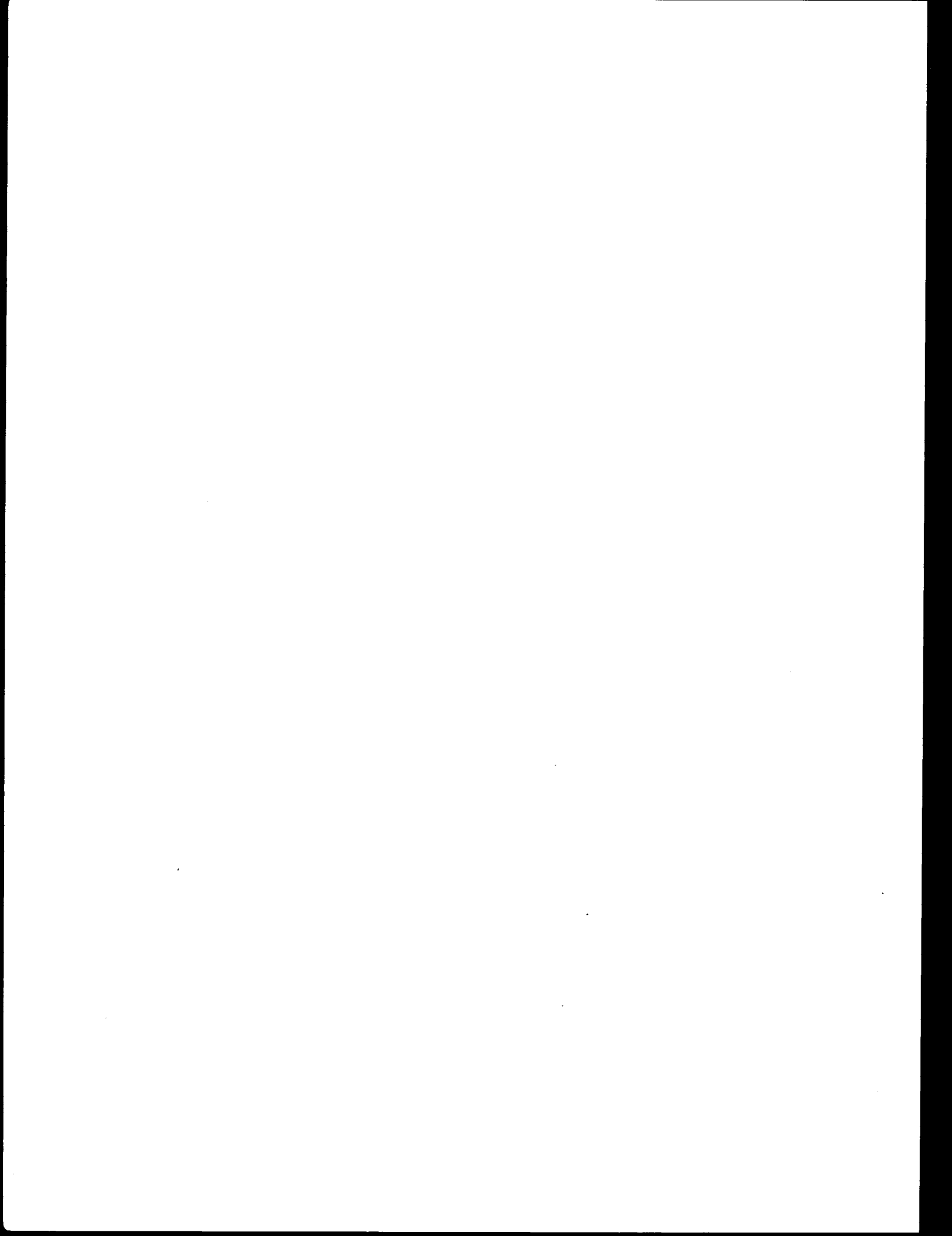


TABLE OF CONTENTS

	<u>Page</u>
GLOSSARY OF ACRONYMS.	xv
SUMMARY	S-1
Background.	S-1
The Proposed Action	S-2
Description of the Proposed Action.	S-4
Effluents and Waste Management.	S-5
Impacts of Effluents on the Environment	S-5
Impacts on Human Health	S-6
Socioeconomic Impacts	S-6
Accident Scenarios.	S-7
Alternatives to the Proposed Action	S-7
The No Action (Store and Delay Alternative)	S-8
Chemical Destruction Alternatives	S-8
Transportation Route Alternatives	S-9
Alternatives Eliminated from Detailed Examination	S-9
Decommissioning and Decontamination	S-10
References.	S-12
1.0 INTRODUCTION: PURPOSE AND NEED FOR ACTION.	1-1
1.1 History of PCBs and Applicable Regulations.	1-2
1.2 Hazardous Waste Materials at DOE Facilities	1-3
1.2.1 PCB Contaminated Waste Materials.	1-4
1.2.2 Other Hazardous Waste Materials	1-4
1.2.3 Radioactive Contamination in Waste Materials.	1-5
1.3 Regulatory Requirements for Disposal and Storage for Disposal.	1-6
1.3.1 Regulations Applicable to PCB Materials	1-6
1.3.2 Other Regulations Applicable to PCB Materials	1-7
1.3.3 Regulations Relevant to the Nuclear Contamination of the Waste Materials.	1-7
1.4 Other Reports on the Proposed Project	1-8
1.5 References.	1-9

TABLE OF CONTENTS
(Continued)

	<u>Page</u>
2.0 ANALYSIS OF THE PROPOSED ACTION AND ALTERNATIVES.	2-1
2.1 The Proposed Action.	2-1
2.1.1 Project Description	2-1
2.1.1.1 Collection and Transport Facilities	2-4
2.1.1.2 Transport Routes.	2-7
2.1.1.3 Waste Material Quantities	2-7
2.1.1.4 Characterization of Waste Materials	2-10
2.1.1.5 Receiving and Storage	2-11
2.1.1.6 Blending.	2-13
2.1.1.7 Rotary Kiln and Incineration Process.	2-14
2.1.1.8 Emission Controls	2-20
2.1.1.9 Solid Waste Management.	2-21
2.1.1.10 Liquid Effluent Controls.	2-22
2.1.2 Effluents, Waste Management, and Impacts.	2-23
2.1.2.1 Air Emissions	2-23
2.1.2.2 Solid Wastes and Leachates.	2-24
2.1.2.3 Liquid Wastes	2-25
2.1.2.4 Noise	2-26
2.1.2.5 Effluent Mitigation	2-26
2.1.2.6 Impacts of Effluents on the Environment	2-27
2.1.2.7 Impacts on Public Health.	2-28
2.1.2.8 Impacts on Occupational Health and Safety	2-29
2.1.2.9 Socioeconomic Impacts and Mitigation.	2-29
2.1.2.10 Impacts of the Maximum Credible Accident.	2-30
2.1.3 Accident Analyses	2-30
2.1.3.1 Process Accident.	2-30
2.1.3.2 Transportation Accident	2-31
2.1.3.3 Accident Prevention Measures.	2-32
2.1.3.4 Spill Containment and Control	2-33

TABLE OF CONTENTS
(Continued)

	<u>Page</u>
2.2 The No Action (Store and Delay) Alternative	2-33
2.2.1 Regulatory Considerations to No Action (Store and Delay).	2-33
2.2.2 Requirements for Management of PCB Materials.	2-34
2.2.3 Impacts of the No Action (Store and Delay) Alternative	2-35
2.2.3.1 Effluents from Storage.	2-35
2.2.3.2 Impacts of Effluents on the Environment	2-36
2.2.3.3 Other Waste Materials	2-37
2.2.3.4 Summary of Impacts.	2-37
2.3 Chemical Destruction Alternatives	2-38
2.4 Alternative Routes.	2-41
2.5 Alternatives Eliminated from Detailed Study	2-41
2.5.1 Commercial Disposal.	2-46
2.5.2 Alternative Processes.	2-47
2.5.3 Alternative Sites.	2-47
2.5.3.1 Siting at Another DOE Oak Ridge Operations Plant	2-47
2.5.3.2 Other Sites	2-49
2.5.4 Multiple Incinerators.	2-50
2.5.5 Alternative Modes of Transportation	2-50
2.5.5.1 Rail.	2-51
2.5.5.2 Barge	2-51
2.6 References.	2-52
3.0 THE AFFECTED ENVIRONMENT.	3-1
3.1 Physiography.	3-1
3.1.1 Topography.	3-2
3.1.2 Geology	3-3
3.1.3 Soils	3-3
3.1.4 Groundwater	3-3
3.1.5 Seismology.	3-4
3.2 Climatology and Meteorology	3-4
3.3 Hydrology	3-5

TABLE OF CONTENTS
(Continued)

	<u>Page</u>
3.4 Noise and Acoustics	3-5
3.5 Terrestrial Ecology	3-6
3.6 Aquatic Ecology	3-8
3.7 Rare and Endangered Species	3-10
3.8 Background Chemical and Radiological Characteristics.	3-10
3.8.1 Soils	3-10
3.8.2 Air	3-11
3.8.3 Water	3-12
3.8.4 Biota	3-13
3.9 Socioeconomic Environment	3-14
3.10 Land Use and Related Activities	3-14
3.10.1 Residential Use	3-15
3.10.2 Agricultural Use.	3-15
3.10.3 Industrialization	3-16
3.11 Paducah Gaseous Diffusion Plant	3-16
3.12 Portsmouth Gaseous Diffusion Plant.	3-17
3.13 References.	3-18
4.0 ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION	4-1
4.1 Effluents and Emissions	4-1
4.1.1 Emissions to the Atmosphere	4-2
4.1.1.1 Hydrocarbons.	4-2
4.1.1.2 Acid Gases.	4-5
4.1.1.3 Carbon Monoxide	4-7
4.1.1.4 Particulates.	4-7
4.1.1.5 Nitrogen Oxides	4-8
4.1.1.6 Other Pollutants.	4-8
4.1.2 Aqueous Effluents	4-8
4.1.3 Solid Waste	4-12
4.1.4 Noise	4-13

TABLE OF CONTENTS
(Continued)

	<u>Page</u>
4.2 Impacts of Discharges on the Physical Environment	4-14
4.2.1 Air Quality Impacts	4-14
4.2.2 Solid Waste Disposal Impacts.	4-17
4.2.3 Water Quality Impacts	4-19
4.2.3.1 Direct Impacts.	4-19
4.2.3.2 Indirect Impacts.	4-22
4.2.4 Impact on Groundwater	4-24
4.2.5 Noise Impacts	4-26
4.3 Effects of Construction on the Physical Environment	4-26
4.3.1 Construction Activities	4-26
4.3.2 Impacts to Air Quality from Construction Activities .	4-27
4.3.3 Impacts to Water Quality from Construction Activities	4-27
4.3.4 Noise Impacts of Construction	4-28
4.4 Impacts on Terrestrial and Aquatic Ecology.	4-28
4.4.1 Habitat Destruction	4-29
4.4.2 Ecological Impacts of Changes in the Physical Environment	4-29
4.5 Impacts on Public Health and Mitigation	4-30
4.5.1 Public Health Impacts from Radionuclides.	4-31
4.5.2 Public Health Impacts from Polychlorinated Biphenyls (PCBs).	4-35
4.5.3 Public Health Impacts of Polychlorinated Dibenzodioxin (PCDD) and Dibenzofurans (PCDF)	4-36
4.6 Impacts on Occupational Health.	4-36
4.6.1 Potential Exposure.	4-39
4.6.2 Review of Proposed Industrial Hygiene and Control Technology/Mitigative Measures.	4-40
4.6.3 Review of Regulations and Guidelines.	4-41
4.7 Socioeconomic Impacts and Mitigation.	4-49
4.7.1 Socioeconomic Impacts Related to Construction	4-50
4.7.2 Socioeconomic Impacts Related to Operation.	4-51

TABLE OF CONTENTS
(Continued)

	<u>Page</u>
4.8 Accident Analysis	4-51
4.8.1 Process Accidents	4-52
4.8.1.1 Accident No. 1: Fire in Incinerator Shedder	4-53
4.8.1.2 Accident No. 2: Fire in Liquid Receiving/Storage/Blending Tanks.	4-55
4.8.1.3 Accident No. 3: Explosion in Incinerator Shredder.	4-57
4.8.1.4 Natural Phenomena	4-58
4.8.2 Transportation Accidents and Releases	4-59
4.8.2.1 Routing	4-59
4.8.2.2 Scenarios	4-59
4.8.2.3 Accident Risk and Impacts	4-61
4.8.3 Accident Prevention Measures.	4-62
4.8.4 Spill Prevention and Contamination Control.	4-62
4.8.5 Impacts of the Maximum Credible Accident.	4-63
4.9 Unavoidable Adverse Impacts on the Environment.	4-64
4.9.1 Air Resources	4-64
4.9.2 Water Resources	4-64
4.9.3 Noise	4-64
4.9.4 Ecology	4-65
4.9.5 Human Health.	4-65
4.9.6 Socioeconomic Impacts	4-65
4.9.7 Accident Risk Impacts	4-65
4.10 Short-term Use Versus Long-term Productivity of the Environment	4-66
4.11 Irreversible or Irretrievable Commitments of Resources.	4-66
4.12 Decommissioning and Decontamination	4-67
4.13 References.	4-68
5.0 LIST OF PREPARERS	5-1
5.1 Project Management and Scoping.	5-1
5.2 Purpose and Need, Regulations	5-2
5.3 Process and Effluents	5-2

TABLE OF CONTENTS
(Continued)

		<u>Page</u>
5.4	Physical Environment.	5-3
5.5	Transportation.	5-5
5.6	Accident Analyses	5-6
5.7	Occupational and Public Health.	5-7
5.8	Socioeconomics.	5-8
5.9	Miscellaneous	5-8
6.0	PERSONS, AGENCIES, AND ORGANIZATIONS TO WHOM COPIES OF THE DRAFT EIS WERE SENT	6-1

APPENDICES

A.	DATA TO SUPPORT WASTE MATERIALS INVENTORY, INCINERATOR DISPOSAL RATE ESTIMATES, AND INCINERATOR FUEL REQUIREMENTS.	A-1
	A.1 Waste Materials Inventory	A-1
	A.2 Incinerator Disposal Rate Estimates	A-3
	A.3 Incinerator Fuel Requirements	A-4
	A.4 References.	A-6
B.	TRANSPORTATION ANALYSES	B-1
	B.1 Routes from Portsmouth Gaseous Diffusion Plant to ORGDP	B-1
	B.1.1 The Proposed Route from Piketon to ORGDP.	B-1
	B.1.2 Alternative Routes: Piketon to Interstate 75	B-4
	B.1.3 Alternative Routes: Interstate 75 to ORGDP	B-7
	B.1.4 Hazardous Sections of the Proposed Route from Piketon	B-10
	B.2 Routes from Paducah Gaseous Diffusion Plant to ORGDP.	B-14
	B.2.1 The Proposed Route from Paducah to ORGDP.	B-14
	B.2.2 Alternative Approaches to ORGDP	B-17
	B.2.3 Hazardous Sections of the Proposed Route from Paducah	B-17
	B.3 Routes from ORNL and Y-12 to ORGDP.	B-22
	B.3.1 ORNL to ORGDP	B-22
	B.3.2 Y-12 Plant to ORGDP	B-22
	B.4 References.	B-24

TABLE OF CONTENTS
(Continued)

	<u>Page</u>
C. CHEMICAL DESTRUCTION ALTERNATIVES	C-1
C.1 Technical Issues.	C-1
C.2 The PCBX Process.	C-2
C.2.1 PCBX Process Description.	C-3
C.2.2 PCBX Technical Performance.	C-3
C.2.3 Technical Barriers.	C-3
C.2.4 Probable Impacts from the PCBX Process.	C-5
C.3 The Sodium Naphthalide Process.	C-6
C.3.1 Process Description	C-6
C.3.2 Technical Performance and Barriers.	C-8
C.3.3 Probable Impacts.	C-10
C.4 Wet Air Oxidation	C-10
C.4.1 Process Description	C-11
C.4.2 Technical Performance and Barriers.	C-11
C.4.3 Probable Environmental Impacts.	C-13
C.5 Summary	C-13
C.6 References.	C-15
D. TABLES OF BACKGROUND CHEMICAL AND RADIOLOGICAL DATA ON THE ORGDP AREA	D-1
E. REGULATED AREA POLLUTANTS	E-1
F. ESTIMATION OF EMISSIONS OF VOLATILE ORGANICS.	F-1
G. CALCULATION OF PRIMARY NOISE EMISSION FROM STACK OF PROPOSED INCINERATOR.	G-1
G.1 Sound Power of the Source	G-1
G.2 Correction for Propagation Angle.	G-1
G.3 Computation for Length of the Propagation Path.	G-2
G.4 Prediction of Sound Level	G-3
G.5 Variable Factors.	G-4
G.6 Other Locations	G-5
G.7 References.	G-5
H. AIR QUALITY IMPACT ANALYSES	H-1

TABLE OF CONTENTS
(Continued)

	<u>Page</u>
I. CALCULATIONS OF THE WATER QUALITY EFFECTS OF THE PROPOSED ALTERNATIVE (INCINERATION)	I-1
I.1 Direct Discharges	I-1
I.2 Indirect Discharges	I-6
J. DATA TO SUPPORT PUBLIC HEALTH IMPACT ASSESSMENT	J-1
J.1 Health Effects of Low Level Ionizing Radiation.	J-1
J.1.1 Somatic Effects	J-1
J.1.2 Genetic Effects	J-4
J.1.3 Derivation of Risk Factors.	J-5
J.2 Health Effects of PCBs.	J-7
J.2.1 Absorption, Metabolism, and Excretion	J-7
J.2.2 Occupational Exposure	J-7
J.2.3 Exposure of the General Population.	J-8
J.2.4 Carcinogenicity	J-9
J.2.5 Mutagenicity.	J-10
J.2.6 Teratogenicity and Reproductive Effects	J-10
J.3 Health Effects of Polychlorinated Dibenzodioxins and Polychlorinated Dibenzofurans	J-11
J.3.1 Polychlorinated Dibenzodioxins.	J-11
J.3.2 Polychlorinated Dibenzofurans	J-13
J.4 References.	J-15
K. PROCESS DESCRIPTION OF THE PROPOSED PCB INCINERATION FACILITY, ORGDP.	K-1
L. ACCIDENT PREVENTION AND SPILL CONTAINMENT MEASURES PLANNED FOR THE PROPOSED FACILITY.	L-1
L.1 Accident Prevention Measures.	L-1
L.2 Spill Containment and Contamination Control	L-4
L.3 References.	L-6
M. ESTIMATION OF HEXACHLOROBENZENE PRODUCTION FROM COMBUSTION OF PCB.	M-1
M.1 Technical Issues.	M-1
M.2 Conclusions	M-3
M.3 References.	M-3

TABLE OF CONTENTS
(Continued)

		<u>Page</u>
N.	COMMENTS ON THE DRAFT EIS AND RESPONSES TO COMMENTS.	N-1

LIST OF TABLES

Table 2-1	Waste Materials Inventory	2-10
Table 2-2	Estimated Incinerator Mass Balance.	2-17
Table 2-3	Waste Removal and Disposal Rates.	2-19
Table 2-4	Technical Comparison of Chemical Destruction Alternatives with Proposed Action	2-39
Table 2-5	Selected Impacts Expected from Chemical Destruction Alternatives, Comparison to Proposed Incinerator.	2-40
Table 2-6	Advantages and Disadvantages of Transportation Routes Compared to Proposed Routes.	2-45
Table 3-1	Plant Communities and Nonvegetated Areas Near the ORGDP	3-7
Table 3-2	Animals of Economic Importance on the Reservation	3-8
Table 4-1	Estimated Emissions from Handling Solvents.	4-3
Table 4-2	Estimated Emissions of Toxic Organics	4-5
Table 4-3	Acid Gas Concentrations and Removal Efficiencies.	4-6
Table 4-4	Particulate Concentrations and Removal Efficiencies	4-9
Table 4-5	Atmospheric Emissions Summary	4-10
Table 4-6	Scrubber Purge Water Composition.	4-12
Table 4-7	Emissions and Maximum Ground Level Concentrations of Major Air Pollutants.	4-16
Table 4-8	Effects of Facility Direct Aqueous Discharges on Water Quality in Poplar Creek.	4-21
Table 4-9	Summary of Public Exposures from Stack Emissions.	4-30
Table 4-10	75-Year Dose Commitment Due to Liquid Effluents to the Clinch River	4-32
Table 4-11	50-Year Dose Commitments Due to Air Discharges for One Year	4-33
Table 4-12	Risk Factors of Cancer Mortality.	4-34
Table 4-13	Individual Lifetime Risk of Cancer Mortality.	4-35

TABLE OF CONTENTS
(Continued)

	<u>Page</u>
Table 4-14 Assumptions Used in Developing Dioxin (TCDD) Cancer Risk Factor.	4-37
Table 4-15 Inventory of Hazardous Materials.	4-39
Table 4-16 Review of Control Technology for Proposed PCB Incineration Facility, ORGDP	4-42
Table 4-17 Threshold Limit Values and Short Term Exposure Limits of Chemical Agents Encountered in the Proposed PCB Incineration Facility	4-46
Table 4-18 NIOSH Guidelines for Occupational Protection from Exposure to PCBs.	4-47
Table 4-19 Population of Oak Ridge City, Anderson County and Roane County 1960-2000.	4-49
Table 4-20 Construction Employment Requirements - Total During Construction	4-50
Table 4-21 Possible Contributing Factors to Accidents.	4-60
Table A-1 Waste Materials Inventory	A-2
Table A-2 Incinerator Fuel Requirements Computation	A-5
Table B-1 Description of Piketon to Oak Ridge Route Alternatives.	B-5
Table B-2 Description of Alternative Approaches to ORGDP from Lake City	B-8
Table B-3 Summary of Traffic and Accidents on the Proposed Route from Piketon to ORGDP.	B-11
Table B-4 Description of Paducah to Oak Ridge Route	B-15
Table B-5 Description of Alternative Approaches to the ORGDP from Interstate 40 at TN 58	B-18
Table B-6 Summary of Traffic and Accidents on the Proposed Route from Paducah to ORGDP	B-20
Table D-1 ORGDP Perimeter and Remote Site Radionuclide Content in Soil as Compared to Naturally Occurring Levels.	D-1
Table D-2 Elemental Content of Sediments in Poplar Creek and the Clinch River in the Vicinity of the ORGDP	D-2
Table D-3 Chemical Analysis of Groundwater from ORGDP Well Number 5	D-3

TABLE OF CONTENTS
(Continued)

	<u>Page</u>
Table F-1 Values for Calculating Working Losses from Fixed Roof Tanks	F-2
Table G-1 Correction Factors, By Octave Band, for Horizontal Propagation.	G-2
Table G-2 Sound Power Data for Horizontal Propagation	G-2
Table G-3 Computation of Resultant Sound Pressure Level for Closest Receiver.	G-4
Table I-1 Calculation of Lead and Fluoride Concentrations in K-1700 Outfall	I-4
Table J-1 Toxic Effects of 2,3,7,8-TCDD Reported in Humans.	J-12
Table J-2 Comparative Acute Oral Toxicity of 2,3,7,8-TCDD and 2,3,7,8-TCDF	J-14
Table M-1 Results from the Combustion of PCB.	M-1

LIST OF FIGURES

Figure S-1 Locations of the Oak Ridge Operations Gaseous Diffusion Plants.	S-3
Figure 2-1 Site of the Proposed Incinerator.	2-2
Figure 2-2 Proposed Oak Ridge Waste Disposal Facilities.	2-3
Figure 2-3 Proposed Routes: Piketon, OH and Paducah, KY to ORGDP.	2-8
Figure 2-4 Proposed Routes: Y-12 Plant and ORNL to Proposed Site.	2-9
Figure 2-5 Proposed ORGDP Incinerator System	2-15
Figure 2-6 Alternative Routes: Piketon to Interstate 75	2-42
Figure 2-7 Alternative Routes: Interstate 75 to ORGDP	2-43
Figure 2-8 Alternative Routes: Interstate 40 to ORGDP	2-44
Figure 4-1 Location of Residences With Respect to the Proposed Plant Site	4-18
Figure B-1 Proposed Routes: Piketon, OH and Paducah, KY to ORGDP.	B-2
Figure B-2 Alternative Routes: Piketon to Interstate 75	B-6
Figure B-3 Alternative Routes: Interstate 75 to ORGDP	B-9

TABLE OF CONTENTS
(Continued)

	<u>Page</u>
Figure B-4 Alternative Routes: Interstate 40 to ORGDP	B-19
Figure B-5 Proposed Routes: Y-12 Plant and ORNL to Proposed Site. . . .	B-23
Figure C-1 PCBX Process.	C-4
Figure C-2 Sodium Naphthalide Goodyear Process	C-7
Figure C-3 Wet Air Oxidation Process	C-12
Figure H-1 Computer Output of Computation of Pollutant Dispersion.	H-2
Figure H-2 Output from CDM Computer Simulation	H-5
Figure I-1 Conceptual Scheme of Water Quality Calculations	I-2
Figure I-2 Incremental Lead and Uranium Concentrations in Eroded Soil Particles.	I-8
Figure M-1 HCB Emissions from Burning PCB.	M-2

THIS PAGE IS INTENTIONALLY BLANK

GLOSSARY OF ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
AIRDUS	Computer program for estimating dose to man from air emission of radionuclides
AQCR	Air Quality Control Region
AQUAMAN	Computer program for estimating dose to man from radionuclide emissions to water
Be	beryllium
Btu/hr	British thermal unit per hour
Btu/kg	British thermal unit per kilogram
Btu/lb	British thermal unit per pound
C	degrees centigrade
CARL	Comparative Animal Research Laboratory
CBE IR	Committee on Biological Effects of Ionizing Radiation
CDM	Climatological Dispersion Model
CDR	Conceptual Design Report
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CFM	Cubic feed per minute
CHEMTREC	Chemical Transportation Emergency Center
Cl	Chlorine
Ci/ml	curies per milliliter
cm	centimeter
CO	carbon monoxide
CO ₂	carbon dioxide
CUEX	cumulative exposure index
dB	decibel

DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
dscf	dry standard cubic foot
EA	environmental assessment
EIS	environmental impact statement
ENSCO	Energy Systems Company
EPA	U.S. Environmental Protection Agency
ESP	electrostatic precipitator
F	degrees Fahrenheit
FDA	U.S. Food and Drug Administration
FR	Federal Register
ft ²	square foot
g/m ³	grams per cubic meter
GDP	Gaseous Diffusion Plant
gr/dscf	grains per dry standard cubic foot
HCB	hexachlorobenzene
HCl	hydrogen chloride (hydrochloric acid)
HF	hydrogen fluoride (hydrochloric acid)
hr	hour
hrs/yr	hours per year
hz	hertz
ICRP	International Commission for Radiological Protection
ID	induced draft
in	inch
J/kg	joules per kilogram
kg	kilogram

kg/yr	kilogram per year
lb	pound
lb/hr	pounds per hour
LD ₅₀	lethal dose fifty (dose which results in fifty percent mortality)
m	meter
mci	microcurie
mg	milligram
mg/l	milligrams per liter
mi	mile
mrem	millirem
m ²	square meter
Na	sodium
NaOH	sodium hydroxide
NEPA	National Environmental Policy Act of 1969
ng/dscf	nanograms per dry standard cubic foot
ng/m ³	nanograms per cubic meter
NIOSH	National Institute for Occupational Safety and Health
NO	nitrogen oxide
NO _x	oxides of nitrogen
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
O ₂	oxygen
O ₃	ozone
ORGDP	Oak Ridge Gaseous Diffusion Plant
ORO	Oak Ridge Operations
ORNL	Oak Ridge National Laboratory

OSHA	Occupational Safety and Health Administration
Pb	lead
PCB	polychlorinated biphenyl
PCB/kg	polychlorinated biphenyl per kilogram
PCDD	polychlorinated dibenzodioxins
PCDF	polychlorinated dibenzofurans
pCi/g	picocuries per gram
pH	hydrogen ion concentration in gram equivalents per liter used in expressing both acidity and alkalinity
PO_4^{3-}	phosphate ion
ppb	parts per billion
PPE	personal protective equipment
ppm	parts per million
ppt	parts per trillion
PSAR	Preliminary Safety Analysis Report
PSD	prevention of significant deterioration
psi	pounds per square inch
psia	pounds per square absolute
psig	pounds per square gauge
PTMAX	Point Maximum (Air Quality Dispersion Model)
RCRA	Resource Conservation and Recovery Act of 1976
SCBA	self-contained breathing apparatus
SPCC	spill prevention control and countermeasure plan
SO_4^{2-}	sulfate ion
STEL	short-term exposure limit
TDS	total dissolved solids
THF	tetrahydrofuran

TLV	threshold limit value
TSCA	Toxic Substances Control Act of 1976
TSS	total suspended solids
TVA	Tennessee Valley Authority
TWA	time-weighted average concentration
U	uranium
U-235	the uranium-235 isotope
uCi/ml	microcuries per milliliter
ug/m ³	micrograms per cubic meter
USDA	United State Department of Agriculture
VOC	volatile organic compounds
W	Watt
yr	year

xx

THIS PAGE IS INTENTIONALLY BLANK

SUMMARY

This final Environmental Impact Statement (EIS) has been prepared by the U.S. Department of Energy (DOE) to assess the environmental impacts of a proposed DOE action to build and operate at the Oak Ridge Gaseous Diffusion Plant (ORGDP), an incineration facility to dispose of radioactively contaminated polychlorinated biphenyls (PCBs) and other combustible wastes from the Paducah, Portsmouth and Oak Ridge Gaseous Diffusion Plants and other DOE facilities at Oak Ridge, all hereinafter referred to as DOE Oak Ridge Operations facilities.

This final EIS has been prepared in accordance with DOE's guidelines (45 FR 20694, March 28, 1980) for compliance with the National Environmental Policy Act (NEPA) of 1969, as implemented by the regulations promulgated by the Council on Environmental Quality (CEQ; 40 CFR 1500-1508). A Notice of Intent to prepare an environmental impact statement was issued by DOE on February 10, 1981 (46 FR 11703). Public scoping meetings, to assist in determining the level of coverage of issues in the final EIS, were held in Oak Ridge, TN (February 24, 1981), Nashville, TN (February 25, 1981), Frankfort, KY (February 26, 1981), and Columbus, OH (March 3, 1981). DOE issued a Notice of Availability of the draft EIS on November 13, 1981. Although the public comment and review period closed on December 28, 1981, DOE accepted and responded to comments received through January 18, 1982. DOE incorporated revisions into the final EIS and has responded to individual comments in an Appendix to this report.

Background

Polychlorinated biphenyls are synthetic organic compounds which have been used in commercial and industrial applications for over fifty years. Characteristics of chemical stability and resistance to degradation, coupled with widespread use and lack of regulatory control, led to distribution of the substance throughout the biosphere. Today, PCBs are considered a significant environmental pollutant which have been shown to pose a risk to human health and the environment. In 1976, Congress, as part of the Toxic Substances Control Act (TSCA), banned the further manufacture of PCBs. Subsequent

regulations (40 CFR 761) impose specific storage and disposal requirements for materials containing PCBs.

The Oak Ridge Operations Office of the Department of Energy directs the operation of five facilities (three gaseous diffusion plants at Paducah, KY, Portsmouth, OH, and Oak Ridge, TN; the Y-12 Plant and the Oak Ridge National Laboratory both in Oak Ridge). Each of these facilities has, in storage and in service in electrical, hydraulic, and various other equipment, large quantities of material containing PCBs and trace quantities of radioactivity. The disposal of the stored materials and additional materials as they come out of service will be accomplished in an environmentally sound and timely manner, in accord with EPA regulations (40 CFR 761). Because of the radioactive contamination, disposal in commercial facilities will not be available in the foreseeable future (Section 2.5.1).

The Proposed Action

The proposed incineration facility is to provide a means of disposal for PCB contaminated wastes and other liquid organic wastes, which are contaminated with very small concentrations of radionuclides (primarily low-assay uranium). The proposed project consists of the construction and operation of a high temperature incinerator and its associated auxiliary equipment to be located at the Oak Ridge Gaseous Diffusion Plant (ORGDP) in Oak Ridge, Tennessee, and waste storage, packaging, and shipping facilities to be located at the Paducah Gaseous Diffusion Plant in Paducah, Kentucky, and the Portsmouth Gaseous Diffusion Plant in Piketon, Ohio. Although no new facilities would be provided as part of this project for the Y-12 Plant and Oak Ridge National Laboratory in Oak Ridge, they too would ship wastes to the incinerator at the ORGDP.

Figure S-1 shows the location of the DOE Oak Ridge Operations facilities included in the proposed project. The proposed incinerator would be capable of handling about 194 kg per hour of solid wastes and about 174 kg per hour of liquid wastes. Construction of the facility is planned to commence in 1984 and the facility could become operational in 1987. Approximately 60 percent of the wastes would contain detectable concentrations

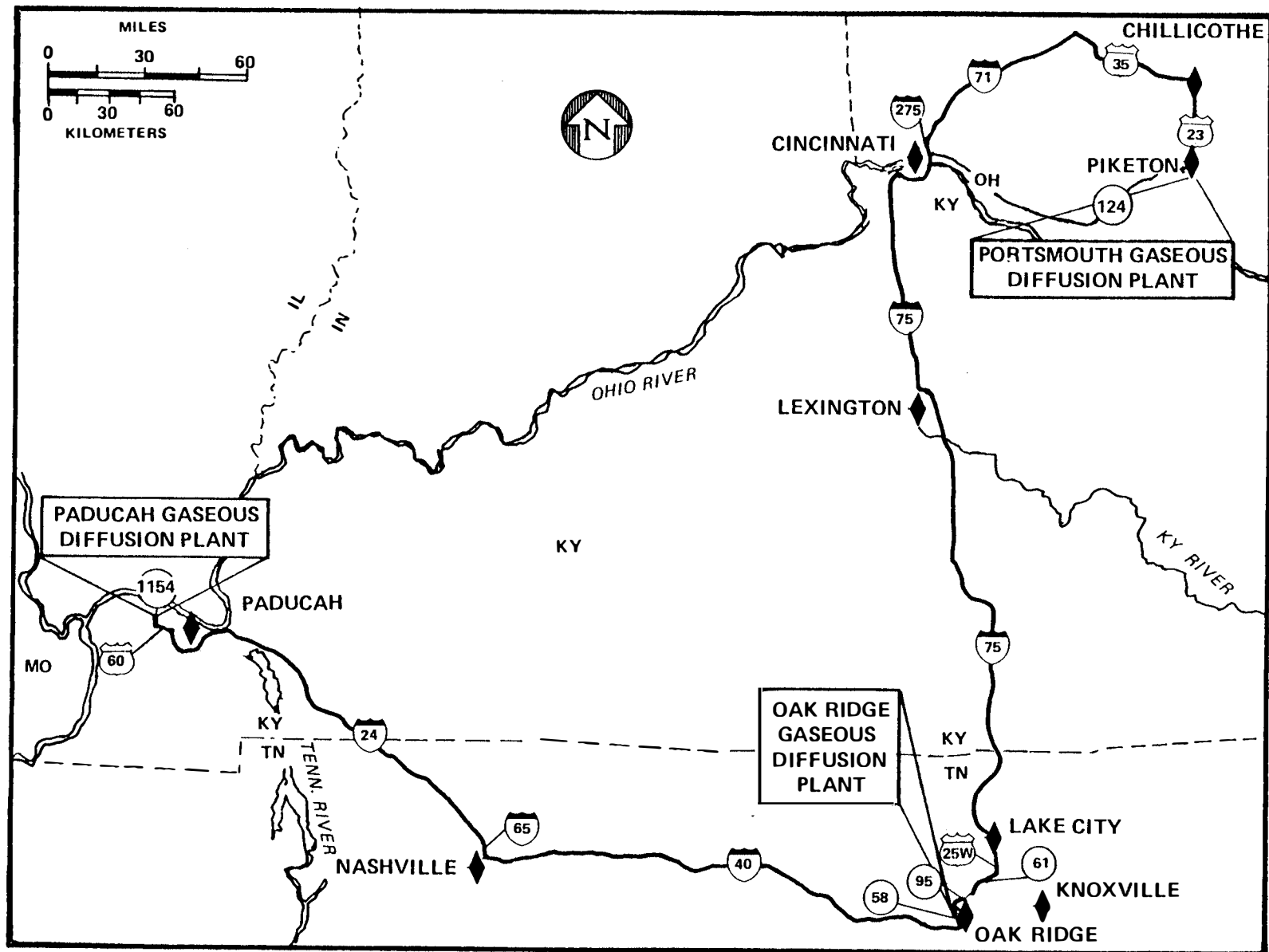


FIGURE S-1. LOCATIONS OF THE OAKRIDGE OPERATIONS GASEOUS DIFFUSION PLANT

of uranium and about 15 to 20 percent would contain detectable concentrations of PCB.

Description of Proposed Action

Receiving, storing, blending, and incineration facilities would be constructed at the ORGDP site. In addition, special handling and storage facilities would be constructed at the Paducah and Portsmouth plants. Existing storage and handling facilities would be utilized at the Y-12 Plant and ORNL.

Each of the DOE facilities would be responsible for collecting, identifying, and storing wastes. The wastes would be stored until the incinerator is functional and then shipped to ORGDP for disposal. Wastes from the DOE facilities would be shipped by truck, over predetermined routes. All shipments would be made using Department of Transportation (DOT) approved containers (49 CFR 171, 172, 173, 177, and 178) labelled so as to identify the contents.

Waste materials received from the DOE facilities would be sampled immediately and analyzed, segregated, and placed in short-term storage. Based on the appropriate analytical data, the wastes would be properly blended and fed into the incinerator along with auxiliary fuel as required. The incineration process itself would consist of a primary rotary kiln stage followed by a secondary burner stage. The temperature and residence time of the secondary stage would be designed to adequately destroy PCBs in accord with EPA regulations (40 CFR 761). PCBs are the most thermally stable material to be incinerated.

The off-gas from the incinerator would then be passed through a four-stage treatment system for cooling and the removal of particulates and combustion byproducts. This system would consist of a quench chamber, a venturi scrubber, a packed bed scrubber, and a wet electrostatic precipitator.

The ash removed from the system would be analyzed for organic content, and if acceptably free, would be disposed of through existing radioactive waste disposal facilities within the Oak Ridge DOE reservation. If the organic content were to be above predetermined acceptable levels, the ash would be recycled through the incinerator.

The liquid wastes generated by the scrubber systems would also be analyzed for organic content, and if acceptably free, neutralized and disposed of through existing facilities. If the scrubber wastes were found to contain unacceptable organic concentrations, they would be filtered through activated carbon and/or recycled through the incinerator.

Effluents and Waste Management

The proposed incineration of PCB contaminated materials and other organic wastes would result in air emissions, solid wastes, and liquid wastes. The majority of air emissions would be from stack gases, but additional fugitive emissions would result from storage, handling, and potential spills and leaks. The principal solid waste to be generated by the combustion process would be the kiln residue contaminated with metal from shredded waste drums and unidentified ash materials from the combustion of liquid and solid waste materials. The residue is expected to contain about 60 mg of uranium per kg of dry ash. Liquid wastes would include overflow from the ash pit, scrubber water, and storm and fire water from diked areas. The solid waste resulting from the facility will be disposed of in an existing radwaste burial site on the Oak Ridge Reservation. The liquid wastes will be treated by an existing waste treatment facility.

60 mg

Impacts of Effluents on the Environment

Overall, the impacts of the proposed action on the environment from air emissions, solid wastes, and liquid wastes are expected to be minimal.

Air emissions, after flue gas scrubbing, would result in minimal contribution to ambient air levels. In addition, fugitive emissions are expected to be small and distributed over the storage area. Air quality changes which would result from the proposed action would be insignificant.

The kiln residue from the combustion process should be essentially free of toxic organics, including PCBs. Low levels of lead and beryllium may be present in the ash residue. The environmental impact of the disposal of incinerator residue would be negligible.

The effluent contribution from the proposed incinerator would not measurably increase the concentrations of pollutants in Poplar Creek or the Clinch River. Thus, impacts of effluents from direct discharge and from runoff should be negligible. Even though heavy metal accumulation in area streams is a concern, the additional input of lead from surface runoff and effluent discharge should not significantly increase this problem.

Impacts on Human Health

Potential exposure to PCBs, their degradation products, and low level ionizing radiation under the proposed action would be demonstrably low. It is estimated that the low level of ionizing radiation from the normal process would result in an increase in the risk of cancer mortality of 3×10^{-7} for the most exposed individual. This compares to a risk of from 1×10^{-5} to 6×10^{-5} for low level ionizing radiation emitted from coal-fired power-plants, and is a negligible increase over the average cancer mortality of 1.64×10^2 in the U.S.

Worker exposure to chemical and physical aspects of the proposed process are not likely to result in risk. Specific control measures have been identified which would prevent or lessen worker exposures. Engineering and administrative controls and worker protection practices would limit exposures. The control technologies incorporated into the facility design, along with a comprehensive health and safety program as planned, will limit worker exposures to these agents and therefore limit the risk to worker health and safety.

Socioeconomic Impacts

The proposed facility would result in only 25 additional employees at the ORGDP, compared to existing employment of about 3000. If all moved into the study area with an average family of three individuals, the overall growth in population would be 75 people. This represents about 0.065 percent of the 1980 population of the study area. The socioeconomic impact of this potential growth is considered to be insignificant. The socioeconomic impacts of

construction activities would be insignificant, with peak employment reaching only 75-80 people.

Accident Scenarios

Two types of accidents could occur as a result of the proposed action; process related accidents at the proposed incineration facility and transportation related accidents during the shipment of wastes to the facility. For accidents at the proposed incineration facility, a Preliminary Safety Analysis Report (PSAR) has been prepared. The PSAR reports on the probability and consequences of a number of accidents, of which three were determined to be both possible (probability of more than 1 in 10,000 during the lifetime of the facility) and of significant adverse consequences. Those consequences, for the most likely and most severe accident, consist of the exposure of workers at the proposed incinerator to high concentrations of PCBs in smoke (more than 1000 ug/m³) for very short durations (less than 10 seconds). The analysis did not identify any significant radiological consequence, either on-site or off-site; no off-site impacts were identified for any of the accident scenarios.

For transportation accidents, the impact of an accident would result from the spill of the contents of the container. The behavior of the materials which could have an adverse impact on the environment, primarily PCBs and uranium, is such that recovery of the spilled materials would be possible, with minimum loss to the environment. A previous spill of PCBs studied by the Environmental Protection Agency resulted in no detectible permanent damage to the environment. Thus, no significant impact to the environment would be expected to occur as a result from a transportation accident.

Alternatives to the Proposed Action

There are three reasonable alternatives to the proposed action: no action (store and delay), chemical destruction, and alternative transportation routes. These are examined in detail in Sections 2.2, 2.3, and 2.4 of the EIS and summarized below. In addition, five classes of alternatives

(commercial disposal, alternative processes, alternative sites, multiple incinerators, and alternative modes of transportation) were eliminated from detailed analysis because they do not represent feasible alternative actions that would be reasonable for DOE. These are discussed in Section 2.5 in the EIS.

The No Action (Store and Delay) Alternative

The no action alternative would involve the storage of the PCBs and other hazardous organic materials and delay until some future date a decision to construct and operate a disposal facility for these materials. This decision would require the construction and operation of additional storage facilities and would incur a number of environmental impacts, including effluents from redrumming, leaks and spills, and the risk of unrecoverable accidental releases from fire, explosion or other catastrophe. In addition, environmental impacts would result from the eventual implementation of the future method of disposal. This course of action would not be in accord with the intent of federal laws and regulations concerning the disposal of PCBs.

Chemical Destruction Alternatives

Three candidate processes for the destruction of hazardous organic materials may be commercially available by the start of construction of the proposed incinerator facility. These are the SunOhio PCBX process, the Goodyear sodium naphthalide process, and the wet air oxidation process. A review of these processes indicates that none of them meet the technical requirements of environmentally sound destruction of the entire waste materials inventory now in storage at five DOE facilities. Two processes have been demonstrated to dechlorinate or otherwise destroy PCBs; one of these is limited to pure PCBs or PCBs in oils and the other may not be effective in the presence of water or certain of the other constituents of the waste inventory. The remaining process has not been demonstrated to destroy PCBs and probably could not destroy high molecular weight chlorinated hydrocarbons.

The environmental impacts probably associated with the implementation of these processes would be greater in some respects and smaller in others,

when compared to the proposed action. Under the assumption that each could effectively dispose of the entire waste inventory, or that some combination could be employed, there is no evidence that a reduction in environmental impact would be achieved by selecting these alternatives in lieu of the proposed action.

Transportation Route Alternatives

There are three alternative routes from Piketon (Portsmouth Gaseous Diffusion Plant) to Interstate 75, three from Interstate 75 to ORGDP, and three from Interstate 40 (from Paducah) to ORGDP. The proposed alternative in each case represents the best route based on an analysis of two types of factors, those related to the probability of an accident, and those related to the impact of an accident should one occur. Thus, the proposed routes would minimize the potential environmental impact of the transportation of the waste materials to the proposed incinerator. The impacts of a transportation accident have been described as a part of the proposed action.

Alternatives Eliminated from Detailed Examination

Five classes of alternatives were eliminated from detailed examination because they do not constitute reasonable alternatives to the proposed action. The five classes and the reasons for their elimination are discussed below and in Section 2.5.

Commercial disposal is not a reasonable alternative because it is not a feasible course of action for DOE. At present, there are no facilities with both an EPA license to dispose of PCBs and a license from the Nuclear Regulatory Commission to accept and dispose of special nuclear materials (those containing any quantity of enriched uranium, regardless of the level of enrichment). It is also unlikely that a commercial facility would undergo the expense and effort associated with obtaining and operating under both types of licenses. (DOE is exempt from NRC licensing under the Atomic Energy Act of 1954; P.L. 83-703).

An alternative process involving removal of uranium from PCB contaminated waste was not examined in detail because the current state-of-

the-art technology for separation of uranium from PCB waste does not approach 100% removal efficiency. This performance criteria would be necessary in order for this alternative to be considered.

Alternative sites are not reasonable alternatives because an alternative site would increase either the impact associated with the construction and operation of the facility or the risk of a transportation accident. Siting at another DOE Oak Ridge Operations facility would increase the volume and number of shipments of materials, increasing the risk of a transportation accident. Siting at any other alternative site would increase both risks of a transportation accident and the impacts of construction and operation due to the need for support facilities and personnel already present at an existing plant.

Multiple incinerators are not reasonable as alternatives because the cost and impact of construction for each of a number of incinerators would approach those for the proposed action. Impacts of operation would be dispersed, rather than lessened. The increase in capital cost from approximately \$30 million to about \$60 million (two incinerators) or \$90 million (three incinerators) would achieve only the elimination of the small risk of a transportation accident. Operational costs would increase as well, due primarily to the need for operational personnel at each incinerator.

Alternative modes of transportation are not reasonable alternatives primarily because these modes (rail, barge) would increase the risk of transportation accident and the likelihood that a spill or release would not be as easily or quickly recovered. Costs would also increase. No reduction in other impacts would occur as a result of selecting an alternative mode of transportation.

Decommissioning and Decontamination

The decommissioning and decontamination of the proposed incinerator would not occur until sometime after all of the PCBs and PCB contaminated materials have been removed from service at the five DOE Oak Ridge Operations plants. Since the lifetime of PCB transformers and capacitors is indefinite, some of the PCB equipment will probably remain in service until the respective

plant is decommissioned; thus, the incinerator would be a part of the decommissioning and decontamination plan for the DOE Oak Ridge Operations facilities. Decontamination of the proposed incinerator facility will follow the procedure for extended shutdowns during the operation of the facility. No significant impacts would be expected from the decommissioning of the proposed incinerator.

References

Preliminary Safety Analysis Report for Compliance with the Toxic Substance Control Act (TSCA) ORGDP Project No. 83-OR-14. Prepared for Union Carbide Corporation, Nuclear Division, Oak Ridge, Tennessee by Battelle Columbus Laboratories, June 1981.

P.L. 83-703. Atomic Energy Act of 1954.

40 CFR 761. Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution, and Use Prohibitions. U.S. Environmental Protection Agency.

40 CFR 1500-1508. Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act. Council on Environmental Quality, Executive Office of the President.

49 CFR 171. Hazardous Materials Regulations, General Information Regulations, and Definitions. U.S. Department of Transportation.

49 CFR 172. Hazardous Materials Regulations, Hazardous Materials Table and Hazardous Materials Communications Regulations. U.S. Department of Transportation.

49 CFR 173. Hazardous Materials Regulations, Shippers - General Requirements for Shipments and Packagings. U.S. Department of Transportation.

49 CFR 177. Hazardous Materials Regulations, Carriage by Public Highway. U.S. Department of Transportation.

49 CFR 178. Hazardous Materials Regulations, Shipping Container Specifications. U.S. Department of Transportation.

45 FR 20694. Compliance with the National Environmental Policy Act; Final Guidelines. U.S. Department of Energy, 45 FR 20694-20701, March 28, 1980.

46 FR 56040. Notice of Availability of EIS. U.S. Environmental Protection Agency, 46 FR 56040, November 13, 1981.

46 FR 11703. Compliance With The National Environmental Policy Act; Intent to Prepare an Environmental Impact Statement on an Incineration Facility at Oak Ridge Gaseous Diffusion Plant (ORGDP), Oak Ridge, Tennessee. U.S. Department of Energy, 46 FR 11703-11704, February 10, 1981.

1.0 INTRODUCTION: PURPOSE AND NEED FOR ACTION

Polychlorinated biphenyls (PCBs) are highly stable, synthetic organic compounds. They have been used widely for the past 50 years in industrial and commercial applications, including use as a dielectric liquid in electrical transformers and as an additive to hydraulic fluids. It is estimated that 180,000 metric tons (200,000 tons) exist in the environment (EPA, 1979), while 340,000 metric tons (375,000 tons) remain in industrial and commercial use (EPA, 1981).

Recent investigations have demonstrated that PCBs pose a risk to human health and the environment. In 1976, Congress, as part of the Toxic Substances Control Act (TSCA), banned the further manufacture of PCBs. Subsequent regulations (40 CFR 761) impose specific storage and disposal requirements for materials containing PCBs.

The Oak Ridge Operations Office of the Department of Energy (DOE) supervises the operation of five facilities. These facilities include three gaseous diffusion plants (Oak Ridge, TN; Paducah, KY; and Portsmouth, OH), the Y-12 Plant and the Oak Ridge National Laboratory (both in Oak Ridge, TN). Each of these facilities has, in storage and in service, PCB contaminated materials, some of which also contain trace quantities of low-assay enriched uranium^a, a special nuclear material regulated by the Nuclear Regulatory Commission (NRC).

The disposal of PCB and uranium contaminated materials will be accomplished in an environmentally sound and timely manner, in accord with EPA regulations (40 CFR 761). DOE proposes, as set forth in a Notice of Intent (46 FR 11703, February 10, 1981), to build and operate at the Oak Ridge Gaseous Diffusion Plant (ORGDP) an incinerator for the purpose of destroying these PCB and uranium contaminated materials.

This final Environmental Impact Statement (EIS) has been prepared in accordance with DOE's guidelines (45 FR 20694, March 28, 1980) for compliance

^a Enriched uranium is uranium in which the percentage of the uranium - 235 isotope has been increased above 0.7 percent of the total uranium. The materials proposed for disposal involve uranium containing 0.7 to 1.0 percent uranium - 235 relative to the total uranium.

with the National Environmental Policy Act (NEPA) of 1969, as implemented by the regulations promulgated by the Council on Environmental Quality (CEQ; 40 CFR 1500-1508), to support a decision on the proposed action.

The proposed action consists of the construction and operation of a high temperature rotary kiln incinerator and associated auxiliary equipment at the Oak Ridge Gaseous Diffusion Plant (ORGD), and waste storage, packaging, and shipping facilities at the Paducah Gaseous Diffusion Plant and the Portsmouth Gaseous Diffusion Plant. The incinerator would dispose of materials contaminated with PCBs together with other hazardous wastes. A complete description of the proposed incinerator facilities and operation is presented in Section 2.1.1 of this EIS.

1.1 History of PCBs and Applicable Regulations

PCBs were first synthesized in 1881. They are a group of chlorinated organic compounds resulting from the direct chlorination of the chemical biphenyl. They were brought into commercial production in this country in 1929 and were used initially for cooling and insulating electrical equipment.

PCB compounds are highly stable, fire resistant, have high resistance to the flow of electrical current (dielectric properties), and have good heat transfer characteristics. These characteristics make them very suitable for applications in the electrical industry. They are widely used as a dielectric liquid in electrical transformers, capacitors, and other electrical equipment. The commercial production of PCBs in a wide range of viscosities and melting and boiling points also led to applications as a plasticizer, dye carrier, and additive to materials such as lubricating oils and hydraulic fluids (EPA, 1979).

This widespread commercial and industrial application of PCBs was paralleled by little or no regulatory control on their use, storage, and

disposal. The fact that the chemical is highly stable and resistant to degradation, coupled with its widespread use and the lack of regulatory control, led to distribution of the substance throughout the biosphere. In 1966, it received recognition as a widespread pollutant which, once released to the environment, is essentially impossible to remove. Today, PCBs are considered a significant environmental pollutant which have been shown to pose a risk to human health and the environment.

Recognition of PCBs as a class of toxic chemicals has led to establishment of regulatory controls. PCBs are currently regulated by the United States Department of Agriculture (USDA), the Food and Drug Administration (FDA), and the Environmental Protection Agency (EPA).

The authority of EPA to control PCBs was initially limited to regulation of discharge of contaminated wastewater under the Clean Water Act. On February 2, 1977, EPA promulgated a rule (42 FR 6532) which banned the discharge of PCBs by manufacturers of electrical transformers and capacitors.

However, in 1976, under Section 6(e) of TSCA, the EPA was given a specific mandate by Congress to control the manufacture, processing, distribution in commerce, use, disposal, and marking of PCBs. On February 17, 1978, EPA took the first step to implement provisions of Section 6(e) by publishing the PCB Disposal and Marking Rule (43 FR 7150). This rule regulates disposal of PCBs and sets requirements for marking. Clarifying amendments to this rule were published by EPA on August 2, 1978 (43 FR 33918).

Final regulations on the use of PCBs were published by EPA on May 31, 1979 (40 CFR 761). These regulations integrate the earlier rule on PCB Disposal and Marking and its amendments and set additional requirements on the manufacture, processing, distribution in commerce, and use of PCBs. The final rule includes requirements for disposal and storage prior to disposal.

1.2 Hazardous Waste Materials at DOE Facilities

The purpose for the proposed action is to dispose of these waste materials from the five facilities operated by the Oak Ridge Operations Office of the Department of Energy, and to accomplish this disposal at the earliest

practical time and in an environmentally sound manner, consistent with the regulations which are described below. Of the five facilities, four are production plants and one is a research laboratory. The operation of these facilities results in a variety of waste materials which require disposal. These materials may be characterized as PCB contaminated materials, both liquid and solid, and other hazardous organic materials, including waste solvents, waste organic chemicals, sludges, and waste oils. Approximately 800,000 liters (220,000 gallons) of liquid organic materials are expected to require disposal each year, together with approximately 18 metric tons (20 tons) of solid wastes. In addition, by 1987, it is estimated that the five DOE Oak Ridge Operations facilities will have in storage more than 2,400,000 liters (634,000 gallons) of liquid organic wastes and 6400 metric tons (7000 tons) of solid wastes. Many of these wastes contain trace quantities of low-assay enriched uranium, as described below.

1.2.1 PCB Contaminated Waste Materials

By regulation (40 CFR 761), materials containing more than 50 parts per million (ppm) PCB are defined as PCB materials. The liquid materials presently stored by the Oak Ridge Operations facilities include approximately 190,000 liters (50,000 gallons) of liquid PCB materials, including oils, solvents, and water. An additional 65,000 liters (17,000 gallons) are expected annually as PCB containing equipment in use is taken out of service. Almost all the solid waste materials in storage are PCB contaminated, as are approximately 40 percent of the solid materials expected in the future. The PCB content of the wastes ranges from below 5 ppm to more than 60 percent; the average PCB content of all wastes proposed for destruction is about 1.6 percent (see Section 2.1.1 and Appendix A).

1.2.2 Other Hazardous Waste Materials

In addition to the PCB materials, other hazardous materials (waste solvents, sludges, waste oils, waste chemicals) require disposal. Solvents are used at DOE facilities for cleaning and degreasing, among other purposes.

Approximately 170,000 liters (45,000 gallons) will be generated annually by 1987. Sludges from waste paints, degreasing operations, and other activities, together with miscellaneous photographic, biological, and chemical waste materials, will amount to an additional 170,000 liters (45,000 gallons) per year; waste oils are expected to amount to about 450,000 liters (120,000 gallons) per year.

The proposed action includes the disposal of these other wastes for two reasons. First, some of these wastes also contain uranium contamination (see Section 2.1.1) and require disposal in an environmentally sound manner. The proposed incinerator will constitute a safe and effective method for this disposal. Second, the incineration of PCBs requires high temperatures, usually accomplished through the use of a fuel such as fuel oil. Many of the wastes have heat values sufficiently high to permit their use as a fuel in the proposed incinerator, thereby reducing the volume of fuel oil required for the destruction of the PCBs. Thus, the disposal of these wastes in the proposed incinerator also reduces the cost of the proposed action.

1.2.3 Radioactive Contamination in the Waste Materials

Most of the materials described in the previous two sections have been used in close proximity to various nuclear materials and processes. As a result, these waste materials have become contaminated with trace quantities of radioactivity, primarily enriched uranium. The uranium content of the waste materials proposed for disposal in the incinerator averages less than 200 ppm with a maximum concentration of less than 10,000 ppm. The uranium-235 content, as a percentage of total uranium, will be less than 1.0 percent; the treatment or disposal of wastes which contain uranium with more than 1.0 percent of the uranium-235 isotope will be by other means of disposal and is therefore outside the scope of the proposed action.

Material which contains any amount of enriched uranium, regardless of the degree of enrichment, is a special nuclear material under the regulations of the Nuclear Regulatory Commission (10 CFR 70). A license is required for a non-DOE facility to accept, process, or dispose of any material containing even trace quantities of special nuclear material. At present, there are no

facilities which have licenses from the EPA for disposal of PCBs and hazardous wastes and which also have an NRC license to receive and dispose of special nuclear material.

1.3 Regulatory Requirements for Disposal and Storage for Disposal

Wastes from the DOE facilities include both PCB materials and other hazardous materials; these materials are also contaminated with radioactivity. Disposal of these wastes will therefore be performed in accord with provisions of TSCA, as well as the regulations which apply to nuclear materials.

1.3.1 Regulations Applicable to PCB Materials

Requirements for the disposal and interim storage for disposal of PCB contaminated waste are contained in the final EPA rule (40 CFR 761) which implements Section 6(e) of TSCA. These regulations define PCB as any substance, combination of substances (mixture), or item which contains 50 ppm PCB or greater. However, waste oil which contains any detectable concentration of PCB is an exception to the 50 ppm limit. The application of such PCB contaminated waste oil as a sealant, coating, or dust control agent is prohibited. This prohibition is to prevent the use of PCB contaminated material which would result in widespread environmental contamination.

The final rule does not require early retirement of PCB equipment in service. However, once retired from service, disposal of the PCBs must be undertaken in compliance with the regulations. The type of PCB disposal required is based on physical form (liquid or nonliquid) and PCB concentration in the waste. The regulations require incineration for any material containing more than 500 ppm PCB. Requirements for incineration are in Annex I of the EPA regulations (40 CFR 761).

Requirements for interim storage for disposal are presented in Annex III of the regulations (40 CFR 761). The requirements stipulate that those PCB articles or PCB containers stored for disposal prior to January 1, 1983, must be disposed of before January 1, 1984. In addition, those PCB articles

or PCB containers stored after January 1, 1983, must be disposed of within one year from date of storage. Annex III also sets requirements for PCB storage facilities.

One of the purposes for the proposed action is to bring DOE operations into accord with the intent of TSCA and the EPA regulations (40 CFR 761) at the earliest possible time. The final EPA regulations were published on May 31, 1979 (44 FR 31514). At that time, DOE began the steps necessary to attain a functionally equivalent program for the disposal of these wastes. These steps included an economic analysis, completed in February 1980, and a preliminary feasibility study, completed in July 1980. Following these, a Conceptual Design Report and Preliminary Safety Analysis Report were prepared; these were published concurrently with the EIS. The necessary steps for the development of the proposed project, including this EIS, have been taken as expeditiously as possible while complying with the procedural requirements of the National Environmental Policy Act (NEPA) of 1969. The estimated operational date for the proposed incinerator is January, 1987; approximately 35 months would be required to dispose of the PCB materials in storage by that date, together with wastes produced during each year of operation.

1.3.2 Other Regulations Applicable to PCB Materials

Additional regulations which may be related to the proposed action include those which cover the handling, storage, and highway transportation of hazardous wastes. These regulations are found in Department of Transportation (DOT) regulations (49 CFR 171, 172, 173, 177, and 178). Sections 115 and 306 of the Clean Water Act, which define the necessary steps for pretreatment and disposal of PCB waste, and Occupational Safety and Health Administration regulations for flammable and combustible liquids (29 CFR 1910.106) also may be applicable. The proposed action would comply with each of these regulations.

1.3.3 Regulations Relevant to the Nuclear Contamination of the Waste Materials

The waste materials requiring disposal contain, in addition to PCBs and other hazardous chemical substances, trace quantities of radionuclides,

primarily enriched uranium. Enriched uranium is uranium which has been processed to increase the percentage of the U-235 isotope above the natural level of approximately 0.7 percent. Under the regulations of the Nuclear Regulatory Commission, enriched uranium or any material containing enriched uranium is a special nuclear material (10 CFR 70). Under these regulations, the receipt, processing, and disposal of special nuclear material is highly controlled. A license from the Nuclear Regulatory Commission is required regardless of the quantity or concentration which may be involved. Under the Atomic Energy Act, DOE is exempt from this licensing requirement.

Because the three gaseous diffusion plants enrich uranium as a part of the nuclear fuel cycle for electrical power production, the exposure of the public to radioactivity from the disposal of the waste materials is also regulated. Environmental Protection Agency regulations limit the amount of radiation which may be received by any member of the public from the nuclear fuel cycle to 75 millirem per year to the thyroid and 25 millirem per year to all other organs (45 FR 2861, January 13, 1977). The disposal method proposed for the waste materials involved must not result in an increase of public exposure above these levels.

1.4 Other Reports on the Proposed Project

In addition to this final Environmental Impact Statement (EIS), there are two other significant reports on the proposed project. Because many of the analyses in this EIS are based upon the information contained in those reports, they are briefly described here.

The Conceptual Design Report for Compliance with the Toxic Substances Control Act (TSCA), Gaseous Diffusion Plants, Project No. 83-OR-14 (CDR; K/D-5222) presents a preliminary design and operational plan for the proposed incinerator and related facilities. The CDR presents the design of the proposed facilities to the detail necessary for estimating the costs of construction and operation, preliminary to detailed design. The CDR is the basis for the description of the proposed action and for analyses of the operation of the proposed incinerator.

The Preliminary Safety Analysis Report for Compliance with Toxic Substances Control Act (TSCA), Oak Ridge Gaseous Diffusion Plant, No. 83-OR-14 (PSAR) reports on the analysis of the safety of the proposed incinerator and the related facilities and operations at the incinerator site. The analysis examined the proposed incinerator in terms of any possible accident or abnormal operation condition. These events were classified according to type and severity of consequences to human health and safety as well as to the probability that the event would occur during a twenty-five year estimated lifetime for the proposed incinerator. The analysis then focused upon those events deemed to be feasible (probability of occurrence greater than 1×10^{-4} events during twenty-five years) and which could result in an unacceptable impact on human health and safety. The three accident scenarios which met these criteria are examined in detail in the PSAR and are reviewed in Chapter 4 of this EIS.

1.5 References

K/D-5222. Conceptual Design Report for Compliance with the Toxic Substance Control Act (TSCA) Project No. 83-OR-14. Goodyear Atomic Corporation, Nuclear Division of Union Carbide Corporation, Engineering Divisions, March 28, 1981.

Preliminary Safety Analysis Report for Compliance with the Toxic Substance Control Act (TSCA) ORGDP Project No. 83-OR-14. Prepared for Union Carbide Corporation, Nuclear Division, Oak Ridge, Tennessee by Battelle Columbus Laboratories, June 1981.

U.S.EPA. Support Document/Voluntary Environmental Impact Statement and PCB Manufacturing, Processing, Distribution in Commerce, and Use Ban Regulation: Economic Impact Analysis. U.S. Environmental Protection Agency, Washington, D.C., April, 1979.

U.S.EPA. Incineration of PCBs, Summary of Approval Actions: Energy Systems Company (ENSCO), U.S. Environmental Protection Agency, El Dorado, Arkansas (Region VI), February 6, 1981.

10 CFR 70. Domestic Licensing of Special Nuclear Material. Nuclear Regulatory Commission.

29 CFR 1910. Occupational Safety and Health Standards, Occupational Safety and Health Administration.

40 CFR 761. Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution, and Use Prohibitions. U.S. Environmental Protection Agency.

40 CFR 1500-1508. Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act. Council on Environmental Quality, Executive Office of the President.

49 CFR 171. Hazardous Materials Regulations, General Information Regulations, and Definitions. U.S. Department of Transportation.

49 CFR 172. Hazardous Materials Regulations, Hazardous Materials Table and Hazardous Materials Communications Regulations. U.S. Department of Transportation.

49 CFR 173. Hazardous Materials Regulations, Shippers - General Requirements for Shipments and Packagings. U.S. Department of Transportation.

49 CFR 177. Hazardous Materials Regulations, Carriage by Public Highway. U.S. Department of Transportation.

49 CFR 178. Hazardous Materials Regulations, Shipping Container Specifications. U.S. Department of Transportation.

42 FR 6532. Standards for Polychlorinated Biphenyls (PCBs): Final Decision. U.S. Environmental Protection Agency, 42 FR 6532-6555, February 2, 1977.

43 FR 7150. Polychlorinated Biphenyls (PCBs), Disposal and Marking. U.S. Environmental Protection Agency, 43 FR 7150-7164, February 17, 1978.

43 FR 33918. Addendum to Preamble and Corrections to Final Rule. U.S. Environmental Protection Agency, 43 FR 33918-33920, August 2, 1978.

44 FR 31514. Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution, and Use Prohibitions. U.S. Environmental Protection Agency.

45 FR 2861. Environmental Radiation Protection Standards for Nuclear Power Operations. U.S. Environmental Protection Agency, January 13, 1977.

45 FR 20694. Compliance with the National Environmental Policy Act; Final Guidelines. U.S. Department of Energy, 45 FR 20694-20701, March 28, 1980.

45 FR 30980. Prohibition of PCB-Containing Equipment or Machinery and Liquid Polychlorinated Biphenyls (PCBs) in Federally Inspected Meat Establishments, Poultry Product Establishments and Egg Product Plants. U.S. Department of Agriculture, 45 FR 30980-30983, May 9, 1980.

46 FR 11703. Compliance With The National Environmental Policy Act; Intent to Prepare an Environmental Impact Statement on an Incineration Facility at Oak Ridge Gaseous Diffusion Plant (ORGDP), Oak Ridge, Tennessee. U.S. Department of Energy, FR 11703-11704, February 10, 1981.

2.0 ANALYSIS OF THE PROPOSED ACTION AND ALTERNATIVES

This chapter presents the analysis of the proposed action and alternatives for the disposition of materials containing PCBs and other organic waste materials from the five DOE Oak Ridge Operations facilities. The alternatives discussed are the proposed action, no action (store and delay), chemical destruction, and alternative routes for the transportation of the wastes. The purpose of this chapter is to present a comparison of these alternatives. In addition, this chapter reviews alternatives which were considered but eliminated from detailed analysis, in accord with the regulations which implement the National Environmental Policy Act (NEPA, 40 CFR 1500-1508). These alternatives include commercial disposal, alternative sites, multiple incinerators, and alternative modes of transportation.

2.1 The Proposed Action

This section describes the proposed action, including ancillary facilities and transportation plans, and summarizes the impacts of the proposed action. A more detailed development of the impacts may be found in Chapter 4.

2.1.1 Project Description

The incinerator for the disposal of waste materials contaminated with PCBs and other hazardous organic waste materials, proposed to be built at Oak Ridge, Tennessee, has been described in a Conceptual Design Report (K/D-5222); a summary description is presented in this section. The Oak Ridge facilities associated with this project will be located on a previously cleared plot of land, 450 meters (1500 feet) east of the steam plant (building K-1501) at the Oak Ridge Gaseous Diffusion Plant (Figure 2-1). Figure 2-2 shows a general plan of the incinerator facility. It will occupy approximately two hectares (five acres) and include:

- Storage tank farm for liquid wastes
- Drum storage and unloading area
- Rotary kiln primary incinerator
- Secondary (after) burner

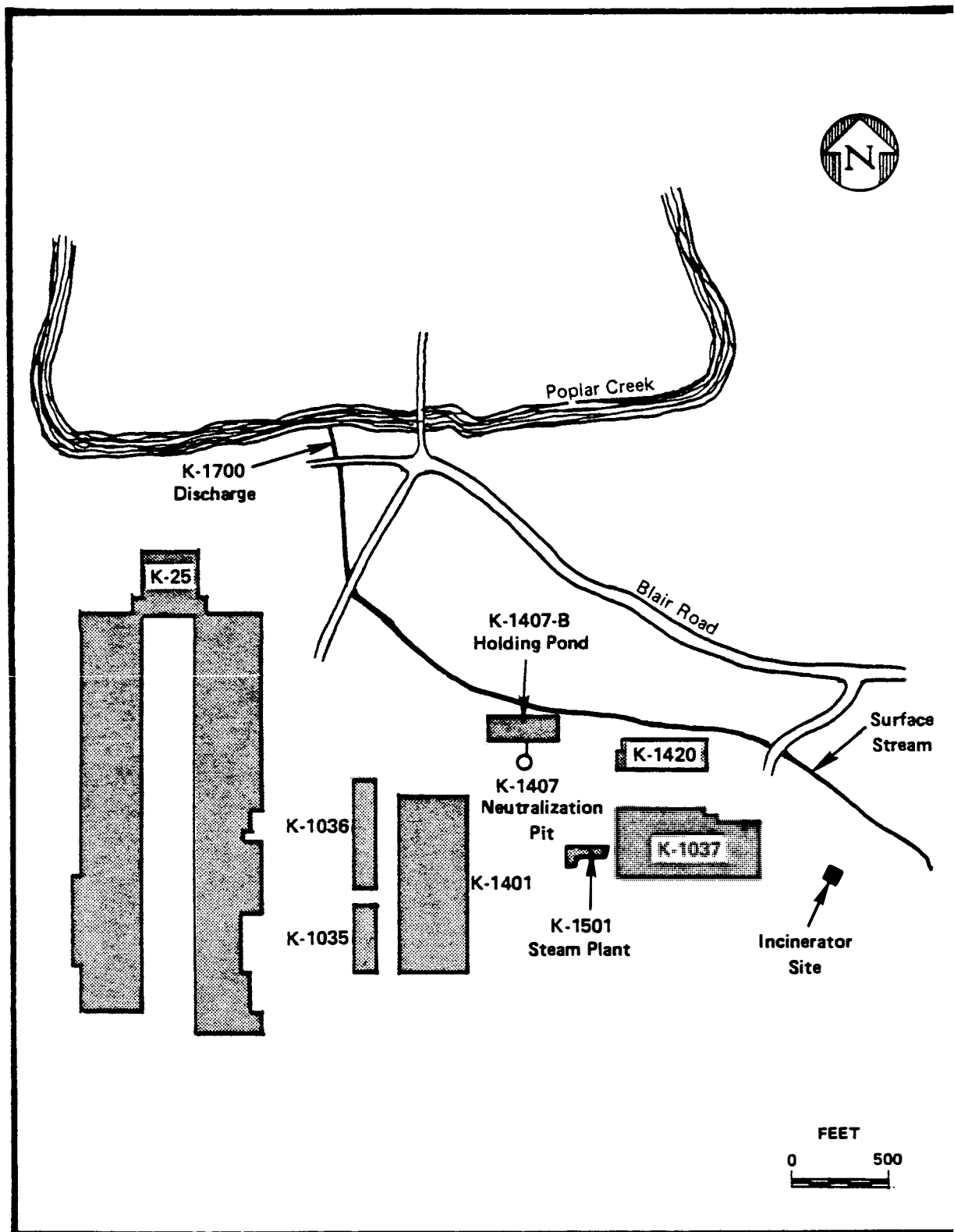


FIGURE 2-1. SITE OF THE PROPOSED INCINERATOR

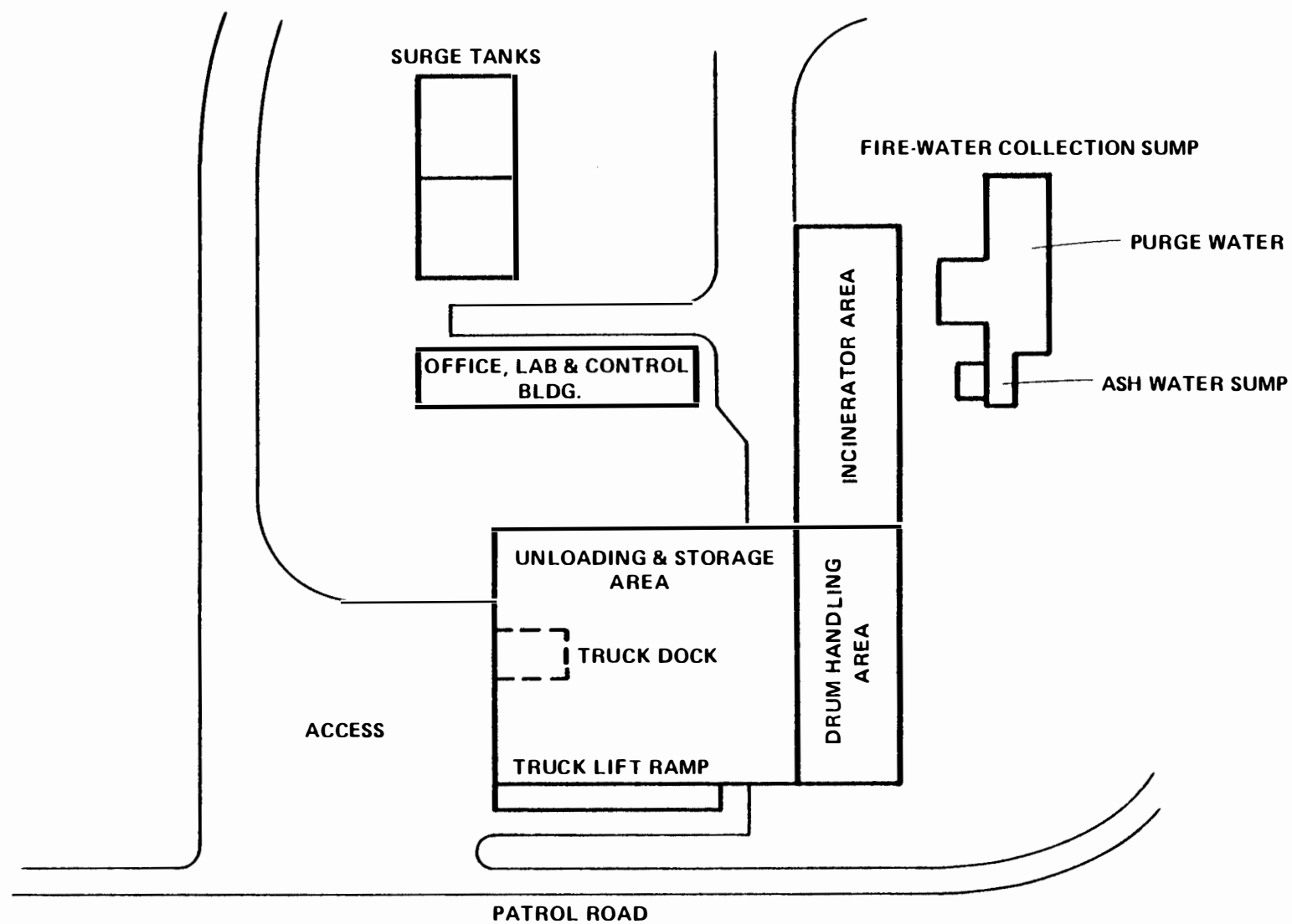


FIGURE 2-2. PROPOSED OAK RIDGE WASTE DISPOSAL FACILITIES

- Emissions control devices
- Collection tanks for spent process water
- Office and analytical laboratory space
- Security fencing and patrol roads around the compound.

Shipments of waste materials to this facility will be made from:

- Portsmouth Gaseous Diffusion Plant (Piketon, Ohio)
- Paducah Gaseous Diffusion Plant (Paducah, Kentucky)
- Oak Ridge National Laboratory (Oak Ridge, Tennessee)
- Y-12 Plant (Oak Ridge, Tennessee)

All shipments will be in trucks and over predetermined routes. Waste materials generated at ORGDP will also be disposed at this facility; a small number of shipments will travel over TN 58 from the west side of the ORGDP to the incinerator site, since this is the only route from the site at which these materials are presently stored.

In addition to the incinerator and associated facilities to be built at the ORGDP, special waste handling and storage facilities described below will be constructed at the Gaseous Diffusion Plants at Piketon and Paducah. Existing handling and storage facilities will be utilized at Y-12 and ORNL.

The incinerator will be designed to incinerate PCBs, although PCBs comprise less than five percent of the total material to be fed to the incinerator (see Appendix A). Since PCBs are among the most difficult organic compounds to thermally degrade (Ahling and Lindskog, 1978), other organic compounds in the materials will be easily destroyed by the incinerator. Some of the non-PCB liquid organic waste materials will serve as the major fuel source for the incinerator. The proposed incinerator facility includes an air emission control (scrubber) system designed to minimize the release of radio-nuclides to the atmosphere; this system and its efficiency are described in Sections 2.1.1.8, 2.1.2.1, and 4.1.1.

2.1.1.1 Collection and Transport Facilities. As indicated above, PCB and other organic waste materials from the Y-12 Plant and Oak Ridge National Laboratory will be shipped to the incinerator. The wastes generated at the Y-12 Plant and ORNL are of sufficiently high heating value so as to minimize the need for high quality auxiliary fuel. High quality auxiliary fuels will be required for pilots (natural gas) and for start up and shut-down

periods (fuel oil), since clean fuels are required for environmental protection during these operations.

As part of the proposed action, facilities will be provided at each of the Diffusion Plants for the decommissioning of PCB containing transformers as they are removed from service. ORGDP already maintains a facility for such purposes. New facilities to be built at the Paducah and Portsmouth Gaseous Diffusion Plants will include prefabricated metal buildings of 186 m² (2,000 ft²) with flooring that is sloped, curbed and drained in such a manner so as to contain and recover spills. PCB containing transformers will be flushed with a suitable solvent such as kerosene, and the resulting contaminated liquid pumped to a storage tank for eventual disposal in the proposed incinerator. Once cleaned, the transformer carcasses will be shipped to EPA approved landfills near each plant for disposal.

2.1.1.1.1 Paducah Gaseous Diffusion Plant Storage Facility. The Paducah Gaseous Diffusion Plant (PGDP) is responsible for collecting, identifying and storing the PCB waste material (both liquid and solid) generated at PGDP. The PCB waste is generated during PCB transformer or capacitor change out, PCB spills, and open PCB systems flushing. The PCB transformers will be taken out of service upon failure, emptied in place, and taken to an area designed for containment of PCBs. The PCBs removed from failed transformers will be stored in a 5700 liter (1500 gallon) portable tank prior to shipment to the incinerator facility. Solvent from transformer rinses will be stored in a 7500 liter (2000 gallon) storage tank. The solvent will be handled as a PCB material. An area in the building will be designated as a PCB storage area for the PCBs, oil contaminated with PCBs, and transformer carcasses.

At the PGDP, facilities currently exist for storage of existing quantities of waste oils and solvents contaminated with enriched uranium. This material will be transported in tank truck or in drums in an enclosed trailer to the incineration facility, following testing and treatment to ensure that the uranium-235 concentration is below one percent of the total uranium content in any container.

2.1.1.1.2 Portsmouth Gaseous Diffusion Plant Storage Facility. The procedures for handling waste materials at the Portsmouth GDP will be very similar to those at the Paducah GDP. Transformers that have failed or have been decommissioned will be drained in place into a tanker dedicated for materials contaminated with PCBs. The tanker and transformers will then be transferred to the transshipment facility to be constructed under the proposed action. The spent dielectric fluid will then be transferred into a 7,500 liter (2,000 gallon) tank. The transformers will be rinsed with solvent and the contaminated solvent transferred to a separate waste solvent tank. The liquid waste materials will be stored in these holding tanks prior to tanker shipment to the incinerator facility.

Additional waste materials storage space will be available at both Portsmouth and Paducah for handling other organic waste materials. These waste materials will also be shipped to the incinerator.

2.1.1.1.3 Shipping Operations. The transport of waste materials contaminated with PCBs and other organic waste materials will require the use of two 15,000 liter (4,000 gallon) tank trailers for bulk liquid waste materials and an enclosed van transport trailer for drummed materials. One tanker will be utilized solely for hauling liquids contaminated with PCBs while the other tanker will carry other liquid organic materials. Prior to shipment, a detailed materials analysis will be sent to the personnel operating the incinerator facilities at ORGDP. This analysis will be used to determine the handling requirements of the materials once they reach the incineration facilities. All shipments will be made using DOT approved containers labelled so as to identify the contents. All shipments of waste materials in motor vehicles to the ORGDP will be placarded in accordance with DOT rules (40 CFR 172.500) These materials will be shipped over the pre-arranged routes described below.

The number of shipments of waste from Portsmouth and Paducah will be sufficiently small to allow scheduling for ideal weather and traffic conditions. Based on the estimated annual quantities of wastes from each plant (K/D-5222), after the backlog of stored wastes is relieved, only seven to eight loads per year would be shipped from Paducah and only three to four from Portsmouth.

2.1.1.2 Transport Routes. Waste materials from the DOE facilities will be transported to Oak Ridge, Tennessee on a combination of local, State, and Federal highways. The proposed routes are shown in Figures 2-3 and 2-4, and described in Appendix B.

Shipments leaving Portsmouth GDP will travel north on US 23 to the intersection of US 23 and US 35. The shipments will then travel westbound on US 35 to Interstate 71, and from there, southbound to Interstate Loop 275 eastbound around Cincinnati, Ohio. Once the carrier has bypassed the Cincinnati metropolitan area, the shipments will travel southbound on Interstate 75 into Tennessee. Within Tennessee, shipments will exit Interstate 75 at Lake City and proceed southbound on US 25W to TN 61 southbound. From TN 61, they will travel via TN 95 to TN 58 southbound and finally onto Blair Road.

Shipments from Paducah will start on KY 1154 to US 60 eastbound, then to Interstate 24 eastbound into Tennessee, and to Interstate 40 eastbound to TN 58 northbound and finally to Blair Road.

Shipments from ORNL and the Y-12 Plant will be transported on Bethel Valley Road and Bear Creek Road to TN 95 northbound to TN 58 southbound and onto Blair Road.

2.1.1.3 Waste Material Quantities. The annual quantity of waste material requiring disposal has been estimated in Table 2-1 based on projections for 1987. By the time the incinerator facility is in operation, approximately 2,500,000 liters (650,000 gallons) of liquids and 6,500,000 kg (14,300,000 lb) of solids will already be in storage. Much of the solid material will consist of top soil to be extracted from a former waste oil landfarm. The soil contains PCB and will be handled as a hazardous material. Most of the stored materials will be located at either the Oak Ridge Gaseous Diffusion Plant or at the Y-12 Plant.

Of the annual quantity of PCB contaminated materials requiring disposal, it is estimated that approximately 14 percent will come from the Paducah Gaseous Diffusion Plant, 9 percent from the Portsmouth Gaseous Diffusion Plant, 64 percent from the ORGDP, and a total of 13 percent from the Y-12 Plant and ORNL. Approximately 81 percent of the annual quantity of non-PCB materials will come from the three Oak Ridge facilities, with

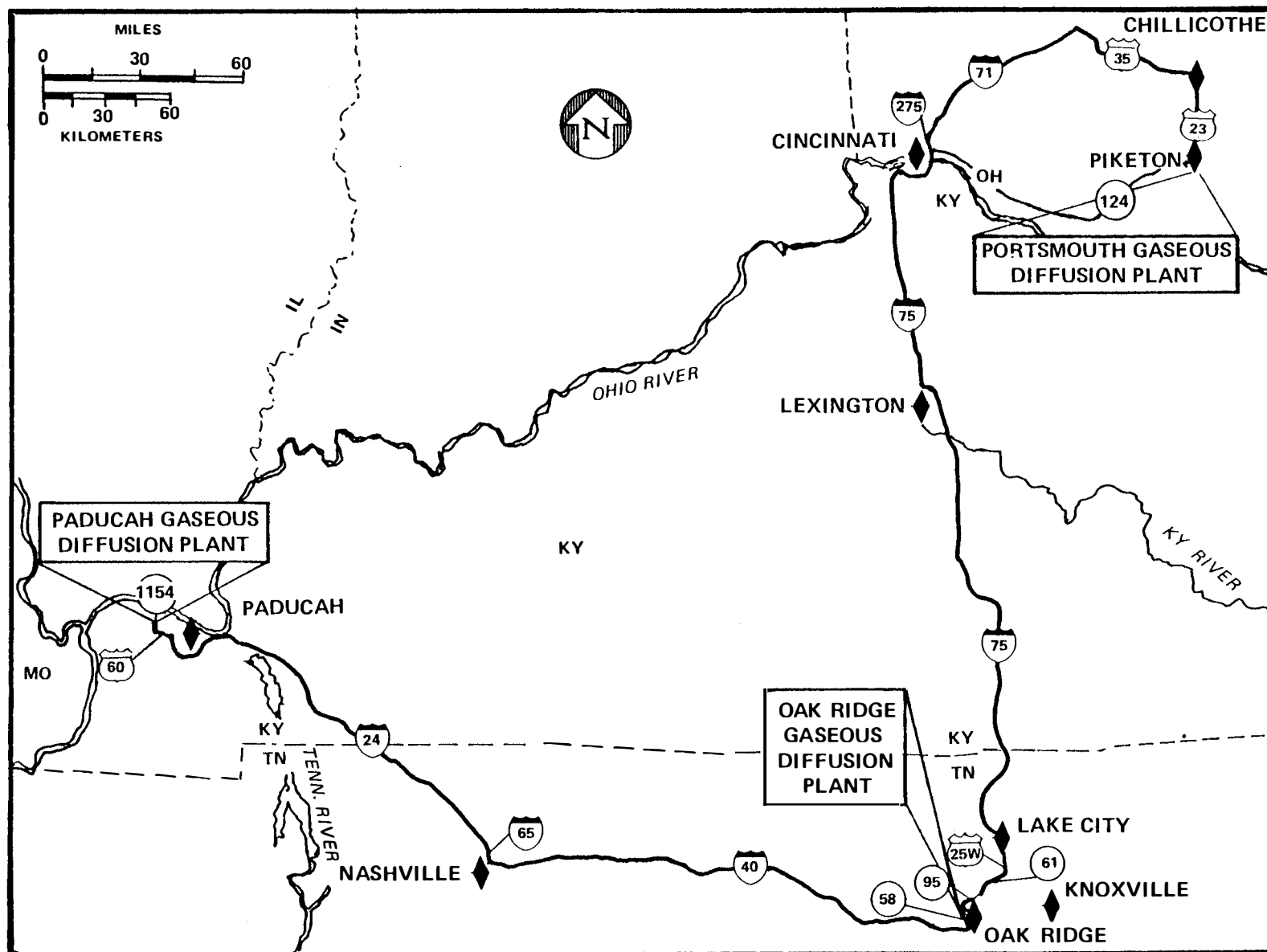


FIGURE 2-3. PROPOSED ROUTES: PIKETON, OHIO, AND PADUCAH, KENTUCKY ORGDP

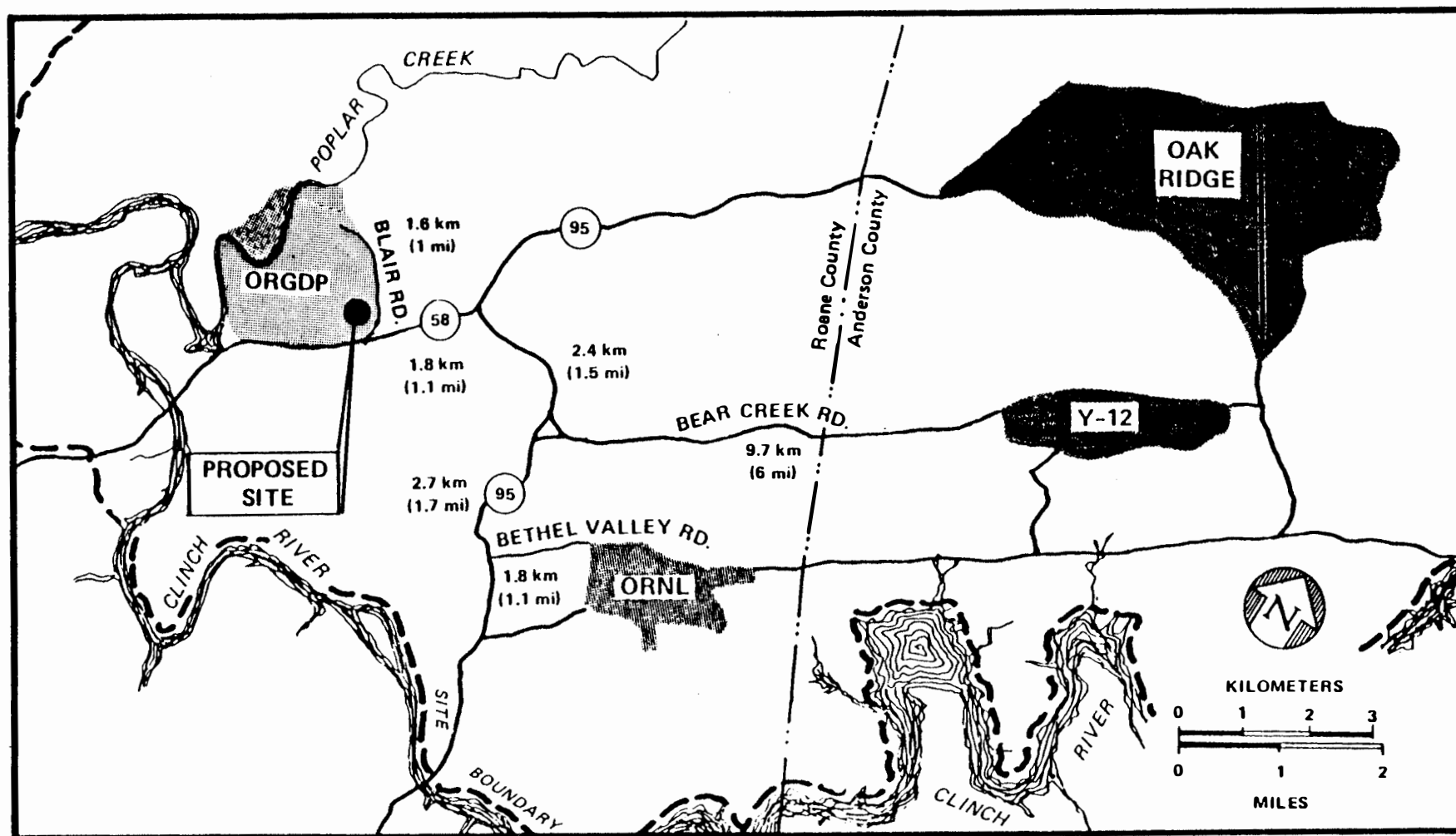


FIGURE 2-4. PROPOSED ROUTES: Y-12 PLANT AND ORNL TO PROPOSED SITE

approximately 11 percent from the Paducah Gaseous Diffusion Plant and 8 percent from the Portsmouth Gaseous Diffusion Plant. These estimates are derived from the detailed waste materials inventory in the Conceptual Design Report (K/D-5222).

2.1.1.4 Characterization of Waste Materials. Only general descriptions are currently available for the future waste materials from the five DOE facilities. The most recent description of the waste materials to be handled by the proposed incinerator is indicated in Table 2-1.

Approximately 1.6 percent of the estimated annual quantity of waste material that will require disposal, will be PCBs (see Appendix A). This value represents the probable maximum PCB content of the total waste

TABLE 2-1 WASTE MATERIALS INVENTORY

<u>Waste Name</u>	<u>Annual Rate 1987</u>	<u>Stored Quantity (1987)</u>
	<u>liters/year</u>	<u>liters</u>
Liquid PCB ^a	11,800	80,440
PCB contaminated oils and solvents ^a	53,500	1,110,000
Waste oils	122,500	550,000
Waste oils ^b	324,000	425,000
Waste solvents	160,000	131,000
Waste solvents ^b	12,000	90,000
Miscellaneous wastes (sludges, degreaser, photographic wastes, biological wastes) ^a	146,000	77,000
TOTAL	829,800	2,463,440
	<u>kilograms/year</u>	<u>kilograms</u>
Solid wastes (PCB contaminated) ^a	24,000	6,400,000
Waste Fullers earth ^a	10,900	82,000
Miscellaneous inorganic chemicals ^a	30,000	--

Source: Computations based on K/D-5222.

^a Portions of these materials contain uranium contamination.

^b These materials contain uranium contamination.

material stream. It is also estimated that approximately 35 percent of all liquid wastes are contaminated with uranium. The maximum concentration of uranium identified in presently stored wastes is 10,000 ppm. However, the average concentration of uranium in the total liquid material inventory will be less than 200 ppm.

Once operations commence at the incinerator, stored PCB contaminated materials will be incinerated preferentially over other materials. If the excess capacity of the incinerator were utilized to incinerate only PCB contaminated wastes in storage, the estimated average PCB concentration of the incinerator feed stream during this operation would be approximately 3.4 percent. The estimated average PCB concentration in the total quantity of stored waste material is approximately 2.34 percent.

Waste materials containing greater than one percent U-235 relative to the total uranium content (i.e., fissile uranium) will not be transported to the proposed facility. The treatment or disposal of such wastes is not a part of the proposed action and is beyond the scope of this environmental impact statement.

2.1.1.5 Receiving and Storage. Waste materials will be received in a 15,000 liter (4,000 gallon) tanker or in an enclosed van. In addition to wastes, raw materials necessary for plant operation and maintenance will also be handled in the receiving area. The materials received in the receiving area include:

- PCB contaminated materials (liquid and solid)
- Waste materials not contaminated with PCBs (other liquid organic wastes)
- Direct burn materials (nonhazardous waste oils and solvents)
- Fuel oil
- Caustic for use in the off-gas scrubbers

The receiving area will be curbed or diked as a means of spill control, with sumps within the dikes being used to collect spilled materials. The collected materials will be analyzed for PCBs and other hazardous constituents, and treated or incinerated as necessary. Water collected in the dikes will be carbon treated if necessary to remove the organics and then discharged to the

K-1700 outfall (see Figure 2-1). Sorbent materials and activated carbon used in the clean up process will be fed to the incinerator for destruction. In the event that the sorbent materials are unable to remove organic contaminants such as PCBs, the contaminated wastes and other materials will be injected directly into the incinerator.

All waste materials will be sampled and analyzed to determine the characteristics of interest. The materials will then be transferred by separate pumps into six different receiving tanks, according to the following types:

- Concentrated PCB wastes
- Dilute PCB wastes
- Aqueous PCB wastes
- Non-PCB wastes for the primary burner
- Non-PCB wastes for the secondary burner
- Non-PCB aqueous wastes

Concentrated PCB wastes will be primarily the dielectric material extracted from failed PCB transformers. Dilute PCB wastes will be materials containing less than 500 ppm PCBs, such as mineral oil from PCB contaminated transformers. Each receiving tank will have a storage capacity of 19,000 liters (5,000 gallons), an agitator, and high pressure rupture disks and flame arrestors. All tanks will be nitrogen blanketed.

Palletized drums of waste materials will be unloaded from the trucks and taken to the drum storage area where the individual drum contents will be checked for agreement with the data provided to the incinerator administrative personnel before shipment. Drums verified as containing solids will be taken directly from the drum storage area and dumped into the incinerator shredder. Drums containing liquids will be moved from the storage area and the contents pumped into tanks. Facilities will be available for emptying PCB and non-PCB containing liquids from drums into separate tanks. The drum dumping area will be adequately ventilated to prevent accumulation of vapors and will have curbs designed to contain a minimum of 200 liters (55 gallons) of liquids in the event of a spill. The liquids will be removed from the drums by a device which will open and drain the drum, but retain any solids in the drum. The drum unloading station will provide maximum containment and ventilation to minimize the risk of accidental release and worker exposure to hazardous

chemicals. Explosive "blow-out" panels will be provided at the drum dumping stations as a safety precaution.

From the receiving tanks, liquids will be transferred by pumps to a storage tank farm. The storage tank farm will handle liquids in the six categories identified above. Primary wastes are those which will be fed into the primary combustion chamber of the incinerator and secondary wastes are those which will be fed into the secondary chamber. The storage capacity of the tank farm will be 114,000 liters (30,000 gallons). A 7,500 liter (2,000 gallon) storage tank will also be available for storage of No. 2 fuel oil. The No. 2 fuel oil can be used during start-up and shut-down operations, or as needed to maintain the required incineration temperatures.

2.1.1.6 Blending. Liquids from the storage tanks will be transferred to the blending tanks prior to incineration. The blending tanks will facilitate the formulation of three categories: primary wastes (including all nonaqueous liquid PCB wastes), secondary wastes, and aqueous wastes. The primary and aqueous wastes will be pumped to separate burners on the rotary kiln while secondary wastes will be fed to the secondary burner. The blending tanks will be refilled about once each week. The contents of each tank will then be analyzed and an appropriate rate of waste feed to the incinerator will be determined to ensure smooth operation and complete combustion. The blending operation will help maintain a relatively constant chloride concentration and heat input into the primary and secondary combustion chambers. General guidelines are that liquids to be burned in the primary combustion chamber to ensure smooth operation and complete combustion (the rotary kiln) will have a heat value of 16×10^6 J/kg (7000 Btu/lb) or greater and those fed into the secondary combustion chamber will have a heat value of 23×10^6 J/kg (10,000 Btu/lb) or greater (K/D-5222). The organic chloride content of the wastes fed to the incinerator will be maintained below 30 percent by weight. The average chloride content of the total waste material inventory is approximately 17 weight percent.

Blending of some waste materials can result in violent reactions such as explosions. A preliminary review of the projected waste profile for this incinerator has not revealed any potential blending problems. This will be mitigated by compatibility testing which will consist of the blending of small

quantities in controlled laboratory equipment to verify that problems do not exist.

Solids which also contain liquids will have the liquids decanted in the drum handling area. The liquids will then be transferred to a 600 liter (150 gallon) holding tank and later transferred to the storage and/or blending tanks. The remaining solids will be moved to a solids storage area prior to being fed into the incinerator shredder. Solid waste materials, empty drums and drums containing only solids will be fed directly to a low-speed, high-torque shredder which will charge a conveyor leading to the incinerator feed chute. Administrative controls will be utilized to prevent free liquids from entering the shredder and flowing onto the conveyor since they could flow directly into the incinerator and cause a flashback.

All liquids will be filtered prior to entering the receiving tanks and the cake from the filters will be treated as a solid waste material and incinerated.

2.1.1.7 Rotary Kiln and Incineration Process. Liquids and solids will be fed to the incinerator from the blending tanks, the solids shredder, or from a tanker containing only flammable liquids. Direct burn materials will be combustible materials which can be safely and conveniently transferred from a tanker into incinerator without further processing. Solids and PCB containing liquids will be fed to the rotary kiln section of the incinerator and non-PCB combustible liquids will be fed into the incinerator afterburner. Some PCB containing liquids may be burned in the afterburner when the rotary kiln section is not in operation.

2.1.1.7.1 Rotary Kiln. The first stage of the incinerator will consist of the rotary kiln which will be used to destroy the organic waste materials in both solid and liquid wastes (see Figure 2-5). The rotary kiln will be a 2.5 m x 6 m (8 ft x 20 ft) refractory lined rotating cylinder. Enough residence time will be provided in the kiln to completely volatilize and thermally degrade the liquid components of the waste and oxidize the remaining pyrolyzed char to ash. The rotating action of the kiln will continuously advance and expose unburned materials to oxidizing gases thus assuring complete destruction of the organic content of the solids. The kiln will operate

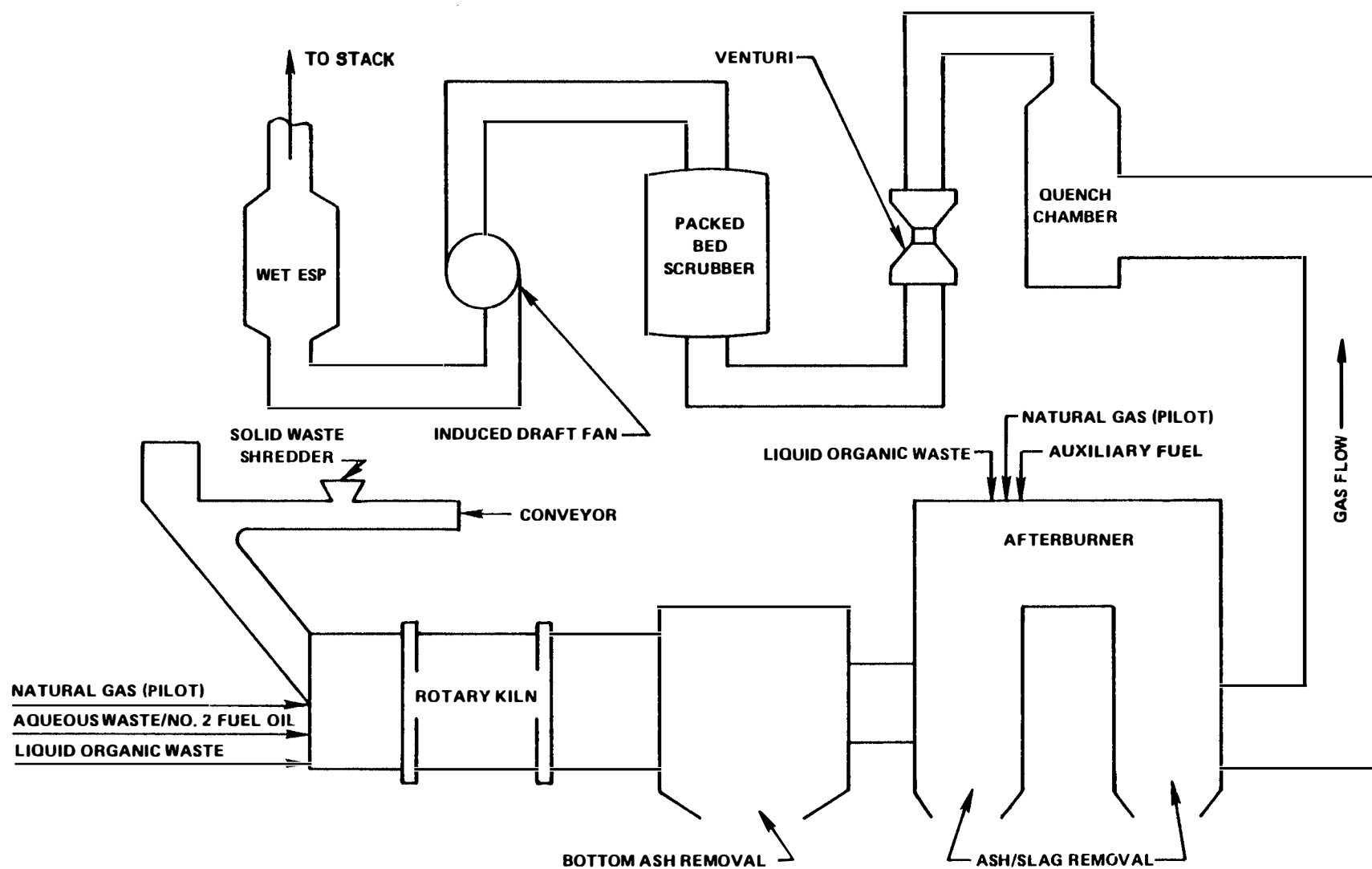


FIGURE 2-5. PROPOSED ORGDP INCINERATOR SYSTEM

at a temperature of approximately 1000 C (1800 F) at 30 percent excess air (3 percent O₂) in the flue gas.

The solids fed into the incinerator will be manually controlled by the facility operator. From the shredder, material will fall onto a feed conveyor which will discharge into the rotary kiln. The shredder will be capable of shredding entire drums and their contents, as well as empty drums. The shredding operation can be expected to reduce a drum to pieces of metal approximately 2 cm x 20 cm (1 in x 8 in). An induced draft fan will maintain sub-atmospheric pressures in both the kiln and in the solids feed system. This will minimize the release of vapors from the feed system and of combustion gases from the incinerator.

Primary waste liquids and liquid PCBs will be fed to the incinerator through a master kiln burner. These liquids will provide most of the heat input into the incinerator. If no PCBs are available for blending with the primary wastes, then these wastes may be fed either to the kiln master burner or directly to the afterburner. The kiln also will have a burner capable of handling aqueous wastes that must be incinerated. The aqueous wastes that will be incinerated may be emulsified with waste oil to produce a high heating value liquid which will have stable burning qualities. The flowrate of materials fed through the aqueous burner will be adjusted according to the ability of the kiln master burner to maintain kiln temperatures. Fuel oil can also be fed through this burner if the materials being fired through the kiln master burner are insufficient to maintain kiln temperature. The mass balance of liquid and solid materials to be fed into the incinerator is shown in Table 2-2.

The blended liquid wastes fed into the kiln will have a heat value of 16×10^6 J/kg (7,000 Btu/lb) or greater (K/D-5222). To ensure stable combustion, natural gas or propane pilot flames will be in continuous operation while material is fed to the incinerator.

The incinerator will start up and shut down on either a fossil fuel, such as No. 2 fuel oil, or a clean (non-PCB containing) combustible waste material, such as kerosene. Materials containing PCBs or other hazardous chemicals will be fed into the incinerator only after the entire incinerator has achieved stable design operating conditions.

TABLE 2-2. ESTIMATED INCINERATOR MASS BALANCE

	Average Feed Rates ^a		
	Rotary Kiln	Afterburner	Total
Liquid organic	85.4	85.4	169.9
Aqueous	4.2	0	4.2
Dirt	181.0	0	181.0
Solids refuse	12.3	0	12.3
Steam	--	--	42.2
Air ^b	2310.0	1150.0	3460.0
Total liquids in			174.0
Total solids in			194.0
Total mass in			3828.0
Total PCBs in (est.)			9.75
Total solids out			115.0

383.6

427

Source: Computed from K/D-5222.

^a Kilograms per hour.

^b This is approximately 30 percent excess air (3 percent O₂) at the maximum design firing rate. Additional air will make its way into the incinerator through seals and expansion joints.

The ash from the rotary kiln will be discharged at the opposite end of the unit into an ash bin where it will accumulate and subsequently be removed batch wise. The combustion gas will leave the rotary kiln and enter the two stage afterburner.

2.1.1.7.2 Afterburner. The afterburner, or secondary combustion chamber, will complete the incineration process by raising the gas temperature to 1200 C (2200 F) through the combustion of high heat value waste and/or fuel oil. The secondary master burner will accept wastes that are pumped from the

secondary waste blending tank. However, this burner also will be able to accept wastes from the primary waste blending tank, the fuel oil tank, or direct burn wastes from a tanker. The secondary master burner will provide the heat input to raise the afterburner temperature to the required level. An auxiliary secondary burner will be used to maintain temperatures within the afterburner in the event that the secondary master burner is unable to provide the required heat input. The residence time in the afterburner section will be approximately 4 seconds. The total excess air level for the incinerator will be approximately 70 percent (7 percent O_2). These combustion conditions are adequate for the destruction of liquid PCBs, as outlined in Federal regulations (40 CFR 761.40, Subpart E). Ash or slag boxes will be placed at the base of the afterburner to remove material that may deposit on the walls.

An emergency draft stack will be provided at the outlet of the secondary combustion chamber and will vent combustion gases to the atmosphere in the event of an induced draft fan shutdown or if there is an interruption of the water feed to the quench chamber. This will prevent damage to the scrubber system during an interruption of quenching and avoid a backward flow from the incinerator during shutdown of the induced draft fan. When the emergency stack is utilized, all waste material and fuel feeds to the incinerator will be discontinued automatically.

In the event that it is undesirable to operate the rotary kiln, the afterburner may be utilized alone as a liquid waste incinerator.

The incinerator will have an average firing capacity of 6.3×10^9 J/hr (7.5 million Btu/hr). Based upon the average waste material destruction rates and the annual waste material removal rates (see Table 2-3), the facility will be operational for approximately 4,320 hrs/yr (180 days at 24 hrs/day). However, to eliminate waste materials that will have accumulated in storage by the time the facility is completed (1987), the incinerator will operate at close to the design maximum rating of 7.9×10^9 J/hr (7.5 million Btu/hr) for 7,300 hours annually. This will allow stored waste materials to be burned off in a period of three to four years, after which the incinerator will be operated at the lower rate indicated above.

2.1.1.7.3 Controls and Monitors. The combustion gas leaving the afterburner will be monitored for temperature, carbon monoxide concentration,

TABLE 2-3. WASTE REMOVAL AND DISPOSAL RATES

	<u>Liquid Waste Materials</u>	<u>Solid Waste Materials</u>	<u>Total</u>
1987 annual generation rate (kg/yr)	819,000	34,900	854,000
Incinerator average design disposal rate (kg/yr)	1,300,000	1,400,000	2,700,000
Time required to dispose of annual wastes (months) ^a	7.6	0.3	7.6
Incinerator maximum design disposal rate (kg/yr) ^b	1,600,000	1,400,000	3,000,000
1987 stored wastes quantity (kg)	2,300,000	6,500,000	8,800,000
Number of years required to dispose of stored wastes while handling annual wastes			
maximum design rating ^c	2.95	4.80	4.80
average design rating ^d	4.78	4.80	4.80

Source: Computed from K/D-5222 and Table 2-1.

^a Assumes 24-hr operation.

^b The maximum heat input rate is approximately 25 percent greater than the average design rating. Based upon this relationship, the maximum waste input rates are assumed to be 25 percent greater than the average waste input rate.

^c Assumes 7,300 hrs annual operation at the maximum design rating of 1,600,000 kg/yr for liquids and/or 1,400,000 kg/yr for solids.

^d Assumes 7,300 hrs annual operation at the average design rating of 1,300,000 kg/yr for liquids and/or 1,400,000 kg/yr for solids.

carbon dioxide concentration, and oxygen concentration. Temperature, carbon monoxide, and oxygen will be monitored on a continuous basis and carbon dioxide will be monitored intermittently. Also, the rate and quantity of PCBs fed to the combustion system will be determined at regular intervals of no longer than 15 minutes.

The flow of PCB materials to the incinerator will automatically stop when any of the following conditions occur:

- Operating temperature of the secondary burner falls below 1200 C
- Failure of monitoring equipment for O₂, CO, and CO₂
- Failure of feed rate and quantity measuring equipment
- Excess oxygen in the stack falls below 3 percent.

The incinerator must also meet certain performance standards established in Federal regulations (40 CFR 761 and 40 CFR 264.343):

- Combustion efficiency of 99.9 percent of carbon converted to carbon dioxide
- Destruction and removal efficiency of 99.99 percent for hazardous wastes other than PCBs
- Emission of no more than 1 mg PCB/kg PCB in solids feed stream.

Continuous monitoring devices will only be able to detect normal products of combustion such as CO, O₂, and CO₂. Special effluent sampling arrangements will be made to measure the efficiency of the incinerator for destroying PCBs and other hazardous wastes. Information from these measurements will be used by ORGDP operating personnel and the regional administrator of the EPA for an evaluation of the performance capabilities of the incinerator.

2.1.1.8 Emission Controls. The combustion of the described waste materials will result in a flue gas containing a few tenths of one percent of hydrochloric and much smaller amounts of other acid gases together with some suspended particulate matter. The flue gas cleaning system will remove the acids and particulates from the gas stream and collect them in water and caustic solutions which will be treated as described in Section 2.1.1.10 before being released.

The hot gases from the secondary combustion chamber will be contacted with water sprays in a brick lined quench chamber. As the water evaporates, it will cool the gases to about 82 C (180 F) and saturate them with water vapor. More water will be used in the chamber than is required to cool the

gases. The surplus will collect some of the more soluble acid gases and the larger particulates and will cause most of the acid anhydrides and volatile metals to condense as fine particulates that can be removed at a later stage of the process. The excess water will drain into a scrubber sump for recycle.

The cooled and partially cleaned flue gas will be further cleaned in a scrubber system consisting of a venturi scrubber and a packed scrubber-entrainment separator. In the venturi, the gases will be contacted with alkalinized recycled water at a high velocity. At the design pressure drop of 30 inches of water (1.1 psi), most of the remaining acid gases and particulates down to submicron sizes will be removed. The flue gas/entrained water mixture then will pass through a packed bed scrubber where it will be contacted with neutralized recycle water for additional removal of soluble acid gases such as HCl and HF. Upon exiting the scrubber, entrained water will be removed by a mist eliminator. The recycle water will drain from the packed bed scrubber to the scrubber sump where it will mix with water from the quench chamber and be recycled to the two units.

A centrifugal fan will then propel the gas to a wet electrostatic precipitator which will utilize a high intensity electrostatic field to collect most of the remaining particulates in a stream of recycled water. The cleaned gas will then be vented to the atmosphere.

The overall removal efficiency of the flue gas cleaning system is described in Section 4.1.1 and is expected to be as follows:

Hydrochloric Acid	99.5%
All Acids	99.2%
Particulates	97.3%.

2.1.1.9 Solid Waste Management. The major solid waste produced by the incinerator system will be the kiln ash, since all containers, contaminated trash, spent activated carbon from waste water treatment and other process generated wastes will be shredded and incinerated in the kiln. This ash is expected to be mainly dirt contaminated with metal from the drums and metallic ash from the liquid wastes. It will fall out of the end of the rotary kiln into a water filled ash trough from which it will be conveyed to a portable container. Small amounts of ash solids removed from strainers in the

recirculated scrubber water lines will be drummed for disposal. All ash will be sampled and analyzed for PCBs. Any ash containing unacceptable levels of PCBs or other hazardous organic wastes will be reincidenterated. After the PCB and organic content of the ash has been determined to be within acceptable limits, it will be hauled to an existing low level radioactive waste disposal site located on the Oak Ridge Reservation.

2.1.1.10 Liquid Effluent Controls. The effluent control system is designed to collect, check, treat with activated carbon if necessary, and transfer the aqueous process wastes to an existing treatment facility.

Overflow water from the ash trough will flow into one of the two sections of a sump. Each day the flow will be switched and the filled section analyzed for PCBs. If unacceptable levels of contamination are detected, the water will be carbon treated or sent to an incinerator feed tank to be burned in the kiln. If the organic contamination is within limits, it will be forwarded to the main purge water tank.

Approximately 19 gallons per minute of scrubber water will be purged from the recycle system to control the solids content of the recirculating water. This purge will flow into one of the two sections of the purge water sump. Each day, the flow will be switched and the filled section sampled and analyzed for organic compounds. If unacceptable concentrations of organics are found, the water will be pumped to one of two surge tanks from which it will be pumped through an activated carbon column to remove the organics and into the second surge tank. Water which has only acceptable levels of organics will also be pumped to the second surge tank.

Water which is acceptable for transfer will be pumped to the existing K-1407A neutralization facility where aqueous wastes from several areas are neutralized and settled before discharge. Fire water and rain water from the area will be collected in a tank and analyzed. If acceptable, it will be pumped to the K-1700 NPDES outfall; if unacceptable, it will be pumped through an activated carbon bed to a surge tank, reanalyzed, and discharged to the K-1700 NPDES outfall once it is acceptable.

2.1.2 Effluents, Waste Management, and Impacts

The emissions and effluents from the proposed facility have been estimated from design data, or from data from analagous incinerator tests, for an operating rate of 7.9×10^9 Joules (7.5×10^6 Btu) per hour and the scheduled operating rate of 7300 hours per year. These are described in detail in Section 4.1 and summarized in this section.

2.1.2.1 Air Emissions. The emissions of the fifteen regulated pollutants and several nonregulated pollutants have been estimated (see Section 4.1.1). The majority of the emissions originate from the main stack but some fugitive emissions will originate from the tank farm and the drum unloading hoods.

Fugitive organic emissions will be generated from unloading and transferring the volatile solvents which comprise about 15 percent of the liquid waste feed. Since the majority of the liquid waste will be nonvolatile lubricating oils, the fugitive emissions related to their handling and storage are expected to be of low concentrations and widely distributed over the tanks. It is estimated that about 410 kg (900 lb) per year of organics, principally halogenated solvents, will be released from the tank farm. The system design is such that essentially no other fugitive emissions are contemplated.

The air pollutants contained in the combustion products released from the main stack can be divided into three categories: products of incomplete combustion, particulates, and acid gases.

The proposed operating conditions and equipment designs have been selected to maximize the combustion efficiency and to reduce the products of incomplete combustion to a minimum. It is estimated that 0.038 kg (0.084 lb) per hour of low molecular weight hydrocarbons, organic acids and aldehydes and less than 2.6×10^{-6} kg (5.7×10^{-6} lb) per hour of unburned PCBs will be emitted. Very small quantities of hazardous products of incomplete combustion such as polychlorinated dibenzo-p-dioxins, dibenzofurans, and hexachlorobenzene (3.8×10^{-9} , 6.0×10^{-8} , 1.7×10^{-6} lb/hr) may also be released. The planned combustion conditions are expected to also produce about 0.03 kg

(0.07 lb) per hour of carbon monoxide which is considerably below the maximum of 0.27 kg (0.61 lb) per hour permitted by the 99.9 percent combustion efficiency requirement.

Most of the ash constituents in the liquid waste materials and some of those in the solids will be entrained in the flue gases leaving the combustion chamber. Over 97 percent of the flyash will be removed in the three control devices in the flue gas cleaning system leaving about 0.18 kg (0.4 lb) per hour of particulates at a concentration of 0.029 grains per dry standard cubic foot (uncorrected) in the emitted gas. The wastes will contain small amounts of uranium and lead and traces of beryllium so that small amounts of the oxides of these metals will occur in the flyash. Since the average particle size of these oxides is expected to be smaller than the flyash, lower collection efficiencies have been assumed (see Section 4.1.1) and the emissions are estimated at 0.0015 kg (0.0034 lb) of uranium, 0.00045 kg (0.0010 lb) of lead and 0.059×10^{-10} kg (1.3×10^{-10} lb) of beryllium per hour.

The waste materials will contain some organic chlorine, small amounts of fluorine and phosphorus, and a trace of sulfur, principally in the auxiliary fuel. Over 99 percent of the acid gases formed from the combustion of these elements will be removed in the flue gas cleaning system and only 0.14 kg (0.3 lb) per hr of hydrochloric acid and less than 0.02 kg (0.05 lb) per hour of each of the other acid gases will be emitted. In addition to these materials, some nitrogen oxides will be formed by fixation of atmospheric nitrogen in the high temperature regions of the incinerator; about 0.31 kg (0.69 lb) per hour of nitrogen oxides will be emitted.

An analysis of the atmospheric emissions and their impacts can be found in Sections 4.1.1 and 4.2.1.

2.1.2.2 Solid Wastes and Leachates. The major solid waste produced by the facility will be the kiln residue which will result from the dirt, clay, and shredded metal fed into the incinerator plus unidentified ash materials from the combustion of liquid and solid wastes. The residue is expected to consist of about 90 percent dirt and 5 percent ground steel drums plus small quantities of unidentified metallic oxides from the various wastes. The small quantity of uranium in the dirt is expected to result in about 60 mg of

uranium per kg of dry ash. The ash is expected to be essentially free of toxic organics including PCBs. Approximately 1140 dry metric tons (1250 dry tons) of ash per year will be collected in water and tested for PCB contamination before disposal according to standard procedures in an existing low level radioactive waste landfill. Ash containing unacceptable levels of organic contamination will be recycled to the incinerator. A minimal amount of ash will be produced from the scrubber water strainers. It will be drummed and disposed of in the same manner as the kiln ash.

Residue from the incinerator will be disposed of at the existing Y-12 Plant low-level radioactive waste burial site. Any remaining PCB in the waste would be relatively immobile because of its low solubility in water and absorption characteristics. Two toxic metals, lead and beryllium, which could be low-level constituents of the residue are also immobilized in soil. As a result, impact of leachate from the disposal of the incinerator residue is expected to be negligible. A more detailed analysis is presented in Sections 4.1.3 and 4.2.2.

2.1.2.3 Liquid Wastes. There will be three sources of liquid wastes from this facility. Storm and fire water from the diked areas will be collected and analyzed for organic contamination, passed through activated carbon if unacceptably contaminated and discharged into the K-1700 NPDES outfall. The organic content of this water is expected to be negligible.

About 7.3 liters (two gallons) per minute of water are expected to overflow from the ash pit, containing suspended and dissolved solids from the ash. This water will be collected and tested for organic contamination, and treated with carbon or burned in the kiln if unacceptably contaminated. Uncontaminated water will be mixed with the scrubber purge water.

About 72 liters (19 gallons) per minute of scrubber water will be purged from the system to control the buildup of salts resulting from the neutralization of the collected acids. Besides the dissolved salts, it will contain suspended ash particles. The purge water will be collected and tested for organic contamination and treated with carbon if unacceptably contaminated. The purge water will be forwarded to the K-1407A treatment facility. In that facility the water will join approximately 1700 liters (450 gallons)

per minute of aqueous wastes from other facilities. The combined flow will be adjusted to a neutral pH (6-9) and passed through a settling pond; this will remove about 57 percent of the suspended solids. Then it will be discharged into an outfall carrying about 2800 liters (750 gallons) per minute to Poplar Creek.

The contribution of this facility to the outfall is expected to increase its total dissolved solids by 62 percent or 330 metric tons (365 tons) per year and to increase the suspended solids by 24 percent or 11 metric tons (12 tons) per year. Contained in the suspended solids is expected to be about 130 kg (285 lb) of uranium oxide and about 31 kg (68 lb) of lead per year.

2.1.2.4 Noise. Construction and operation of the proposed facility will generate two types of noise, high noise levels in the immediate vicinity of machinery and equipment, and relatively low levels in the surrounding area due to the propagation of the high-level noise. The first is frequently referred to as occupational noise and the second as environmental noise. The impact of the proposed facility on the surrounding environment as a result of noise is expected to be negligible. Sections 4.1.4 and 4.2.4 describe in more detail the noise sources and impacts associated with the proposed action.

2.1.2.5 Effluent Mitigation. Air emissions will be controlled by a three stage flue gas scrubber system. First there will be an aqueous quench which is expected to remove about 40 percent of the particulates and about half of the soluble acid gases. It will be followed by a medium energy venturi and packed scrubber-mist eliminator using alkalized water which is expected to remove about 68 percent of the remaining particulates and most of the soluble acid gases. This is in turn followed by a wet electrostatic precipitator which will remove about 86 percent of the remaining particulates which will include principally fine phosphoric acid aerosols, fine metallic oxide particles and fine salt particles. The overall efficiency of the system is expected to be 99.2 percent for the soluble acid gases and 97.3 percent for particulates. The combination of aqueous and alkaline scrubbing and the use of units with the ability to remove fine particles after those that will remove the coarser particles will provide exceptionally efficient control of airborne pollutants.

The solid waste produced by this facility will be disposed of in an existing radioactive waste landfill according to established procedures. Chemical analysis of each batch of ash will insure against the inadvertent inclusion of toxic organics in the material going to the landfill.

The aqueous effluent from this facility will be tested, treated if necessary, and discharged to an existing waste treatment facility. The facility will adjust the pH of the waste and provide some suspended solids removal before discharging the effluent to Poplar Creek. The analysis of each batch of aqueous waste will insure against the discharge of organic contaminants which will not be removed in the treatment system. DOE has proposed and the Congress has authorized the construction of a new waste treatment facility to replace the existing neutralization and settling ponds (Project 81-OR-16). If the funds for the new treatment facility are appropriated and it is constructed, then the effluents from the proposed incinerator would receive more effective treatment, reducing the discharge of suspended solids into Poplar Creek.

2.1.2.6 Impacts of Effluents on the Environment. A major source of potential impacts upon the environment will be the effluents from the proposed incinerator. Those effluents are described above and in Section 4.1. This section summarizes the impacts of those effluents; a more detailed analysis is presented in Section 4.2.

2.1.2.6.1 Air Quality. The air emissions from the proposed incinerator will result in an insignificant decrease in air quality at the location of the nearest residences in any direction. That is, the increases in concentrations of air pollutants at these locations and points further from ORGDP are expected to be so small as to be insignificant and could not be detected by currently available measurement technology.

2.1.2.6.2 Water Quality. Impacts to water quality in Poplar Creek and in the Clinch River from direct discharge and surface runoff would not be significant. Contaminants identified in effluent discharges are chloride,

sulfate, sodium, suspended particulates, beryllium, phosphates, fluoride, lead, and uranium. The last four contaminants could also be found in surface runoff, as a result of the deposition of airborne emissions. Concentrations of these contaminants would be very low and their effects are expected to be negligible. Organic contaminants, such as polychlorinated biphenyls, hexachlorobenzene, benzofurans, and dioxins, would be released in minute quantities. Their concentrations and effects on the aquatic environment would be even less than those of the other contaminants.

2.1.2.7 Impacts on Public Health. Potential public health impacts stem from the possible exposure of the general public to polychlorinated biphenyls and their degradation products (polychlorinated dibenzodioxins or PCDDs and polychlorinated dibenzofurans or PCDFs), and to low level ionizing radiation. Exposure to each of these is very low, even for the residents of the most exposed dwelling, but the serious nature of the health effects requires a detailed analysis of the potential impacts which is presented in Section 4.5. This analysis is complicated by the uncertainty involved in quantifying the dose-response relationship at such low exposures, and by the fact that standards for public exposures have not been published for PCDDs and PCDFs.

Risk factors derived by the National Academy of Sciences Committee on Biological Effects of Ionizing Radiation for low level radiation were applied to dosage estimates calculated by Oak Ridge National Laboratory to yield an estimate of lifetime risk to the most exposed individual; this estimate was 5×10^{-7} for cancer mortality due to the proposed incinerator. This can be compared to the normal cancer mortality risk of 1.64×10^{-1} for the U.S. population based on current mortality data.

Quantitative risk assessment for PCDDs and PCDFs yielded a lifetime risk of cancer mortality to the most exposed individual of about 8.5×10^{-8} ; this estimate assumes a lifetime exposure to the maximum concentration expected from the proposed incinerator. Such estimates for PCBs were not calculated, since an established dose-response relationship has not been published, but the risk is believed to be small.

Given the negligible change in risks to the most exposed individuals, the overall assessment suggests that the impact on human health due to the proposed plant will be insignificant.

2.1.2.8 Impacts on Occupational Health and Safety. The occupational health and safety programs at ORGDP will be extended to the proposed incinerator facility. The specifics of program administration and responsibilities are presented in Section 4.6.

The review of the preliminary engineering design (K/D-5222) identified various control technologies which should assure the protection of worker health and safety. These control technologies are presented in Section 4.6 and include engineering controls, administrative controls, and worker protection practices. In addition to those controls, a comprehensive health and safety program instituted by ORGDP will incorporate the PCB incineration facility. Any unsafe working conditions within the facility which are identified will be corrected in accord with good industrial hygiene practices.

Several agents which may be encountered at the facility present a potential risk of cancer to workers; these include chloroform, benzene, carbon tetrachloride (ACGIH, 1980) and radionuclides. However, the potential of these agents to produce adverse health effects in workers is a function of the hazard presented by the agent (as determined by a dose-response function) and the potential for exposure to the agent. The control technologies incorporated into the facility design, along with a comprehensive health and safety program as planned, will limit worker exposures to these agents and therefore limit the risk to worker health and safety.

2.1.2.9 Socioeconomic Impacts and Mitigation. The proposed facility will employ only 25 people. As a result, the socioeconomic impact is felt to be insignificant (see Section 4.7). The increase in employment, if all new employees moved in from outside the area and had an average family size of three, would generate a population increase of only 75, which represents 0.05 percent of 1980 population in the study area. Because of this extremely small employment impact, detailed analyses and mitigation strategies pertaining to labor conditions, housing, public finance, utility impact, and other socioeconomic factors are not warranted.

The potential socioeconomic impacts of the construction of the proposed facility are also considered insignificant. The construction will require about 122 man years of labor over a three year period with a peak labor force of about 75. In the labor market of the study area, these personnel should be available and immigration of workers should be insignificant.

2.1.2.10 Impacts of the Maximum Credible Accident. The impacts of the maximum credible accident are described in Section 4.8. The effect of such an accident would be the release of less than 0.1 kg (0.2 lb) PCB and less than 0.15 mCi of uranium. The maximum dose commitment estimated to occur due to the release of uranium would be less than 3 mRem. Some workers would be exposed to PCB concentrations in excess of 1000 ug/m³ for about eight seconds; since this is above the occupational exposure standard, mitigative measures to reduce such exposure and/or to further reduce the possibility of such an accident will be investigated during the actual design of the facility. No other significant impacts would occur as a result of the maximum credible accident.

2.1.3 Accident Analyses

The accident analyses are presented in the Preliminary Safety Analysis Report (PSAR) and reviewed in Section 4.8. The analyses include the safety measures considered sufficient to minimize the probability of accident occurrence and mitigate consequences should they occur.

2.1.3.1 Process Accident. Thorough analysis of possible accidents relating to the proposed plant design was performed in the preparation of the PSAR. While numerous accidents were postulated on the basis of the historic record of operations involved in the storage, handling, and processing of toxic substances, most were eliminated for the proposed facility because of the safety features incorporated into the conceptual design (K/D-5222). Most postulated accidents were determined to be of such little consequence should they occur or of such low probability of occurrence during a 25 year period, that they could be dismissed from further analysis. The only accidents found to have both a potential for occurrence (probability greater than 1 in 10,000

that an event would occur in 25 years, but all were less probable than 1 in 10), and a significant detrimental effect should they occur, were three accidents which would involve fire and/or explosion. Accident No. 1 is a fire in the incinerator shredder which has the potential to produce moderate consequences on the health of the operating personnel. Accident No. 2 is a fire in the liquid receiving, storage, or blending tank; offset consequences would likely be minor for both interior and exterior tank fires. Accident No. 3 is an explosion in the incinerator shredder; the potential consequences of such an accident would be localized, with operating personnel in the surrounding area receiving serious injury or burns. It should be noted that the analysis assumed that a number of safety systems and procedures would have to fail for the accident and its impacts to occur. A more thorough discussion of these accidents is presented in Section 4.8.1.

The adverse consequences resulting from an occurrence of the one three possibly detrimental accidents would be occupational exposures to workers in the immediate vicinity of the incinerator to PCBs, smoke, and uranium. No other significant environmental impacts were identified for these accidents.

2.1.3.2 Transportation Accident. Accidents that could occur during transport of PCB materials include single or multiple vehicle collisions as well as non-collision incidents. These types of accidents could result in failure of the PCB containers. The first two are more likely to produce a severe container failure than is the last.

Factors that typically cause transportation accidents include human error, poor driving conditions, equipment failures, and emergency situations. Based on the small number of shipments, the training and supervision of the individuals involved in transporting the waste materials, and the plan to schedule shipments to avoid bad weather and congested conditions, the potential for accidents will be very small. Should an accident occur during transport of the waste materials, the impact should not be significant. The amount of materials shipped in any vessel will be small, less than 15,000 liters (4,000 gallons); many shipments in the tank trailers will likely be less than full. In addition, should a spill occur, it is also unlikely that all of the contents of a vessel would be released. In the event of a complete

spill of a full tank truck, the maximum amount of PCB which could be expected to be involved would be approximately 8,000 kg (17,000 lb); the amount of uranium involved in such a spill would be less than 3 kg (7 lb).

A spill on pavement or soil would be recoverable, and the availability of a trained and equipped recovery team on call would ensure rapid recovery. EPA studies in a PCB spill area showed no evidence of permanent damage to the environment two years after the spill was cleaned up (EPA 904/9-76-014). A spill into a body of water, although extremely unlikely, would create a more significant problem. Since PCBs are heavier than water, this material would sink to the bottom of the stream, lake or river. Depending upon the characteristics of the particular body of water, recovery may or may not be possible. Unrecovered material would add to the existing burden of PCBs in the environment, estimated to be 68,000,000 kg (150,000,000 lb) in the U.S. (EPA 560/6-76-005). The major impact from free PCBs in the environment is bioaccumulation in the food chain and subsequent deposition in human tissues. The impact of the addition of the small amount of PCBs and uranium to the environment would be an insignificant increase in the cumulative exposure to these substances (and to radioactivity from the uranium). The effects of PCBs and of radioactivity are described in Section 4.5.

2.1.3.3 Accident Prevention Measures. The incineration facility will include several features which will combine to reduce the risk associated with accidents at the proposed facility. These features include monitoring and protection systems, administrative controls, ventilation system, fire protection system, and explosion and pressure safety measures. These are discussed in Section 4.8.3 and Appendix L. With proper adherence to the accident prevention measures, the likelihood of detrimental affects on man and the environment will be minimal.

Accident prevention measures for transportation activities center on the containers to be used. Adherence to Department of Transportation (DOT) regulations regarding container specifications will result in the utilization of drums and tank trucks which will meet or exceed all necessary safety requirements. Safe containers coupled with proper route selection, driver training, vehicle inspection, and careful scheduling will minimize the risk of

both accidents and environmental impact should an accident occur. Should an accident occur in spite of the accident prevention measures, emergency response teams will be available to mitigate and clean up any resulting spill (Long, April, 1981).

2.1.3.4 Spill Containment and Control. Preliminary spill prevention and control plans are being prepared in accord with the Toxic Substances Control Act (Long, April, 1981). Containment dikes will be constructed for the proposed incineration facility to capture any spills and prevent contamination of the soils or water outside the facility. The features and plans are described in more detail in Section 4.8.3 and in Appendix L.

2.2 The No Action (Store and Delay) Alternative

The regulations which implement the National Environmental Policy Act (NEPA; 40 CFR 1500-1508) require that an environmental impact statement (EIS) address the environmental consequences of not taking any action; this is known as the "no action alternative" (40 CFR 1502.14(d)). With respect to the PCB contaminated materials now stored and in service at the five facilities managed by DOE Oak Ridge Operations, the no action alternative is to continue to store these materials indefinitely and to add to storage other PCB contaminated materials as they are removed from service. This action would only delay until some future time the need to dispose of these materials in an environmentally acceptable manner, either until an incinerator facility is constructed or an alternative process is developed and available. This section describes the barriers to indefinite storage and summarizes the impacts of a potential decision to select the no action (store and delay) alternative.

2.2.1 Regulatory Considerations to No Action (Store and Delay)

The regulations which implement the Toxic Substances Control Act (TSCA; 40 CFR 761) place definite limits on the length of time that PCBs and PCB contaminated materials may be stored before their disposal. Under these regulations, PCB contaminated material stored prior to January 1, 1983 must be

removed from storage and disposed of through an approved method before January 1, 1984. Further, PCB contaminated material removed from service and stored after January 1, 1983 must be disposed of within one year from the date when it is placed in storage. Selection of the no action (store and delay) alternative would delay disposal of these materials beyond the time projected for the proposed action and until a method of disposal could be implemented and the backlog of stored PCB contaminated materials in storage could be processed. Under the no action alternative, DOE would not show a clear intent to operate in accord with the intent of TSCA and the regulations at the earliest possible time.

2.2.2 Requirements for Management of PCB Materials

When placed in storage prior to disposal, PCB contaminated materials will be stored in accordance with the EPA regulation (40 CFR 761). In addition, containers used to store and transport liquid PCB materials will comply with the specifications of the Department of Transportation (49 CFR 173.346). These regulations, together with prudent management to protect the environment from further PCB contamination, require a number of precautions during storage and the handling of the material prior to and during storage. These precautions would require the construction of additional facilities, the employment of personnel, and a number of other actions. Some examples of the necessary precautions include:

- Employees trained to reduce the number of errors that often cause spills;
- Inspection procedures;
- Secondary containment for the storage areas to contain any spilled PCB liquids that may otherwise contaminate surface and ground water resources;
- Spill cleanup equipment provided and maintained;
- Sufficient security for PCB storage areas;
- Spill prediction model identifying such parameters as flow and direction; and
- Records established and maintained.

The no action alternative would require the construction and operation of larger such facilities for a longer period than would the proposed action.

2.2.3 Impacts of the No Action (Store and Delay) Alternative

Selection of the no action (store and delay) alternative would result in a number of impacts upon the environment, which are described in more detail below. These derive from two types of sources. First, the no action (store and delay) alternative would result in increased impacts due to prolonged storage of larger amounts of the PCB materials. Second, the no action (store and delay) alternative would result in the necessity for DOE to implement, at a later date, some method of disposal and incur the impacts associated with that disposal method.

2.2.3.1 Effluents from Storage. The probability of a spill occurring within a properly designed and operated storage facility is small, if the waste PCB materials have been packaged and stored according to EPA guidelines. However, the chance of the accident occurring always exists and the risk increases with the volume stored and the length of storage. Effluents could result from fires, explosions, and vandalism, as well as from handling and leaks or spills.

Effluents from the store and delay alternative would be liquid, gaseous, and solid materials. Gaseous emissions would result from volatilization of spilled or leaked PCBs and redrumming of deteriorated drums. Solid wastes would include deteriorated or leaky drums, sorbent materials used to clean up spills, and other materials (such as soil) contaminated as a result of spills or leaks. Fire and storm water from diked areas could contain traces of PCB and other organics picked up from leaked or spilled waste materials.

The effluents from the no action alternative would not be significant unless a major spill or leak occurred. However, disposal of these stored materials must ultimately occur, and emissions and effluents will be attendant to the selected method of disposal. For example, if the proposed action is selected as the method, then the effluents would be the same as those described in Section 4.1.

2.2.3.2 Impacts of Effluents on the Environment. The no action (store and delay) alternative was examined for potential impacts on the environment. The environmental impacts are insignificant unless a major spill or leak occurs. It is assumed that the PCB waste material is stored in accordance with EPA regulation (40 CFR 761).

2.2.3.2.1 Air. The no action (store and delay) alternative was examined for the potential impacts on the air environment. Generally, gaseous emissions would enter the atmosphere when minor leaks or spills and redrumming occurs. These emissions would have an insignificant impact on the air quality. However, in case of a major spill, air contamination would occur, resulting in dispersal of the waste materials into the environment, increasing the exposure of humans to these materials.

2.2.3.2.2 Water. The alternative of continued storage of the waste material was evaluated for potential impacts on the water environment. Depending on the length of time that storage would be anticipated, a regular program of facility maintenance with transfer of contaminated material from drums of questionable integrity to new drums can be expected. Transfer would take place in an enclosed area with precautions such as curbs or dikes and a spill control program to prevent the inevitable accidents from affecting areas outside the building where the material is stored.

Very small amounts of contaminants would be emitted to the atmosphere during redrumming. These would have an insignificant effect on water quality.

In the case of a major spill, the water contamination scenario would depend upon the volume of the spill and its location. The potential for significant impact on the quality of surface and groundwater could exist, but such contamination would not be expected to occur. Contamination of water resources would eventually expose the human population to increased amounts of the chemicals and radionuclides involved.

2.2.3.2.3 Occupational and Public Health. The potential for exposure of workers to PCBs or other chemicals from the no action (store and delay) alternative would be dependent upon the frequency and severity of

spills, the frequency of redrumming and the personal protective equipment and mitigative measures employed. If EPA and NIOSH guidelines are followed, occupational impacts would likely be insignificant.

Public health impacts from the no action (store and delay) alternative would likely be insignificant unless a major spill occurs. The impact of a major spill would be the exposure of human population to increased doses of the chemicals involved; the effects of such exposures are addressed in Appendix J.

2.2.3.3 Other Waste Materials. In addition to the PCB contaminated materials now in storage and in service, the proposed action would result in the disposal of other hazardous organic wastes and PCB contaminated soil from a former waste oil land farm. The present management of these materials would continue under the no action alternative. Non-PCB waste materials would be stored and continue to stockpile with the problems associated with such storage. Waste oil containing less than 5 ppm PCBs would continue to be land-farmed. The former waste oil landfarm area would remain in place, and the environmental impacts associated with the PCB contaminated soils would continue. These impacts include the release of chemicals into the environment with eventual increase in human exposure to such chemicals; the effects of exposure are discussed in Appendix J.

2.2.3.4 Summary of Impacts. With the no action alternative, the projected outlay of 30 million dollars for the proposed action is avoided as well as the environmental impacts of the proposed action. However, the savings are temporary, since costs and impacts will be incurred when an ultimate disposal method is selected.

The environmental effects of the no action alternative would be negligible unless a major spill or leak occurs. However, ultimately, disposal of the PCBs must occur and the environmental effects would be attendant to the disposal method used. Thus the no action alternative would not avoid impacts upon the environment, but would delay those impacts while increasing the risk of accidental release from storage and the impacts associated with such release. The primary impact would be increased exposure of the human population

to the chemicals and radionuclides involved and to the health effects of such exposure.

2.3 Chemical Destruction Alternatives

. As alternatives to the proposed incineration methodology, other means of disposing of the waste materials were examined. The alternative methods that were deemed most appropriate are generally labelled as chemical destruction methods. There are a variety of chemical processes that are available to treat different types of waste; however there are very few chemical processes presently identified as being capable of disposing of PCBs, and none has been approved by EPA for general use in destroying PCBs. All of these processes operate at moderate temperatures (less than 500 C) to thermally or chemically degrade the PCB or other wastes. It is uncertain if any chemical process can be used to degrade PCBs in the presence of other chlorinated substances which exist in the waste stream.

Appendix C presents an evaluation of the processes most likely to have the disposal capabilities needed and the prospects of commercial demonstration by 1985, together with an assessment of probable impacts. The process for PCB and other waste disposal will be required to be commercially available in 1985 in order for a facility to be constructed at ORGDP by 1987. This factor eliminates many widely discussed concepts for the destruction of PCBs, since most such processes are at an early stage of development and will not be available in the foreseeable future for the types of wastes in the waste materials inventory at the five DOE Oak Ridge Operations facilities.

Three candidate processes were examined: the SunOhio PCBX process, the Goodyear sodium naphthalide process, and wet air oxidation. As described in Appendix C and shown in Table 2-4, none of the processes had the demonstrated capability to dispose of the entire inventory of organic waste materials generated and stored at the DOE facilities. In particular, none of the processes has been demonstrated to destroy or remove PCB and organic contamination in solids and soils, or to destroy PCBs in the presence of volatile organic solvents and water. Thus, none is presently known to represent an alternative to destruction by incineration for the entire waste inventory.

TABLE 2-4. TECHNICAL COMPARISON OF CHEMICAL DESTRUCTION ALTERNATIVES WITH PROPOSED ACTION

<u>Technical Issue</u>	<u>Alternative</u>			
	<u>PCBX^a</u>	<u>Sodium Naphthalide</u>	<u>Wet Air Oxidation</u>	<u>Proposed Incinerator</u>
Will the process degrade PCBs in oil?	Yes	Yes	No	Yes
Will the process effectively degrade PCBs in the presence of chlorinated organic compounds	Unknown	Likely	No	Yes
Will the process effectively degrade PCBs in the presence of water?	Unknown	Unlikely	No	Yes
Will the process degrade PCBs and other organics in solids and soils?	No	No	No	Yes
Does the process require toxic or hazardous materials?	Unknown	Yes	No	No
Are byproducts or process wastes likely to be toxic or hazardous organic substances?	Yes	Yes	Yes	No
Will the process require a secondary process to destroy or degrade process water?	Likely	Yes	No ^b	No
Will the process result in an increase in the volume of uranium contaminated materials requiring disposal?	Likely	Likely	No ^c	No

Source: Derived from Appendix C.

- a. The PCBX process is proprietary and less well known than the other processes; however, this column represents an assessment based on available information.
- b. PCB destruction has not been demonstrated; oxidation of high molecular weight compounds may produce low-molecular weight hazardous or toxic organics.
- c. If sodium or another chlorine scavenger were added, there would be an increase.

The probable impacts of the three processes were compared, assuming that each could either destroy or decontaminate the entire waste materials inventory. Because the processes are not well known and much of the information on the PCBX process is proprietary, a number of assumptions were required. However, these assumptions are believed to reasonably represent the likely impacts of each process if it were capable of disposing of the entire waste materials inventory. The result of this comparison is shown in Table 2-5. It may be seen that each of the candidate processes is likely to have a more significant negative impact on the environment, given the waste inventory involved.

TABLE 2-5. SELECTED IMPACTS EXPECTED FROM CHEMICAL DESTRUCTION ALTERNATIVES, COMPARISON TO PROPOSED INCINERATOR

<u>Impact^a</u>	<u>Alternative</u>		
	<u>PCBX^b</u>	<u>Sodium Naphthalide</u>	<u>Wet Air Oxidation</u>
Air Emissions:			
Organic Compounds (unless incinerated)	Unknown	Larger	Larger
Particulates and Metals	Smaller	Smaller	Smaller
Acid Gases	Unknown	Unknown	Larger
Liquid Effluents:			
Total Dissolved Solids	Unknown	Larger	Unknown
Organics	Unknown	Larger	Unknown
Thermal Effects	Larger	Larger	Unknown
Solid Wastes/Sludges	Larger	Larger	Same
Worker Exposure to Toxic and Hazardous Chemicals	Same or Larger ^c	Larger	Larger
Volume of Radioactive Mate- rials Requiring Management	Larger	Larger	Same or Larger

Source: See text and Appendix C.

^a Based on assumed operating characteristics of the processes from available literature; see text.

^b The PCBX process is proprietary and less well known than the other processes; however, this column represents an assessment based on available information.

^c Depends upon chemicals which are used; these are proprietary to Sun Ohio.

Thus, the chemical processes likely to be available for implementation by the start of construction of the proposed facility do not meet the technical requirement of the disposal of the entire waste inventory. In addition, if they were capable of meeting these requirements, each would probably result in more significant negative impacts on the environment.

2.4 Alternative Routes

Alternative routes for the shipment of wastes from Paducah and Piketon are described and analyzed in Appendix B and are presented here only briefly. From Piketon to ORGDP, Interstate 75 is the only feasible route for much of the distance; alternatives only exist between Piketon and the Interstate 75 -- Interstate 64 interchange near Lexington, KY, and between Lake City, TN and ORGDP. These alternatives are presented in Figures 2-6 and 2-7. From Paducah to ORGDP, the only feasible route is the proposed route, except from the interchange of Interstate 40 and TN 58 to ORGDP; Figure 2-8 presents the alternatives for this segment of the route.

These alternatives were compared with the proposed route in terms of a number of criteria, as described in Appendix B. These criteria included the percentage of limited-access four-lane divided highway, the overall distance, the number of streams, lakes, and rivers crossed, and the number of metropolitan areas through which the route passes. Table 2-6 presents a summary of the advantages and disadvantages of each of the alternative route segments, including the proposed route where alternatives exist. It may be seen that the proposed routes reduce the probability of a release of the waste materials to the environment by reducing the likelihood of an accident, and also reduce the likely environmental impacts of a release, by avoiding populated areas and bodies of water. Should a spill occur, the impacts would depend upon the specific location and extent of the spill. These impacts are discussed in Section 2.1.3.2.

2.5 Alternatives Eliminated from Detailed Study

The regulations which implement the National Environmental Policy Act (40 CFR 1500-1508) require that an environmental impact statement "explore and

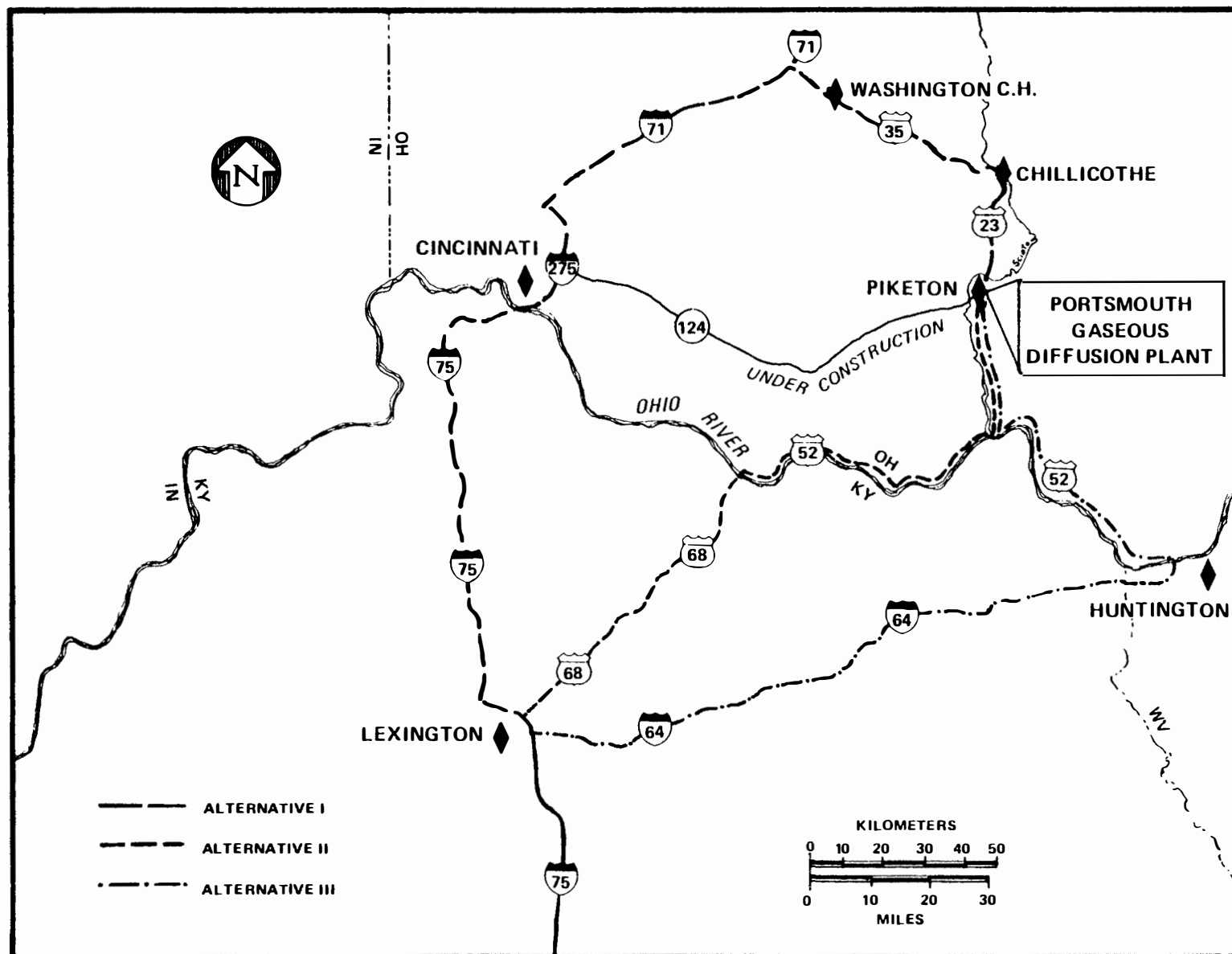


FIGURE 2-6. ALTERNATIVE ROUTES: PIKETON TO INTERSTATE 75

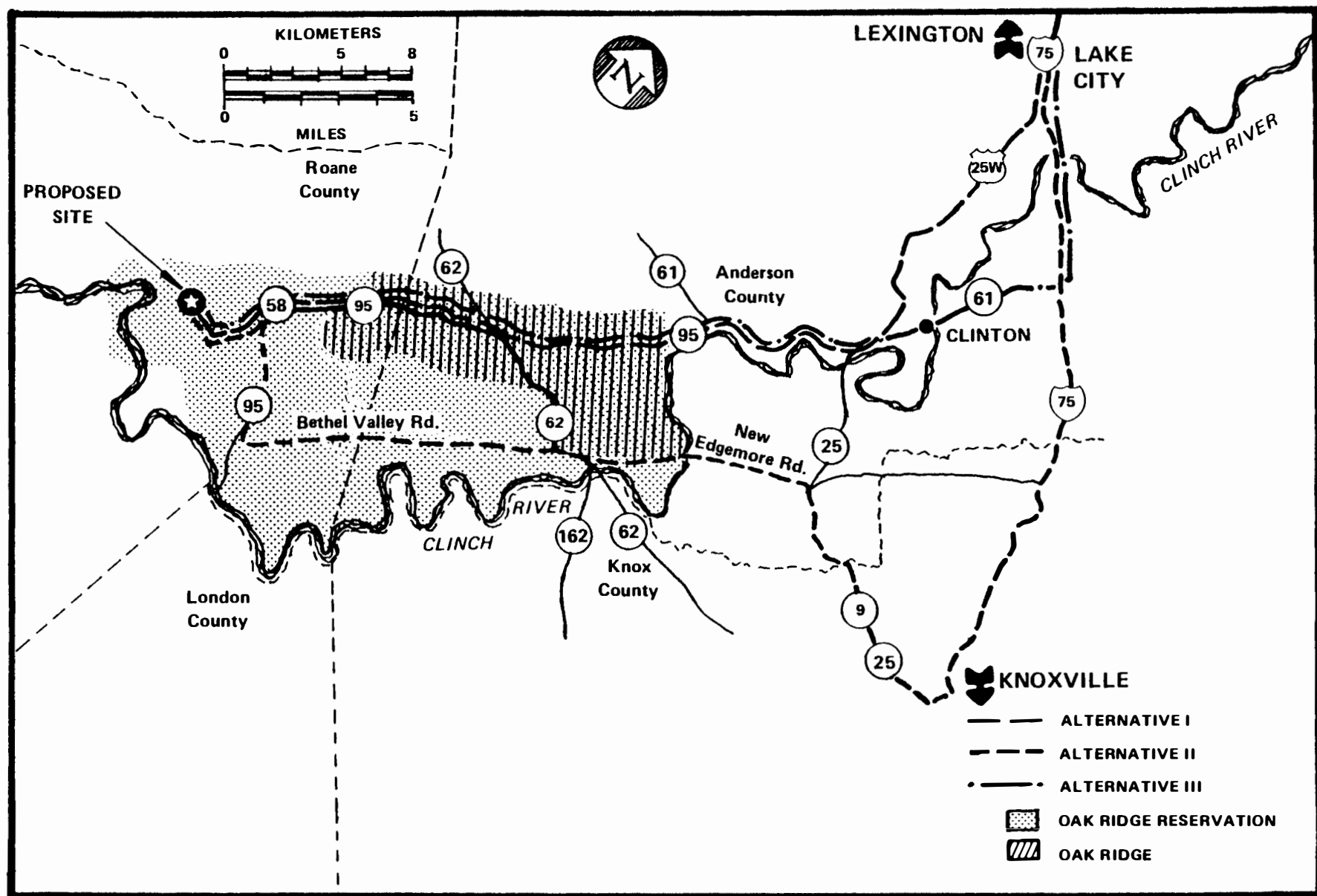


FIGURE 2-7. ALTERNATIVE ROUTES: INTERSTATE 75 to ORGDP

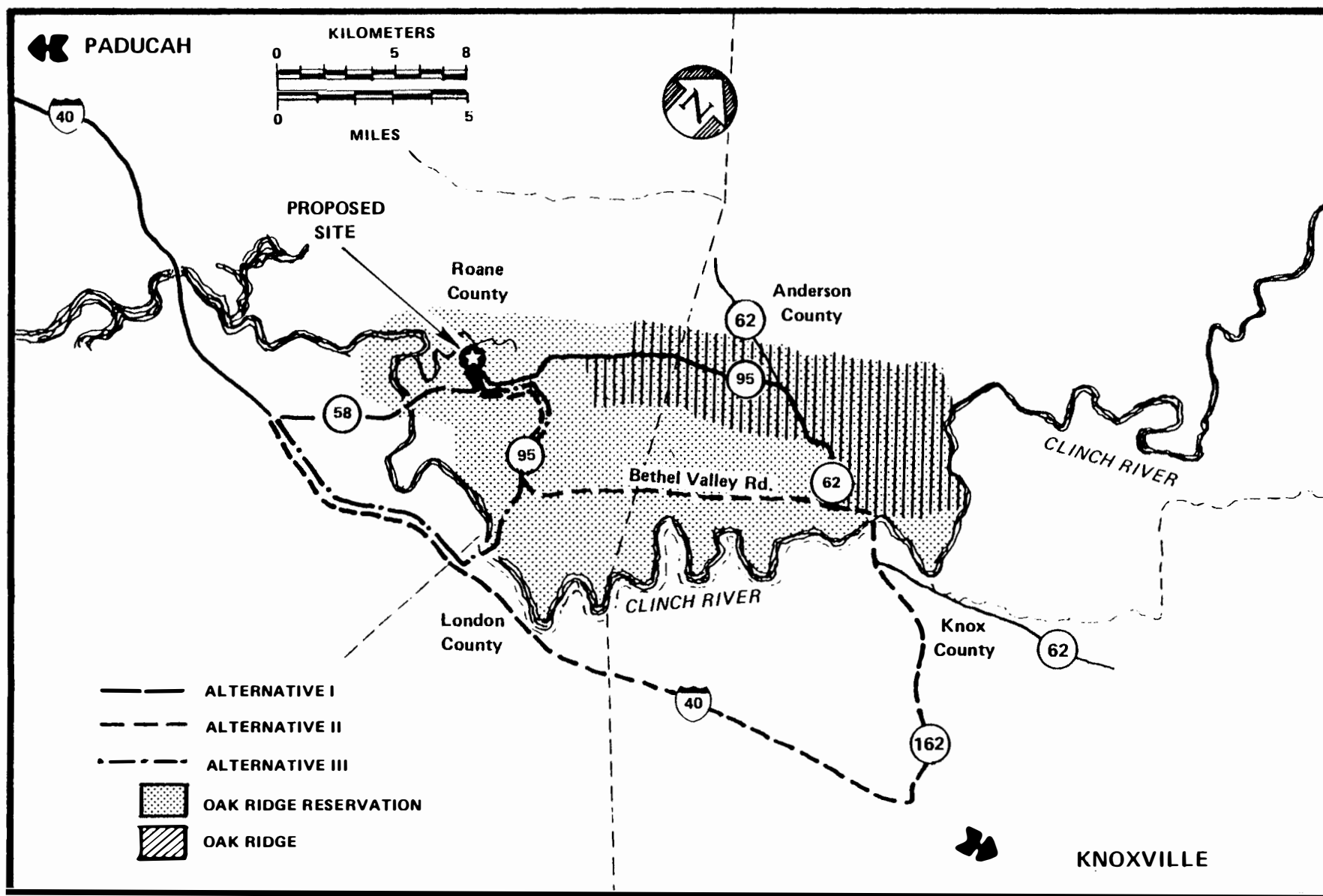


FIGURE 2-8. ALTERNATIVE ROUTES: INTERSTATE 40 to ORGDP

TABLE 2-6. ADVANTAGES AND DISADVANTAGES OF TRANSPORTATION ROUTES COMPARED TO PROPOSED ROUTES

<u>Measure of Comparison^a</u>	<u>Piketon to I-75</u>		<u>I-75 to ORGDP</u>		<u>I-40 to ORGDP</u>	
	<u>I-64^b</u>	<u>US 68</u>	<u>Merchants</u>	<u>TN 61</u>	<u>TN 62</u>	<u>TN 95</u>
Length of Route (short)	+	+	-	-	-	-
Percent Four Lane Highway (high)	+	-	+	-	+	+
Miles of Two Lane Highway (low)	+	-	+	-	-	-
Percent Limited Access Highway (high)	-	-	+	+	+	+
Major Urban Areas Transited (low)	-	-	-	0	-	0
Minor Urban Areas Transited (low)	+	+	-	0	0	0
Congested Areas/Miles (low)	-	+	-	+	-	-
Number of Creek Crossings (low)	+	+	-	-	-	-
Number of Lake and River Crossings (low)	+	+	-	-	0	-
Miles Along Bodies of Water (low)	-	-	+	0	0	0

Source: Derived from Appendix B.

a. Direction of advantage (+) given in parenthesis. Code: + advantage, - disadvantage, 0 no difference.

b. Route labels are derived from the major unique segment or intersection of that particular route.

See figures, text and Appendix B for a complete description of the routes.

objectively evaluate all reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated (40 CFR 1502.14)." The purpose of this section is to describe five types of alternatives and the reasons why these alternatives have been eliminated from detailed study. These types of alternatives include commercial disposal, alternative processes, alternative sites, multiple incinerators, and alternative modes of transportation. A preliminary analysis of these indicates that they are not reasonable alternatives, either because they are not feasible courses of action open to the Department of Energy or because they would result in economic costs and environmental impacts clearly more adverse than those associated with the proposed action.

2.5.1 Commercial Disposal

Commercial disposal is not a feasible alternative for the Department of Energy primarily because there are no commercial disposal facilities which have the necessary licenses to accept and dispose of the waste materials involved, nor is there any reason to believe that any commercial facility will have such licenses in the foreseeable future. To accept for disposal the waste materials involved, a commercial facility would be required by law and regulation to have a license from the EPA for disposal of materials containing more than 500 ppm PCB, as described in Section 1.3.1. A commercial facility would also be required to have an NRC license to receive, process, and dispose of special nuclear materials (see Section 1.3.3). At present, no facility has a license from both the NRC and the EPA.

There are two commercial facilities in the United States which have been licensed for the disposal of materials containing more than 500 ppm PCB. These are the Rollins, Inc. incinerator at Deer Park, Texas, and the ENSCO incinerator at El Dorado, Arkansas. (In addition, EPA has licensed the PCBX process, discussed in Section 2.3, for limited application to PCBs in mineral oil.) Neither of the commercial incinerator facilities has initiated an application for an NRC license for special nuclear materials, and there has been no indication that the operators are willing to undertake the licensing process. Studies of the commercial requirements for PCB disposal (EPRI FP 1207) suggest that commercial facilities licensed for PCB disposal will have

more than sufficient demand for their services for the foreseeable future. Thus, it is unlikely that a commercial facility will undergo the expense of the licensing process for special nuclear materials in order to bear the additional cost of operating under NRC procedures and requirements, when the existing market is sufficient in the absence of the license.

There is, therefore, neither an existing commercial facility which can accept and dispose of the waste materials in question nor any reason to expect that one will become available in the foreseeable future. Commercial disposal is, therefore, not a feasible alternative to the proposed action.

2.5.2 Alternative Processes

An alternative process to incineration involves separation of uranium from the PCB material, followed by incineration of the PCB material and disposal of the uranium by conventional methods. Separation of uranium by physical or chemical processes to achieve a 100% removal efficiency is not technically feasible. This alternative was deemed not to be a reasonable one based on the state-of-the-art technology.

2.5.3 Alternative Sites

There are two types of alternative sites which could be considered for the proposed incinerator. One type of site consists of the existing DOE Oak Ridge Operations plant sites and the other consists of all other (new) sites. This section describes the reasons why alternative sites are not reasonable alternatives to the proposed site at the Oak Ridge Gaseous Diffusion Plant.

2.5.3.1 Siting at Another DOE Oak Ridge Operations Plant. In addition to the Oak Ridge Gaseous Diffusion Plant, there are four other major facilities operated by the Department of Energy's Oak Ridge Operations Office. These are the Paducah Gaseous Diffusion Plant (Paducah, KY), the Portsmouth Gaseous Diffusion Plant (Piketon, OH), the Y-12 Plant (Oak Ridge, TN) and the Oak Ridge National Laboratory (Oak Ridge, TN). The locations of the five plants are shown in Figures 2-3 and 2-4.

There are several factors which mitigate against locating the proposed facility at either Piketon or Paducah, factors which relate to cost and to the risk of adverse environmental impact. The first of these factors is the fact that approximately 80 percent of the annual quantity of waste materials and an even larger percentage of the stored waste materials will come from the three plants located in the Oak Ridge area. To locate the proposed incinerator outside the Oak Ridge area would increase the total interstate shipment of wastes from about 20 percent to over 90 percent of the total, or by a factor of about 4.5. This would increase the cost of transportation, the number of shipments, and the risk of an accident, including the risk of adverse environmental impact which could be associated with an accident were a spill to occur (see Section 2.1.3.2). There is no evidence to suggest that an offsetting reduction in the environmental impact would be obtained by locating the proposed incinerator at either Piketon or Paducah.

Other factors which mitigate against locating the proposed incinerator at either Paducah or Piketon include potential geological and seismological problems at Paducah (Rust Engineering, 1978; KY-717), unavailability of natural gas (for continuous pilot light operation) at Piketon, and the higher cost of construction at both Piketon and Paducah (K/OA-4662).

Based on economic costs and environmental impacts which can be avoided (such as the increased risk of accidental spill during transportation), the Oak Ridge Operations plants outside the Oak Ridge Reservation do not represent reasonable alternatives for the proposed siting of the incinerator. Within the Reservation, specific location of the incinerator relates to two factors. One is the geographical location with respect to the center of population and the waste materials, with the Y-12 Plant closer to the population center and the smallest percentage of the waste materials coming from the Oak Ridge National Laboratory. The second is administrative; locating the incinerator at the ORGDP places it within the program which accounts for the majority of PCB waste materials and at a facility operated solely by and for the Department of Energy. An additional advantage of locating the proposed incinerator at the ORGDP is the immediate availability of support and emergency services, equipment and personnel most appropriate to an industrial activity like the operation of the proposed incinerator.

2.5.3.2 Other Sites. The other type of site alternative is the selection of any site not attached to one of the existing DOE plants. In comparison to such sites, the proposed site at the ORGDP avoids a number of economic costs and potential adverse environmental impacts, as shown in the following examples.

- Infrastructural support facilities already exist at the ORGDP. To provide these facilities (potable water, process water, sanitary sewage, liquid effluent treatment and disposal, electricity, and natural gas for continuous pilot operation) would increase the cost, the construction requirements, and the adverse impacts of the proposed project.
- Service, support, and emergency services, equipment, and personnel are already provided at the ORGDP. These are necessary but only needed on a part-time, occasional, or emergency basis for the proposed incinerator. Among others, these include medical and industrial hygiene personnel, fire and rescue personnel, spill containment personnel, laboratory services, plant protection (access control), and related equipment. To provide these on a 24 hour basis at a remote site would increase the cost and the scope of the project (for facilities), thereby also increasing the environmental impacts associated with construction.
- The site at the ORGDP is already a cleared industrial-use site that belongs to the government. Locating at another site could involve purchase of the site, conversion to industrial use, and clearing and leveling. This would result in increased costs and environmental impacts, including possible habitat destruction.
- Locating the incinerator outside the Oak Ridge area would increase the transportation of the waste materials resulting in increased costs and in increased risks of an accident with the potential for adverse environmental impact.

In contrast to the increase in economic costs and potentially adverse environmental impacts, there is no apparent benefit to be gained by locating the proposed incinerator on another site. In particular, the emissions and effluents from the incinerator and the process accidents which could occur would be the same regardless of the location; any reduction in impacts from operation would be related strictly to the dispersion of the emissions and effluents into the environment. For the proposed action, the impacts of those emissions and effluents are not significant.

The location of the proposed incinerator at a site apart from one of the five DOE plants would incur increased costs and the potential for

increased adverse environmental impacts relative to the proposed action. Such sites are not, therefore, reasonable alternatives to the proposed action.

2.5.4 Multiple Incinerators

The construction and operation of multiple incinerators (e.g., one each at Paducah, Piketon, and Oak Ridge) is not a reasonable alternative to the transportation of the waste materials to a single incinerator, primarily for reasons which relate to the costs which would be associated with such an alternative. The capital cost estimated for the proposed action is \$30,000,000 with approximately \$29,000,000 for the proposed facilities at Oak Ridge. The incinerator and associated facilities described in the Conceptual Design Report (K/D-5222) and in Section 2.1.1 are the smallest practical size for the destruction of PCBs and the protection of the environment (K/D-5222). The approximate cost of each of a number of incinerators would approach \$29,000,000 and would increase the cost of the project accordingly. In addition, the operating costs would increase were multiple incinerators to be built, since the wastes from the three Oak Ridge facilities will provide much of the heat value required, saving on fuel oil, and since additional personnel, maintenance, and other costs would increase. It would be irresponsible for the Department of Energy to incur costs approximately three times as great as necessary in order to avoid the risk of the limited environmental impact which would likely be the result of a transportation accident (see Section 2.1.3.2). Thus, multiple incinerators is not a reasonable alternative to the proposed action.

2.5.5 Alternative Modes of Transportation

Two modes of transportation could be considered as alternatives to truck transportation of the waste materials from Paducah Gaseous Diffusion Plant and the Portsmouth Gaseous Diffusion Plant to ORGDP. These are rail and barge. From the Y-12 Plant and the Oak Ridge National Laboratory to ORGDP, the wastes would necessarily be moved by truck. In addition, for each of the alternative modes, some truck transport would be required to move the waste materials to a transshipment point on that particular mode.

2.5.5.1 Rail. Shipment by rail requires access to a rail terminal or dock at both ends of the shipment or transport by truck to and from the rail dock. At Piketon and Paducah, selection of the rail transport alternative would require that the waste materials be loaded onto trucks, transported to the rail dock, transferred to the rail car, and then shipped to ORGDP. Once the materials reached ORGDP, the materials would then be transferred again to a truck, transported to the proposed incinerator site, and then unloaded. Selection of the rail alternative would therefore require that the waste materials in drums be handled at least two additional times, with corresponding increases in the probability that a spill or other handling accident would occur and the impacts associated with such an accident (see Section 2.1.3.2). In addition, the proposed action involves the use of dedicated trucks, to prevent possible contamination of other shipments; selection of the rail alternative would eliminate the effect of this mitigative measure. Rail transport would also decrease the likelihood that a spill or leak would be detected quickly and therefore reduce the probability of an effective recovery. Finally, the small volume of waste materials to be transported from Piketon and Paducah would make the shipment of waste materials by rail uneconomical, and this alternative would increase the cost of transport with no apparent environmental benefit. Thus, rail transport is not a reasonable alternative to the proposed action.

2.5.5.2 Barge. Many of the factors that apply to rail transport also apply to movement of the waste materials by barge. None of the originating sites or the receiving site has direct access to barge facilities. Thus, truck transport would be required between the sites and a barge facility. This would either involve additional handling of the waste materials or loading the truck trailers onto a barge; either action increases the probability of an accidental release into a body of water, in this case the Ohio, Tennessee, or the Clinch Rivers. In addition, any leak, spill, or other accident during the barge shipment would involve a high probability that waste material would find its way into the water, from which recovery is difficult in comparison to soils or pavement. Finally, the small volumes of material to be shipped from Piketon and Paducah would make barge transportation uneconomical, with no apparent decrease in the potential for environmental impact compared to the proposed alternative. Barge transport is not, therefore, a reasonable alternative to the proposed shipment by truck.

2.6 References

Ahling, B., and Lindskog, A. Thermal Destruction of PCB and Hexachlorobenzene. The Science of the Total Environment, 1978, 10, p. 51-59.

American Conference of Governmental Industrial Hygienists (ACGIH). Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment with Intended Change for 1980, Cincinnati, Ohio, 1980.

EPA 560/6-76-005. PCBs in the United States Industrial Use and Environmental Distribution. U.S. Environmental Protection Agency, Washington, D.C., February, 1976.

EPA 904/9-76-014. Study of the Distribution and Fate of Polychlorinated Biphenyls and Benzenes After a Spill of Transformer Fluid. U.S. Environmental Protection Agency, Washington, D.C., 1976.

EPRI FP-1207. Disposal of Polychlorinated Biphenyl (PCBs) and PCB Contaminated Material. Electric Power Research Institute, September, 1980.

K/D-5222. Conceptual Design Report for Compliance with the Toxic Substance Control Act (TSCA). Project No. 83-OR-14. Goodyear Atomic Corporation, Nuclear Division of Union Carbide Corporation, Engineering Division, March 28, 1981.

Long, L.W. Environmental Management Group, Union Carbide, Nuclear Division, Oak Ridge Gaseous Diffusion Plant. Letter to Battelle, April 10, 1981.

K/OA-4662. Economic Analysis of PCB Disposal (Revision 1). Union Carbide Corporation, Nuclear Division, Oak Ridge, Tennessee, 1981.

KY-717. Environmental Monitoring Report, United States Department of Energy, Paducah Gaseous Diffusion Plant, Calendar Year 1980. Union Carbide Corporation, Nuclear Division, Paducah, Kentucky, 1981.

Preliminary Safety Analysis Report for Compliance with the Toxic Substance Control Act (TSCA) ORGDP Project No. 83-OR-14. Prepared for Union Carbide Corporation, Nuclear Division, Oak Ridge, Tennessee by Battelle Columbus Laboratories, Columbus, Ohio, June 1981.

Rust Engineering Company. Site Development Plan, Paducah Gaseous Diffusion Plant, 1978.

40 CFR 264. Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities. U.S. Environmental Protection Agency.

40 CFR 761. Polychlorinated Biphenyls (PCBs). Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions. U.S. Environmental Protection Agency.

40 CFR 1500-1508. Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act. Council on Environmental Quality, Executive Office of the President.

49 CFR 173. Hazardous Materials Regulations. Shippers--General Requirements for Shipments and Packagings. U.S. Department of Transportation.

THIS PAGE IS INTENTIONALLY BLANK

CHAPTER 3. THE AFFECTED ENVIRONMENT

The proposed incineration facility will be constructed at the Oak Ridge Gaseous Diffusion Plant (ORGDP) on the Oak Ridge Reservation with auxiliary facilities at the Paducah and Portsmouth Gaseous Diffusion Plants. The existing environment of the Paducah and Portsmouth Plants is described briefly in Sections 3.11 and 3.12. The ORGDP area is described in more detail below.

The ORGDP area is a level, 259 hectare (640 acre) tract at the northwestern end of the 15,000 hectare (37,000 acre) Oak Ridge Reservation. The Reservation is located south and west of the City of Oak Ridge and northwest of Knoxville, in Roane and Anderson counties (see Figure 2-4). Detailed information concerning the affected environment can be found in the Environmental Assessment of the Oak Ridge Gaseous Diffusion Plant Site (DOE/EA-0106), the Environmental Statement Related to the Construction and Operation of the Clinch River Breeder Reactor Plant (NUREG-0139), and in annual monitoring reports for the Reservation (Y/UB-10, Y/UB-13, Y/UB-15).

The PCB incinerator facility will be constructed adjacent to existing buildings of ORGDP (see Figure 2-1). The facility will occupy 2 hectares (5 acres) for the incinerator and all associated ancillary facilities. Solid waste will be disposed in an existing disposal area associated with the Y-12 Plant.

3.1 Physiography

Physiographically, the Oak Ridge area lies between two mountain ranges and is bordered on one side by the Clinch River. The Cumberlands rise to 914 m (3000 ft) or more about 16 km (10 mi) northwest, while 113 km (70 mi) to the southeast, the Great Smokies reach an altitude of some 2012 m (6,600 ft). Ninety square miles of this rolling wooded land was purchased by the U.S. Government in 1942 for the purpose of building the City of Oak Ridge and several major plants.

Oak Ridge and the associated Federal Reservation lands are within the region known as the Great Valley of the Tennessee River. It is part of the Valley and Ridge physiographic province and is characterized by alternating

elongated and parallel valley troughs and ridges. The former are typically broader than the ridges.

3.1.1 Topography

The topography of the Oak Ridge Reservation is typical of the Valley and Ridge Province, being characterized by subparallel northeast trending ridges and valleys. Altitudes within the area range from 226 m (741 ft) in the southwestern part of the area to 413 m (1356 ft) at Melton Hill, which is also in the southwestern part of the area (NUREG-0139).

The ORGDP is situated in the Valley and Ridge Subregion of the Appalachian Highlands Province. The long, narrow symmetrical ridges are breached at irregular intervals by stream channels which otherwise follow the trend of the ridges. The ORGDP is located between Black Oak Ridge to the northwest and Pine Ridge to the southeast. A small remnant of East Fork Ridge, McKinney Ridge, borders the ORGDP on the northeast.

Poplar Creek cuts through the ORGDP from the northeast and joins the Clinch River to the southwest. Maximum relief in the immediate vicinity is 127 m (420 ft) from the surface of the Clinch River to the top of McKinney Ridge.

The ORGDP occupies virtually all of the area resulting from a small delta formed by the confluence of Poplar Creek and the Clinch River (DOE/EA-0106). The original topography of the delta has been almost completely altered by site work for the ORGDP. The structures and yards occupy virtually all of the delta, extending to the ridges on all sides except the southwest, which opens toward the Clinch River. Physical isolation is created by two parallel ridges which extend beyond the ORGDP to the Clinch River. McKinney Ridge partially blocks the valleys to the northeast and the Clinch River cuts across them to the south. The result is roughly a three-sided enclosure bordered by the Clinch River on its open side.

The proposed incinerator site is a level area on the northeast side of the ORGDP. The site is at the head of a small valley in which a stream arises and flows to the K-1700 discharge (see Figure 2-1). The proposed incinerator site is above the 500 year floodplain for both the Clinch River and Poplar Creek.

3.1.2 Geology

The Oak Ridge Reservation is underlain by nine geologic formations or groups ranging from Early Cambrian to Early Mississippian. The formations are of sedimentary origin, both chemical (limestone and dolomite) and clastic (sandstone and shale), and from oldest to youngest include the Rome Formation, the Conasauga Group, the Knox Group, the Chickamauga Limestone, the Sequatchie Formation, the Rockwood Formation, the Chattanooga Shale, the Maury Formation, and the Fort Payne Chert. Of these, the most important from the standpoint of occurrence in the Oak Ridge area are the Rome Formation, the Conasauga Group, the Knox Group, and the Chickamauga Limestone (NUREG-0139).

3.1.3 Soils

The typical soil types of the Valley and Ridge Province, as in much of the Southeast, are red-yellow podsollic, reddish-brown lateritic, or lithosols. They usually are strongly leached, acid, low in organic content, and have exchange capabilities of less than 10 milli-equivalents per hundred grams of soil (NUREG-0139).

The depth of alluvium beneath the ORGDP area ranges from near zero to 18.3 m (60 ft). Soils developed on the Chickamauga Formation, which underlies most of the site, are typically yellow to yellow-brown montmorillonites which contain small chips of chert, pebbles of siltstone, and small blocks of limestone. The Conasauga Shale underlying the southeast section of the area develops a silty brown, tan, greenish, and maroon clay which is micaceous and contains fragments of unweathered parent rock. At least five distinct rock units have been identified within the Conasauga in Bethel Valley and all have variable soil descriptions (NUREG-0139).

3.1.4 Groundwater

The most important aquifers in the region are the Knox (dolomite) and Chickamauga (limestone). The amount of groundwater available is controlled by fractures, but yields are adequate for domestic supplies to large diameter

wells and from spring zones which occur on hillsides at the outcrop of the limestone layers. Groundwater movement in the area generally follows the topography of the local terrain.

In the vicinity of the proposed incinerator, there is no withdrawal of groundwater. A groundwater fed surface stream arises adjacent to the site and flows to the K-1700 outfall. A monitor well (ORGDP Number 5) is located in proximity to the proposed site; this well is sampled monthly, and the average analytical results for 1980 are included in Appendix D.

3.1.5 Seismology

The Oak Ridge Reservation is crossed by two major thrust faults: the Copper Creek fault in the southeastern part of the area and the White Oak Mountain fault in the northwestern part. The strata and the fault zones dip primarily to the southeast. The White Oak Mountain fault in the Oak Ridge area exhibits several subsidiary features, including branch faults, a syncline northwest of the fault, and two slices of dolomite of the Knox Group (NUREG-0139).

Forty recorded earthquakes have occurred within 250 km (155 miles) of the site. One in 1918 had an epicentral modified Mercalli intensity of VII. Moderately strong epicentral shaking (maximum intensity VI) also occurred from local events in 1844 and 1956 (NUREG-0139).

3.2 Climatology and Meteorology

The climatology of the Oak Ridge area is of the humid continental type characterized by mild winters [3.4°C (38.1°F) in January] and warm summers [25°C (77°F) in July] with high and low extremes of 40.5°C (105°F) and -22.8°C (-9°F) (NUREG-0139). General weather patterns of the area do not reflect those of the more mountainous segments of the southeastern United States due to its topography. Prevailing wind regimes travel predominantly in a northeast-to-southwest line, both up and down valley, in alignment with the parallel ridges. Intense, highly-confined storms of short duration occur frequently within the area, especially at points of topographical discontinuity, because of the production of significant barometric gradients.

Heavy precipitation occurs in both the winter and summer, whereas spring and autumn are comparatively dry. Annual mean total precipitation is 134 cm (52 in). Only under unusual conditions is snowfall a significant portion of the precipitation (NUREG-0139).

3.3 Hydrology

The total Tennessee River drainage area of 106,000 km² (40,910 sq mi) includes about 80 percent of the state of Tennessee, a major segment of northern Alabama, and regions of Kentucky, Mississippi, Georgia, Virginia, and North Carolina (DOE/EA-0106).

The Clinch River is the immediate receiver of waters discharged from the Oak Ridge Reservation. The Reservation proper is composed of a series of limited drainage basins through which small streams flow and ultimately reach the Clinch River. Poplar Creek receives drainage from a 350 km² (136 sq mi) area. The creek flows through a basin that is about 65 percent wooded; the remainder is farmland. Some contamination occurs from the extensive surface coal mining that has occurred in the Cumberland Mountain district. The creek also receives municipal effluents from several small communities. The hydrodynamics of the Clinch River-Poplar Creek system is highly complex due to the flow alterations induced by Melton Hill and Watts Bar dams. Flows in the vicinity of the ORGDP can be downstream, upstream, or stationary. Temperatures of the waterways adjoining the ORGDP area depend somewhat on the effects induced by the release of surface waters from Melton Hill Reservoir and the backup of subsurface waters from the Watts Bar Reservoir. Thus, temperatures can vary greatly from day to day, especially in the summer. The average high to low annual temperature range for the Clinch River is 22.2°C (72°F) to 8.9°C (48°F). This range is nearly true also for the East Fork of Poplar Creek (DOE/EA-0106).

3.4 Noise and Acoustics

The results of a short-term measurement program (K/SUB-13876-81/1) carried out in April, 1981, have been used to establish a basic range of sound levels for the area in general, as well as for the fenceline of ORGDP.

The study area for the acoustical impact analysis includes the area which may be expected to be influenced significantly by noise emissions resulting directly or indirectly from operation of the proposed incineration facility. The study area is essentially a circle with a radius of 2.5 km (1.6 mi) with its center at the location of the incinerator exhaust stack. Included within the circle are the ORGDP, approximately a 5 km (3.1 mile) length of the Oak Ridge Turnpike (Tennessee Route 58), and the ORGDP visitors overlook area.

The existing acoustical environment is made up of combined manmade sounds and natural sounds. Two sources contribute most of the noise found in this area, i.e., traffic on the Oak Ridge Turnpike, and the ORGDP and its auxiliary facilities. Noise from the ORGDP consists normally of pure tone sounds associated with the process machinery in the process buildings and transformer substations.

The character of the noise environment at the fenceline of the ORGDP was observed to be innocuous, consisting primarily of low level continuous pure tones. During weekday day shift operations, some low level metallic impulsive sounds were observed; however, these were not loud enough at the fenceline to be measurable with the A-weighted, slow response channel of the sound level meter. At the sound measurement locations south and west of ORGDP, highway traffic is the dominant noise source.

3.5 Terrestrial Ecology

Appalachian oak-hickory forest is the dominant native plant association of the Oak Ridge Reservation. Northern hardwoods are climax types found in coves that are interspersed along the dissected ridge system. Currently, most of the region is covered by a second-growth forest composed of several plant communities. Particular seral communities found within a 3000 m (9843 ft) radius of the ORGDP and non-vegetated areas are shown in Table 3.1 (DOE/EA-0106).

TABLE 3-1 PLANT COMMUNITIES AND NONVEGETATED AREAS NEAR THE ORGDP

<u>Community Type</u>	<u>Hectares</u>	<u>Acres</u>	<u>Percentages</u>
Bottomland hardwoods	38	93	1
Oak-hickory	514	1270	18
Mixed-mesophytic forest	4	10	1
Pine and pine hardwoods	1018	2516	36
Cedar, cedarpine, cedar-hardwoods	57	140	2
Unforested	896	2215	32
Open water	188	466	7
Buildings and highways	118	293	4
Total	2833	7003	100

Source: DOE/EA-0106.

The original mature forests were extensively cleared and the land cultivated during settlement. Since cultivation ceased in 1942, cultivated fields have developed into forests through natural succession. Between 1948 and 1954, many of the abandoned fields were planted with various pine species. These plantations have been maintained with little or no invasion by deciduous hardwoods. Other abandoned fields not replanted with pines underwent a natural succession from Virginia pine and eastern red cedar to hardwood pine-cedar forests. This is an intermediate or developmental association, and some pine remains even when hardwoods become dominant.

Vegetative communities in the area, primarily woodland, provide varied habitat for many wildlife species. Many communities found in the area are typical of east Tennessee and are rich in flora and fauna. Game and economically important mammals, birds, reptiles, and amphibians will be considered in the following sections.

The greatest diversity of mammals occurs in the mixed hardwoods and hardwood-cedar-pine association, whereas the least diversity occurs in pine plantations and lawns near the Gaseous Diffusion Plant. ORNL studies of the Oak Ridge area, and particularly of the Melton Valley area, can be used to characterize the mammalian fauna. Economically important mammals, birds, reptiles and amphibia on the Oak Ridge Reservation are listed in Table 3.2.

TABLE 3-2 ANIMALS OF ECONOMIC IMPORTANCE ON THE RESERVATION

Mammals

Whitetailed deer	Raccoon
Cottontail rabbit	Striped skunk
Eastern gray squirrel	Red fox
Opossum	Gray fox
Woodchuck	Longtail weasel
Beaver	Mink
Muskrat	Bobcat

Birds

Bobwhite quail	Ruffed grouse
Mourning doves	Canada geese

Reptiles and Amphibia

Bullfrog
Snapping turtle
Eastern spiny softshell turtle

Source: DOE/EA-0106.

3.6 Aquatic Ecology

Five major biotic communities occur in the waters adjacent to ORGDP: phytoplankton, periphyton, zooplankton, benthic macroinvertebrates, and fish. The information has been obtained primarily from the biological monitoring effort conducted for the ORGDP (DOE/EA-0106).

The phytoplankton communities of the waters around ORGDP are typical of riverine-reservoir habitats of the southeastern United States. During most of the year, diatoms are the predominant group with peaks occurring

occasionally among the green and blue-green components. Densities are greatest in late spring and early fall and are generally greater in the Clinch River stations farthest downstream (probably due to the greater pooling effect of Watts Bar Reservoir in these areas). The upper reaches of Poplar Creek display lower densities from the influence of swifter currents and a greater canopy coverage and the community composition differs from the other stations.

The pattern of periphyton (attached algae) dominance and abundance from June 1977 through March 1978 was typical of that found in the Clinch River in previous years. The relative contribution of diatoms was highest during the cooler months (November through February) when they made up 87 to 99 percent of the total, whereas blue-green and green algae substantially increased during the summer and early fall.

Rotifiers are the most common group of zooplankton collected from April 1977 through March 1978. This group consistently accounted for over 84 percent of the total zooplankton numbers from May through October at all Clinch River stations, a dominance characteristically found in riverine systems. This pattern was also characteristic of previous Clinch River zooplankton studies, in which rotifiers commonly accounted for more than 90 percent of all organisms during the warmer months. However, rotifiers typically accounted for less than 50 percent of the total during the low standing crops of the winter season. The copepods and cladocerans were periodically abundant during the summer and fall.

Benthic macroinvertebrates collected from April 1977 through March 1978 were dominated by the arthropods (primarily flies), worms, and molluscs (primarily bivalves). These groups constituted 47 percent, 38 percent, and 15 percent, respectively, of the total number of organisms collected. The Clinch River sites were dominated by worms (45 percent of the total number) and dipterans (26 percent), whereas a converse pattern was evident in Poplar Creek where dipterans and oligochaetes represented 60 percent and 37 percent, respectively, of the total number.

A recent ORGDP monitoring survey resulted in the collection of 30 fish species from 10 families. Numerically, Clinch River stations were comprised of 58 percent game fish, 14 percent rough fish, and 28 percent forage fish; Poplar Creek sites harbored 32 percent game, 23 percent rough fish, and 45 percent forage fish.

3.7 Rare and Endangered Species

Five species of terrestrial fauna considered endangered by the U.S. Department of the Interior have been observed on or around the Oak Ridge Reservation (DOE/EA-0106). The only two federally endangered mammalian species likely to occur on the Reservation are the Indiana and gray bats. Three federally endangered birds have been reported on or near the Reservation; the Southern bald eagle, the Peregrine falcon, and the red cockaded woodpecker.

Thirteen species of terrestrial fauna known or expected to occur in the area of the Oak Ridge Reservation are classified as endangered or threatened by the State of Tennessee. The Tennessee cave salamander reported from Roane County is considered threatened. The Bachman's (pinewoods) sparrow has been observed on the Reservation and is considered endangered. The sharp-shinned hawk has been observed on the Reservation and is considered threatened.

One bird species considered endangered in Tennessee, the osprey, and four bird species considered threatened in Tennessee--the Cooper's hawk, the marsh hawk, the Bewick's wren, and the grasshopper sparrow--are expected to occur on the Oak Ridge Reservation.

3.8 Background Chemical and Radiological Characteristics

The proposed action involves the disposal of radioactively contaminated organic chemicals, including PCBs. This section describes the existing chemical and radiological characteristics of the environment, to provide the basis for the analysis of impacts.

3.8.1 Soils

PCB concentrations on the ORGDP have been determined to be below the 0.1 ppm limit of detection. Lead content ranges from 20-153 ppm with an average of 59 ppm (Long, June, 1981).

Radionuclide content of the soils around the ORGDP perimeter has not significantly varied from remote, or background, level during the last several years of monitoring (Y/UB-10, Y/UB-13, Y/UB-15). Additionally, levels are not significantly different from naturally-occurring levels reported in the literature. Detailed listing of nuclide levels in samples from 1978 through 1980 are found in Appendix D.

3.8.2 Air

Regional air quality is the product of local meteorology, terrain, land use, and emission sources. The predominance of high pressure systems restricts the dispersive capacity of the atmosphere. Consequently, eastern Tennessee has a high pollution potential. Anderson County, which is adjacent to Roane County wherein the proposed incinerator site lies, has been cited for nonattainment for total suspended particulates. The sources of these emissions are various facilities in the county, and the emissions are not attributed to the DOE plants. Attainment status exists in both counties for sulfur dioxide. The area has not been classified for the remaining primary air pollutants which are nitrogen oxides, carbon monoxide, photochemical oxidants (ozone), and hydrocarbons (DOE/EA-0106).

The results of air monitoring during 1980 for suspended particulates, sulfur oxides, and fluorides found levels well below all applicable standards. The maximum suspended particulate level observed for a 24-hr period was 108 $\mu\text{g}/\text{m}^3$ as compared to the Tennessee standard of 260 $\mu\text{g}/\text{m}^3$ maximum. Sulfur oxides compared similarly with the maximum 24-hr average observed in February at 0.053 ppm compared to the 0.14 ppm standard. The highest fluoride level observed at a monitoring site was 1.2 $\mu\text{g}/\text{m}^3$ for a 7-day average, also below state standards of 1.6 $\mu\text{g}/\text{m}^3$ for a 7-day average (Y/UB-15).

Atmospheric concentrations of radioactive and nonradioactive pollutants in the vicinity of the Oak Ridge facility are monitored by a network of ambient sampling stations. The average gross beta concentration of radioactivity from particulates in the air, measured by the perimeter and remote monitoring stations, were 0.07 and 0.08 percent of the applicable concentration guide (10^{-10} Ci/ml). The average gross alpha concentration in the

perimeter and remote monitoring stations was 0.03 percent of the concentration guide (4×10^{-12} Ci/ml). Annual discharge of radioactivity to the atmosphere has been reported for 1980. A total of 0.02 curies of uranium and 4.9×10^{-6} curies of unidentified alpha-emitting isotopes were released from the Y-12 Plant and ORGDP combined. Although some radioactivity was released to the atmosphere, measurements in the Oak Ridge area indicate that environmental levels were below established standards (Y/UB-13, Y/UB-15).

3.8.3 Water

Both the Clinch River and Poplar Creek can be characterized chemically as moderately hard bodies of water (DOE/EA-0106). Dissolved oxygen levels in the river approximate 6.0 ppm or greater year-round and vary little with depth. Values of BOD are nearly always less than 3.5 ppm. Nitrogen and phosphorus levels vary greatly in both river and creek. Ammonia concentrations at times exceed recommended levels for the protection of aquatic biota. Mercury in the water has been found in concentrations significantly above background (up to 0.003 ppm). Of the heavy metals that have been analyzed, only zinc was found to occur in concentrations potentially harmful to biota. PCB concentrations have been determined at five locations in the river and creek; all values were below the 0.5 ppb limit of detection (Long, May, 1981). Concentrations below 1.0 ppb are not believed to significantly affect aquatic biota (45 FR 79339).

Cadmium levels in the sediments near ORGDP may be elevated above concentrations expected in an uncontaminated environment, as well as levels of chromium, copper, lead, manganese, mercury, nickel and zinc. The mercury values are particularly noteworthy as some of the concentrations have been found to be up to five orders of magnitude greater than those found in relatively pristine areas. Data on sediment concentrations of PCBs indicate that levels in Poplar Creek are higher than in the Clinch River. Summary data are presented in Appendix D.

3.8.4 Biota

Atmospheric and liquid releases of the Oak Ridge plants have been associated with increased levels of various contaminants in the biota of the area. Atmospheric fluoride releases on the site have caused damage to loblolly pine needles (DOE/EA-0106). Analysis of the needles showed ranges of fluoride concentrations to be from 50 to 80 ppm. Leaf damage to sensitive plants on the site have been induced by oxides of nitrogen concentrations of 4700 ug/m³ for 2 hours. Maximum annual NO_x dosages which occur southwest of ORGDP are only 1.2 percent of those required to produce visible damage to sensitive plants. Possible effects of atmospheric emissions consist of chronic plant injury due to normal emission of cooling-tower-drift salts. Elevated values of fluoride, chromium, and zinc concentrations have occurred in Reservation plants. Atmospheric fluoride releases have not had a direct effect on animals eating the fluoride contaminated vegetation on the site (DOE/EA-0106, Y/UB-15).

Possible effects to aquatic biota include (1) acute and/or chronic toxic effects, (2) community composition changes caused by osmotic shifts from the dissolved solids and sulfate additions, and (3) increased bioaccumulation of heavy metals (DOE/EA-0106).

In an analysis of 362 fish (including 15 species), only mercury and PCBs were found at levels indicating contamination. More than 14 percent of the game fish from Poplar Creek and the Clinch River had muscle tissue mercury concentrations in excess of 0.5 ug/g, whereas 2 percent of the game fish from all six sites had mercury levels exceeding 1.0 ug/g, the action level on mercury in fish recently recommended by the U.S. Food and Drug Administration (FDA). A large-mouth bass that had the highest concentration measured of all the specimens contained 2.14 ug/g wet weight. Significant seasonal differences in tissue concentrations of mercury were found in large-mouth bass. Tissue concentrations of PCBs in most of the fish had concentrations below the FDA action level of 5 ug/g. However, concentrations near this level were found in ten channel catfish collected in Poplar Creek. Two fish had levels as high as 6.0 and 7.0 ug/g, but the highest body burden (8.5 ug/g) was found in a longnose gar from the creek (DOE/EA-0106).

The present (and projected) operation of ORGDP contributes to the chemical loading of Poplar Creek and the Clinch River. During periods of low or zero flow, the quantities released may induce severe local impacts, but the effects from such episodes should be transient, with the possible exception of increased heavy-metal body burdens. During periods of average flow, significant impacts from the effluents above are not likely, but toxicant additions may incrementally affect organisms exposed to high ambient toxicant levels. The currently high mercury and PCB body burdens in fish and the high sediment concentrations of these and other contaminants likely stem largely from releases unrelated to current ORGDP operation (DOE/EA-0106).

3.9 Socioeconomic Environment

The region around the Oak Ridge Reservation has been subject to fluctuations in population since the 1940's when the Reservation was established (NUREG-0139). The population increased from 1000 families in 1940 to a high of 75,000 families in 1944. Fluctuations in federal programs have been a continuing influence on the population and economy of the region. The U.S. Bureau of the Census (1981) reports the 1980 population of the City of Oak Ridge as 27,552 and of Anderson and Roane counties as 66,878 and 47,715 respectively. Projections of the population to the year 2000 show an increase of 12 percent for the City of Oak Ridge, 20 percent for Anderson County, and 3 percent for Roane County.

The labor force for Anderson and Roane counties in 1980 was 30,720 and 16,570 respectively, with corresponding unemployment rates of 5.4 and 11.4 (Tennessee State Department of Economic and Community Development, 1981). The 1977 estimated per capita income was \$7,240, \$5,587, and \$4,814, for the City of Oak Ridge and Anderson and Roane counties (U.S. Bureau of the Census, 1980).

3.10 Land Use and Related Activities

The Oak Ridge Reservation lies within the East Tennessee Development District which is generally rural in character. Knoxville is the district's

regional center and the only city with a population in excess of 50,000. The cities of Alcoa, Harriman, Maryville, Morristown, Newport, and Oak Ridge make up communities within the 7,500 to 50,000 population range within the district. All are incorporated and have a definite central core and provide major employment and trade opportunities. Of the district's 1,700,010 hectares (4,200,800 acres), approximately 80 percent is in agricultural and forest land use. Anderson and Roane counties in which the Reservation is located are also approximately 80 percent committed to agriculture and forest land use (DOE/EA-0106).

3.10.1 Residential Use

The population centers nearest the Oak Ridge Reservation include Oak Ridge 10 km (6 mi) NE, Oliver Springs 13 km (8 mi) NNE, Kingston 14 km (9 miles) WSW, Lenoir City 19 km (12 mi) SSE, Loudon 23 km (14 mi) S, and Harriman 15 km (9 mi) W (DOE/EA-0106). Oak Ridge, the nearest population center, is an urban center with a minimum of agricultural activities, in contrast to the county land-use patterns. Of the 5,510 hectares (13,615 acres) of nonfederally owned land within the city limits, approximately 30 percent is residential and 30 percent is vacant. Only 1 to 2 percent of the land is used for commercial or industrial enterprises.

3.10.2 Agricultural Use

Farming in this region of Tennessee has followed the national trend of steadily decreasing numbers of farms and of the remaining farms increasing in average size. Of the 530,000 hectares (1,310,000 acres) in the five counties surrounding the Oak Ridge Reservation, approximately 36 percent is in farms and 50 percent is in commercial forest (U.S. Bureau of the Census, 1977). Beef cattle production has replaced dairy cattle over the last few decades primarily due to the less labor-intensive nature of beef cattle. Currently, there are only five commercial dairy farms within a 6 km (10 mi) radius of the Reservation, four in Roane County and one in Loudon County. The principal cash crops of the five counties of this region are tobacco, corn,

soybeans, and wheat. Commercial forest land is periodically logged and replanted in fast growing pines (DOE/EA-0106).

3.10.3 Industrialization

The Oak Ridge Reservation occupies approximately 14,970 hectares (37,000 acres) of DOE-owned lands (NUREG-0139). Currently, the principal plant complexes on the reservation are as follows: Y-12, ORGDP, ORNL, and the Comparative Animal Research Laboratory (CARL). Around each research and production facility is a buffer zone to provide security, space for expansion, and for isolation from the general public. About 5,666 hectares (14,000 acres) are allocated for buffer zones around operating reactors, waste disposal areas, and streams that receive routine waste releases and burial ground seepages. Acreage used for high-voltage transmission lines, pipeline rights-of-way, transportation corridors, and security fences amounts to about 2023 hectares (5,000 acres). About 80 percent of the Reservation is forested and a comprehensive forest management program is carried out.

The DOE plants on the reservation are the major industries within a 16 km (10 mi) radius and employ approximately 15,000 people. Numerous smaller industries exist in the region which are generally in nuclear related activities such as fuel element fabrication, radioisotope calibration, manufacture of radioactive tracers, and the like (DOE/EA-0106).

3.11 Paducah Gaseous Diffusion Plant

The environment of the Paducah Gaseous Diffusion Plant has been described in monitoring reports (KY-717) and in a recent site development plan (Rust Engineering, 1978).

The Paducah Gaseous Diffusion Plant (PGDP) is located on a 1385 ha (3,425 acre) site in a generally rural area of McCracken County, Kentucky. The site is approximately 6 km (3.7 mi) south of the Ohio River. The nearest incorporated towns are Metropolis, Illinois, located 8 km (5 mi) to the north-east, and LaCenter, Kentucky, located 18 km (11.2 mi) southwest. Paducah, Kentucky, is the nearest population center (35,000) and is located 19 km

(11.8 mi) east of the plant. The climate is characteristic of the humid continental zone where summers are warm and winters are moderately cold. Winds are predominantly from the SSW, averaging 4.4 meters/second (14.4 ft/sec). Rainfall averages 119 centimeters (47 in) per year; the heaviest precipitation usually occurs during March, April and May. The area is low in relief ranging from 112-116 meters (367-381 ft) above sea level. Much of the plant property is leased to the Commonwealth of Kentucky and maintained by the West Kentucky Wildlife Management Area for suitable wildlife habitat as scattered woodlands, scrub growth, and grasslands. The area is drained by and plant discharges flow into two small tributaries of the Ohio River, Big and Little Bayou creeks. These creeks derive most of their flow from plant discharges except during the wetter months of the year. The creeks enter the Ohio River through a common discharge on the TVA Shawnee Plant Reservation. No human habitations are found within 900 meters (2953 ft) of the PGDP process buildings (KY-717; Rust Engineering, 1978).

3.12 Portsmouth Gaseous Diffusion Plant

The environment surrounding the Portsmouth Gaseous Diffusion Plant has been described in monitoring reports (GAT-2009) and in a recent environmental impact statement (ERDA-1549).

The Portsmouth Gaseous Diffusion Plant is located in sparsely populated rural Pike County, Ohio, on 1618 ha (4000 acres) about 1.6 km (1 mi) east of the Scioto River Valley at an elevation approximately 36.6 m (120 ft) above the Scioto River flood plain. The highest recorded flood was 100 ft below the level of the plant.

The nearest urban areas are Piketon, Ohio, 6.4 km (4 mi) from the site with a population of 1347, and Waverly, Ohio, 12.9 km (8 mi.) with a population of 4858. The nearest large urban population is Portsmouth, 30.6 km (19 mi) to the south, with a population of 27,633.

The terrain surrounding the plant consists of marginal farmland and densely forested hills. The flood plain, however, is farmed extensively. The Scioto River Valley is underlain by abundant sand and gravel which form an aquifer which serves as the primary source of water for the plant. The

climate is characteristic of the humid continental zone. Temperatures are moderately cold in the winter and moderately warm and humid in the summer. Annual precipitation averages about 101 cm (39.8 in.) generally distributed throughout the year; however, fall tends to be the driest. The predominant winds blow from the south or southwest and at times from the north. Local tributaries flowing into the Scioto River are relatively unpolluted except for agricultural runoff. Liquid effluents from the Portsmouth Gaseous Diffusion Plant are discharged into Little Beaver Creek, Big Run Creek, two pipelines, and a drainage ditch, all of which ultimately flow into the Scioto River. Little Beaver Creek receives most of the chemical discharges from the plant after treatment (ERDA-1549, GAT-2009).

3.13 References

DOE/EA-0106. Environmental Assessment of the Oak Ridge Gaseous Diffusion Plant Site. U.S. Department of Energy, July, 1981.

ERDA-1549. Portsmouth Gaseous Diffusion Plant Expansion, Piketon, Ohio. Final Environmental Statement. 2 Vols. U.S. Energy Research and Development Administration, Washington, D.C., 1977.

45 FR 79339. Water Quality Criteria. U.S. Environmental Protection Agency, 45 FR 79339, November 28, 1980.

GAT-2009. Portsmouth Gaseous Diffusion Plant Environmental Monitoring Report for Calendar Year 1980. Goodyear Atomic Corporation, 1981.

K/SUB-13876-81/1. Measurement of Outdoor Noise Levels Adjacent to the K-25 Facility, Oak Ridge Gaseous Diffusion Plant. Union Carbide Corporation, Nuclear Division, Oak Ridge, Tennessee, 1981.

KY-717. Environmental Monitoring Report, United States Department of Energy, Paducah Gaseous Diffusion Plant, Calendar Year 1980. Union Carbide Corporation, Nuclear Division, Oak Ridge, Tennessee, 1981.

Long, L. W. Environmental Management Group. Union Carbide, Nuclear Division, Oak Ridge Gaseous Diffusion Plant. Letter to Battelle, May 6, 1981.

Long, L. W. Environmental Management Group. Union Carbide, Nuclear Division, Oak Ridge Gaseous Diffusion Plant. Letter to Battelle, June 10, 1981.

NUREG-0139. Environmental Statement Related to Construction and Operation of Clinch River Breeder Reactor Plant. U.S. Nuclear Regulatory Commission, Washington, D.C., 1977.

Rust Engineering Company. Site Development Plan, Padacuh Gaseous Diffusion Plant, 1978.

Tennessee State Department of Economic and Community Development. Personal Communication with A. Rudolph (Battelle). Knoxville, Tenn., April, 1981.

U.S. Bureau of the Census, Census of Agriculture 1974. U. S. Department of Commerce, Washington, D.C., 1977, 1, Pt. 42.

U.S. Bureau of the Census. Current Population Reports, P-25 Series, No. 885. U.S. Department of Commerce, Washington, D.C., June 1980.

U.S. Bureau of the Census. Characteristics of Population and Housing: Preliminary Reports, PHC-80-P-44, Tennessee. U.S. Department of Commerce, Washington, D.C., January 1981.

Y/UB-10. Environmental Monitoring Report, United States Department of Energy, Oak Ridge Facilities: Calendar Year 1978. Union Carbide Corporation, Nuclear Division, Oak Ridge, Tennessee, June, 1979.

Y/UB-13. Environmental Monitoring Report, United States Department of Energy, Oak Ridge Facilities: Calendar Year 1979. Union Carbide Corporation, Nuclear Division, Oak Ridge, Tennessee, June, 1980.

Y/UB-15. Environmental Monitoring Report, United States Department of Energy, Oak Ridge Facilities: Calendar Year 1980. Union Carbide Corporation, Nuclear Division, Oak Ridge, Tennessee, June, 1981.

THIS PAGE IS INTENTIONALLY BLANK

4.0 ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION

The purpose of this chapter is to present a detailed assessment of the environmental consequences of the proposed action.^a Based on the descriptions in Chapter 2 and other information about the proposed action, the probable impacts are described, together with the methods used to assess those impacts.

Each of the many actions directly or indirectly involved in the construction and operation of the proposed facility may be considered potentially capable of causing changes in the existing conditions or characteristics of the environment at or near the proposed facility. The impacts of the proposed action are analyzed in terms of the effluents and emissions expected from the facility and the impacts of those emissions and effluents on the chemical and physical quality of the environment. Also analyzed are impacts upon the biota, upon human health and upon the socioeconomic character of the area. Many of the analyses presented herein are based on conservative estimation procedures or worst reasonable case analysis. However, even with such approaches to the estimation of impacts, the projected consequences of the proposed facility are generally insignificant.

4.1 Effluents and Emissions

The materials to be discharged by the proposed facility into the air and the water or onto the land have been identified and the discharge rates estimated as accurately as possible from the limited information available at this stage in the facility design. Actual design figures based on material

^a This chapter does not present an assessment of the environmental consequences of the reasonable alternatives (no action, chemical destruction, alternative routes), since to do so would duplicate the analyses and discussion presented elsewhere in this EIS. The full disclosure purposes of the regulations (40 CFR 1500.1(b,c), 1500.4(f), and 1502.1) are met through the analyses and discussion presented in Chapter 2 and in the Appendices. In particular, the no action alternative is described in Section 2.2, chemical destruction is presented in Section 2.3 and Appendix C, and alternative routes are presented in Section 2.4 and Appendix B.

balances and equipment designs were used where available, but standard factors and data from analagous cases were used where specific data were lacking.

4.1.1 Emissions to the Atmosphere

An air pollutant emissions inventory has been prepared for the incinerator at its initial operating rate of 7.9×10^9 joules (7.5×10^6 Btu) per hour and the scheduled operating rate of 7300 hours per year. The six criteria and nine noncriteria pollutants specified in the PSD regulations (see Appendix E) have been addressed as well as other materials specific to this facility. During normal operation of the incinerator, emissions will originate from four general sources, which are the receiving and storage tanks, the drum unloading hoods, the main stack, and miscellaneous leaks. It is also possible that under abnormal conditions, emissions may originate from the secondary safety relief vent or the feed chute safety relief vent.

4.1.1.1 Hydrocarbons. Liquid materials received by the facility in tank trucks and drums will be unloaded into tanks for storage and blending prior to burning. Small quantities of organics will evaporate into the vapor space in the top of the tanks and will be displaced from the tanks when they are filled or when rising ambient temperatures cause the vapors to expand. Since about 77 percent of the liquid materials to be burned by this facility will be waste lubricating oils which typically have very low volatilities, the concentration of organics in the vapor spaces are expected to be very low. Essentially all of the vaporized organics are expected to result from the handling of the waste solvents which will comprise about 15 percent of the liquid feed to the incinerator. These emissions are expected to originate principally from the unloading hood and from tanks. Estimates of emissions from these tanks have been made using the methods recommended in AP-42 corrected for recent findings (Burr and Moody, 1981) with conservative assumptions as to conditions (see Appendix F). The emissions from the drum unloading cannot be estimated accurately because the units have not yet been designed; an approximation of the possible emissions was developed as described in Appendix F. The solvents expected to be handled and the estimated emissions are shown in Table 4-1.

Emissions from handling the oils that will comprise the bulk of the feed to the incinerator were estimated in a similar fashion using very conservative estimates of the volatility. The emissions of unidentified high boiling organics were estimated to be about 14 kg (30 lb) per year or about 2.0 g (0.004 lb) per hour. Since the emissions from these sources are small, no measures have been taken to further reduce them.

TABLE 4-1. ESTIMATED EMISSIONS FROM HANDLING SOLVENTS

<u>Material</u>	<u>Throughput^a kg/yr</u>	<u>Emission kg/yr</u>
Trichloroethane	63,000	140
Trichloroethylene	73,000	83
Unidentified Mix	42,000	45
Methylene Chloride	3,700	18
Perchloroethylene	43,000	16
Acetone	4,500	13
Varsol	22,000	13
Chloroform	4,200	11
Freon 113	3,400	7
Freon TA	1,800	4
Methanol	4,500	4
Hexane	820	3
Isopropanol	4,500	2
Freon 11	13,000	2
Total Handling Losses		360 ^b
Breathing Losses, All Tanks	Approx.	45
Drum Emptying Losses	Approx.	500
Total Solvent Emissions		900 kg/yr (0.12 kg/hr)

Source: Computation based on data derived from K/D-5222; see Appendix F.

^a Annual production + 1/3 stored material, Basis = 7300 operating hours per year.

^b May not sum to total due to rounding.

Trace quantities of organics, typically low molecular weight hydrocarbons, organic acids, and aldehydes, are normally emitted from incinerator stacks. This incinerator is designed to provide highly efficient combustion so the emissions from this source are expected to be small. Data from a test of a PCB incinerator (EPA 530/SW 122C.5), where hammermilled PCB containing capacitors were burned in a rotary kiln incinerator with fuel oil under conditions similar to those proposed for the proposed incinerator, were used to estimate the hydrocarbon emissions from this incinerator stack at 38 g (0.084 lb) per hour. In addition to these organics, extremely small quantities of unburned materials and toxic products of incomplete combustion may also be emitted.

The regulations for solid PCB material in accord with which the incinerator will operate limit unburned PCB emissions to a maximum of 1 mg per kg of PCB fed (44 FR 31514). For the average operating rate of this unit, the maximum permissible emission of PCB would be 11 mg (2.4×10^{-5} lb) per hour. Actual measurements (EPA 530/SW 122C.5; EPRI FP 1207; Rollins Env., 1979) of emissions during test burns of PCBs under conditions similar to those that will exist in this incinerator, showed no detectable PCB emissions. Other tests (EPA Region 6, 1981a, 1981b) did reveal the emission of extremely small amounts of chlorinated dibenzo-p-dioxins and chlorinated dibenzofurans. The higher of the values reported in those tests has been used to estimate the emissions from this facility. Ahling and Lindskog (1978) have reported detecting hexachlorobenzene (HCB) in the emissions from burning PCBs in a pilot scale incinerator. Contrary to the implication of high emissions presented in their paper, the data may be interpreted to indicate a low emission of HCB at the conditions at which the proposed incinerator will operate (see Appendix M). The estimated emissions of these organics are shown in Table 4-2, based on the emissions from tests described above.

The low volatility of the bulk of the feed materials, the types of equipment which will be used, and the planned operating procedures are expected to hold emissions of organics from minor equipment leaks to an insignificant level.

TABLE 4-2. ESTIMATED EMISSIONS OF TOXIC ORGANICS

<u>Material</u>	<u>Concentration in Flue Gas</u>	<u>kg/hr</u>
PCB	<1 ppb	$<2.6 \times 10^{-6}$
Dioxins	0.018 ng/dscf	1.7×10^{-9}
Furans	0.28 ng/dscf	2.7×10^{-8}
HCB	2.4×10^{-2} ppb	7.7×10^{-7}

Source: Computed based on sources cited in text.

4.1.1.2 Acid Gases. The waste mix which will be burned in the incinerator is expected to contain some chlorinated solvents, a small amount of Freons and organic phosphates, and a trace of sulfur containing materials. It is assumed that upon combustion all of the acid gases formed from acid forming elements will appear in the flue gases, producing the concentrations shown in Table 4-3. A small amount of the chlorine will form elemental chlorine and infinitesimal amounts of fluorine and sulfur trioxide may also form. The flue gas cleaning system has been designed to remove these gases from the flue gas before it is released to the atmosphere.

In the quench chamber, the excess water will dissolve a portion of the water soluble gases and, by lowering the temperature, cause the phosphorous pentoxide to condense as a fine particulate. In the venturi and the packed bed scrubber, contact with alkaline water will remove most of the remaining soluble gases and sulfur dioxide. Part of the phosphorus pentoxide will also be removed with the particulates. The wet electrostatic precipitator following the scrubber will remove most of the remaining phosphorous pentoxide and sulfur trioxide. The expected concentrations of acid gases at various points in the scrubbing system and the removal efficiencies of the control devices are shown in Table 4-3. These values represent best engineering judgement and are reasonable expectations for properly designed and operated equipment of the type specified.

TABLE 4-3. ACID GAS CONCENTRATIONS AND REMOVAL EFFICIENCIES

	Quench		Venturi/Packed Bed Scrubber		Precipitator		Eff. (%)	Overall	
	Inlet (ppm)	Eff. (%)	Inlet (ppm)	Eff. (%)	Inlet (ppm)	Eff. (%)		Outlet (ppm)	Outlet (kg/kr)
HCl	6,000	50	3,000	99	33	0	99.5	33	0.14
HF	540	74	140	93	<10	0	98.1	<10	<0.02
SO ₂	12	0	12	>75	<3.1	0	>75	<3.1	<0.02
Cl ₂	2.6	0	2.6	>75	<0.6		>75	<0.6	<0.005
P ₂ O ₅	0.080 ^a	0	0.080 ^a	64	0.029 ^a	88	95.5	0.004 ^a	0.02

Source: Computation based on data derived from K/D-5222

a gr/dscf

The regulations require that the incinerator system be operated under a slight negative pressure with relationship to the atmosphere to prevent leakage of flue gas, and the exposed scrubber water will be adjusted to a neutral or alkaline condition, so no release of acid fumes from other parts of the system is expected.

4.1.1.3 Carbon Monoxide. The carbon monoxide content of the flue gases will be monitored as required by regulation and the combustion conditions will be controlled so that the combustion efficiency does not drop below 99.9 percent. At the expected operating conditions, this would allow a maximum of 87 ppm of carbon monoxide in the stack which would be an emission of 280 g (0.61 lb) per hour. Data from test burns of PCBs in two similar units (EPA 530/SW 122C.5, EPRI FP 1207) showed a maximum of 10 ppm of carbon monoxide which would be an emission of 32 g (0.070 lb) per hour.

4.1.1.4 Particulates. Most of the ash constituents of the liquid waste material and some of those from the solid waste material will become entrained in the flue gas and carried out of the combustion chamber. The solid material will consist largely of contaminated dirt containing about 100 ppm of uranium but the identity of the ash materials in the liquid material is largely unknown except for an average concentration of about 186 ppm of uranium. The incinerator is expected to also burn a small amount of waste motor oil which may contain as much as 6000 ppm of lead, and a very small amount of oil containing a trace of beryllium oxide. A conservative assumption of complete carryover of the ash from the liquid and about 25 percent carryover of the uranium from solids gives a carryover of about 44 g (0.096 lb) per hour of uranium in 6.8 kg (15 lb) of fly ash per hour from the combustion chamber to the quench chamber.

Most of the ash particles will be removed by the flue gas cleaning system. The quench chamber will remove the largest particles, the venturi scrubber will remove most of the remaining particles down to submicron sizes, and the wet electrostatic precipitator will remove most of the remaining fine particles. In estimating the metals emissions, a conservative approach was taken. Since a part of the uranium is known to be soluble, it is estimated

that the uranium oxide in the flue gas will contain fewer coarse particles than the rest of the flyash. The collection efficiency of the quench chamber for uranium has been reduced by 50 percent to account for the fewer large particles. It is conservatively estimated that the lead and beryllium will not form coarse particles, so no collection of these metals is assumed in the quench chamber. The efficiencies of the controls and the concentrations of the particulates at various points in the scrubbing system are shown in Table 4-4. These values represent best engineering judgement and are reasonable expectations for properly designed and operated equipment of the type specified.

4.1.1.5 Nitrogen Oxides. The waste materials to be burned are not known to contain any organic nitrogen, so the only source of nitrogen oxide emissions would be the fixation of atmospheric nitrogen in the high temperature regions of the incinerator. Data from the two test burns at similar incinerators showed 11 ppm in one case (EPRI FP 1207) and 60 ppm in the other (EPA 530/SW 122C.5). Using the higher value, the emissions from this incinerator would be 310 g (0.69 lb) per hour. The nitrogen oxide emissions will be set by the choice of burner, design of the combustion chambers, and the operating conditions of the incinerator. The emissions are expected to be of a magnitude that would make additional controls unnecessary.

4.1.1.6 Other Pollutants. No mercury, asbestos, vinyl chloride, or reduced sulfur compounds are known to be in the waste to be burned so no emissions of these materials are expected.

A summary of all emissions to the atmosphere is shown in Table 4-5.

4.1.2 Aqueous Effluents

There will be three aqueous wastes from this facility which will be combined into two effluents leaving the facility. Each of the effluent streams will be stored and checked for organic contamination before it is discharged to a treatment facility and subsequently to the K-1700 NPDES outfall at Poplar Creek.

TABLE 4-4. PARTICULATE CONCENTRATIONS AND
REMOVAL EFFICIENCIES

	Quench		Venturi/Packed Bed Scrubber		Precipitator		Eff. %	Overall	
	Inlet (gr/dscf)	Eff. %	Inlet (gr/dscf)	Eff. %	Inlet gr/dscf	Eff. %		Outlet (gr/dscf)	Outlet (Kg/hr)
Total Partic.	1.1	40	6.5×10^{-1}	68	2.1×10^{-1}	86	97.3	2.9×10^{-2a}	1.8×10^{-1}
Uranium	6.9×10^{-3}	20	5.5×10^{-3}	68	1.8×10^{-3}	86	96.4	2.4×10^{-4}	1.5×10^{-3}
Lead	1.3×10^{-4}	0	1.3×10^{-4}	68	8.7×10^{-5}	86	95.5	7.5×10^{-5}	4.5×10^{-4}
Beryllium	2.1×10^{-10}	0	2.1×10^{-10}	68	6.7×10^{-11}	86	95.5	$<9.4 \times 10^{-12}$	$<5.9 \times 10^{-11}$

Source: Computation based on data derived from K/D-5222.

a 0.040 gr/dscf corrected to 12 percent CO₂

TABLE 4-5. ATMOSPHERIC EMISSIONS SUMMARY

<u>Pollutant^a</u>	<u>ppm or (gr/dscf)</u>	<u>kg/hr</u>	<u>kg/yr</u>
NO _x	60.0	0.31	2300
Particulates	(0.029)	0.18	1300
HCl	33.0	0.14	910
VOC	<20.0	<0.038	<280
CO	10.0	0.032	230
P ₂ O ₅	(0.004)	0.02	160
SO ₂	<3.1	<0.02	<160
F	<10.0	<0.02	<160
Cl ₂	<0.6	<0.004	<33
U	(0.0003)	1.2 x 10 ⁻³	8.6
Pb	(7.5 x 10 ⁻⁵)	4.5 x 10 ⁻⁴	3.4
PCB	(3.7 x 10 ⁻⁷)	2.2 x 10 ⁻⁶	0.016
HCB	2.4 x 10 ⁻⁵	7.7 x 10 ⁻⁷	5.4 x 10 ⁻³
Furans	4.3 x 10 ⁻⁹	2.7 x 10 ⁻⁸	2.0 x 10 ⁻⁴
Dioxins	2.8 x 10 ⁻¹⁰	1.7 x 10 ⁻⁹	1.3 x 10 ⁻⁵
Be	(<9.4 x 10 ⁻¹²)	<5.9 x 10 ⁻¹¹	4.3 x 10 ⁻⁷
Fugitive VOC		0.12	900

Source: See text.

^a See Appendix E for a list of regulated and criteria pollutants.

Fire and storm water from the diked areas may contain traces of organics picked up from leaked or spilled waste in the areas. If analyses reveal unacceptable organic contamination, the water will be treated with activated carbon before it is discharged to the K-1700 NPDES outfall. Uncontaminated water will be discharged without treatment. Activated carbon has been reported (EPA 560/6-76-005) to be between 63 and 99.5 percent effective in removing PCBs from contaminated water depending upon the concentration initially present and the carbon dosage used. Residual concentrations as low as 0.1 ppb were reported. The carbon should also remove a wide spectrum of other organics which might be present in water which has contacted spilled incinerator feed materials. The spent activated carbon will be burned in the incinerator. Standard operating procedures will require prompt cleanup of spills without allowing water to contact the spilled material, so substantial

contamination of runoff water is only expected to occur in unusual or emergency situations. Therefore, the discharge of organics or other contaminants in this effluent is estimated to be negligible.

About 7.6 liters (2 gal) per minute of discharge water is expected to overflow from the ash pit. This water will contain suspended and dissolved solids from the ash and may contain some organics leached from incompletely burned residue, although it is expected that the operating temperature and solids residence time in the kiln are sufficient to produce a residue which is essentially free of any organic materials including PCBs. Ash pit water which is found on testing to contain unacceptable organic contamination will be carbon treated or burned in the incinerator. Uncontaminated water will be mixed with the scrubber sump overflow water for discharge. The composition of the two streams is expected to be similar.

The major aqueous effluent from the facility will be the scrubber water purge. This blowdown rate will be about 72 liters (19 gal) per minute of scrubber water containing salts from acidic gases, ash particles, and possible trace organics that are not completely oxidized. The expected composition of this scrubber water is shown in Table 4-6.

Trace quantities of organics may also be present in the water, principally low molecular weight organic acids and aldehydes. The combustion conditions in the incinerator are such that essentially no PCBs or other high molecular weight organics will be present. Data from a test burn of PCBs in a similar incinerator (EPA 530/SW 122C.5) showed no detectable PCBs (<0.007 mg/l) and 0.19 mg/l total organics in the scrubber water. The assumption of no significant organic content is supported by the results of testing a variety of incinerators burning a variety of wastes (EPA 530/SW 155C) all of which showed no organic waste constituents in the scrubber water.

Water which on testing shows an acceptably low organic content will be pumped to an existing neutralization facility once each weekday. In the neutralization facility, it will join with about 1700 liters (450 gal) per minute of aqueous wastes from other facilities. The combined flows will be adjusted to a neutral pH (6-9) by adding acid or alkali as required, and passed through a pond to settle out solids before being discharged into the K-1700 NPDES outfall carrying about 2800 liters (750 gal) per minute to Poplar

TABLE 4-6. SCRUBBER PURGE WATER COMPOSITION

<u>Parameter</u>	<u>Concentration</u> <u>g/l</u>	<u>kg/hr</u>
Chloride	5.7	24.1
Fluoride	2.8×10^{-1}	1.2
Sulfate	3.2×10^{-2}	1.4×10^{-1}
Phosphate	1.6×10^{-1}	6.8×10^{-1}
Sodium	4.1	17.3
Uranium ^a	1.0×10^{-2}	4.0×10^{-2}
Lead ^a	2.4×10^{-3}	1.0×10^{-2}
Beryllium ^a	3.0×10^{-10}	1.2×10^{-9}
Total Dissolved Solids	10.9	46
Total Suspended Solids	8.3×10^{-1}	3.5

Source: Computation based on data derived from K/D-5222.

^a Present as oxides.

Creek. The neutralization facility removes about 57 percent of the suspended solids from the water. At the K-1700 outfall, the incinerator facility is expected to increase the total dissolved solids by 330 metric tons (365 tons) per year or 62 percent and to increase the total suspended solids by 11 metric tons (12 tons) per year or 24 percent.

4.1.3 Solid Waste

The major solid waste produced by the facility will be the kiln residue which will result from dirt, clay, and shredded metal fed into the incinerator plus unidentified ash materials from the combustion of liquids and solids. Since about 90 percent of the noncombustible material fed to the kiln is expected to be contaminated dirt and about 5 percent ground steel drums, the composition of the residue should be similar to that of dirt enriched with iron and small quantities of other unidentified metallic oxides from the wastes. The small quantity of uranium in the dirt is expected to result in

about 60 mg of uranium per kg of dry ash. This would amount to about 68 kg (150 lb) per year in about 1140 metric tons (1250 tons) of dry ash or 2280 metric tons (2500 tons) of wet ash. The ash is expected to be essentially free of hazardous organics including PCBs.

The residue from the incinerator will be analyzed and if the PCB concentration exceeds 50 ppm, it will be returned to the incinerator to be burned again. If the PCB concentration in the residue is less than 50 ppm, the waste will be landfilled in the existing Y-12 low-level radioactive waste burial site, which is located just off Bear Creek Road about 4.8 kilometers (3 mi) west of the Y-12 Plant. The scrubber solids will also be analyzed for PCBs. If the concentration is greater than 50 ppm, the scrubber solids will be incinerated. If not, they will be landfilled with the incinerator residue at the Y-12 waste burial site.

The geology at the Y-12 landfill is of the Conasauga Group, mostly shale (DOE/EA-0106). The waste is buried in trenches which are approximately 60 meters (200 feet) long, 9 meters (30 feet) wide, and 6 meters (20 feet) deep. The thickness of cover soil used at the landfill is 0.6 to 1.5 meters (2 to 5 feet). The design of the burial facilities includes no special liners or leachate collection systems.

4.1.4 Noise

The sound from the induced draft (ID) fans, radiated at the top of the 30 m (100 ft) high stack has been identified to be the most likely noise problem. The basis for the assumption is twofold: (1) the sound power of the ID fan is high, i.e., as high as 114 dB (flat weighting) re 10^{13} W, and (2) the top of the stack is within the line of sight of much of the study area. However, calculations show (Appendix G) that under conditions of no wind, there will be essentially no increase in A-weighted level at any of the measurement locations used in the site noise study. Even with adverse wind conditions, the likelihood of a detectable increase in level would be small.

Another potential problem noise source would be the drum shredder. However it is anticipated that if the shredder proves to be a significant

noise source, it will be enclosed or other precautions will be taken to reduce noise impacts on offsite locations.

4.2 Impacts of Discharges on the Physical Environment

In this section the probable environmental impacts of the proposed action are discussed with respect to the potential effects, both direct and indirect, on the physical environment.

4.2.1 Air Quality Impacts

The purpose of air quality effects analysis is estimation of the maximum ground-level concentrations of pollutants which could occur due to the proposed incinerator. Two types of concentrations are involved, short-term concentrations and average annual concentrations. The analysis presented below estimates these two types of concentrations for the point of absolute highest ground-level concentration and for the residence, among all residences, which could receive the highest concentrations.

Analysis of pollutant dispersion from the incinerator is complicated by the complex local terrain. The proposed site is surrounded on three sides by high ridges, with flat terrain only southwest of the site, beyond the ORGDP. There is no accepted model which will accurately estimate the dispersion from the incinerator, given this terrain. However, as noted in Appendix H, models were selected which result in overestimation of the concentrations. The actual concentrations which should occur will be lower than the estimates presented below.

The complex topography of the area have been described elsewhere (Chapter 3, DOE/EA-0106, Y/UB-13). The site is located immediately east of the ORGDP in a valley running northeast to southwest. Pine Ridge, on the southeast, is 1400 m (4500 ft) from the site with peak elevations about 60-90 m (200-300 ft) above the site. Black Oak Ridge is 2600 m (8400 ft) northwest with similar peak elevations. McKinney Ridge, with a peak of 110 m (350 ft) above the site, protrudes into the valley 550 m (1800 ft) north-northeast.

These ridges affect the estimation of pollutant dispersion. The plume rise from the incinerator (see Appendix H) is 30-100 m (100-300 ft) above the ground and the plume would impact upon the ridges at all but the lowest wind speeds. Because the ridges are within the Oak Ridge Reservation where public access is restricted, and because employees do not visit the ridges regularly, it is not necessary to compute the concentrations on the ridges. However, the ridges elevate the plume, increase the dilution with clean air, and thus reduce the concentration in the valley beyond the ridge. Concentrations would be lower than if the ridge were not there. These factors allow computation of dispersion using models and methods developed for flat terrain, with assurance that concentrations so computed are higher than levels which would actually result from the proposed incinerator.

Estimated emissions from the incinerator are shown in Table 4-5. The first column in Table 4-7 presents these in the units used for estimating dispersion.

The first step in estimating short-term concentrations was modeling of oxides of nitrogen (NO_x) emissions by EPA's PTMAX model (Appendix H) to determine the point of highest short-term concentration and the concentration at that point. The point of maximum concentration was predicted to occur 350 m (1150 ft) from the incinerator; this would be near Blair Road or within the ORGDP boundary depending on wind direction. The concentration of NO_x at this point was used to factor the other emissions, with the results presented in column 2 of Table 4-7.

The second step was estimation of short-term concentrations at nearby residences. Factors derived from Turner (1970) were applied to the values in column 2, Table 4-7 to estimate concentration at the nearby residences. Among the residences, the factor is highest (30 percent) for the houses located about 4 km SSW, beyond the Clinch River, and about 3.2 km NNW. The results for these residences are presented in column 3 of Table 4-7; these are the maximum concentrations which could occur at any residence due to the incinerator.

For annual average concentrations, EPA's CDM model was applied to particulate emissions from the incinerator to determine the point of highest concentration and the concentration at that point, as well as the most exposed residence and the concentration at that residence. The CDM model requires

TABLE 4-7. EMISSIONS AND MAXIMUM GROUND LEVEL CONCENTRATIONS
OF MAJOR AIR POLLUTANTS

Material	Emission ^a g/sec	Estimated ^b Maximum 1 hour Concentration ug/m ³	Estimated ^c Maximum 1 hour Concentration At Most Exposed Residence ug/m ³	Maximum ^d Annual Arithmetic Mean Concentration ug/m ³	Annual ^d Arithmetic Mean Concentration At Most Exposed Residence ug/m ³
NO _x	8.7 x 10 ⁻²	3.2	9.6 x 10 ⁻¹	9.3 x 10 ⁻²	1.0 x 10 ⁻²
TSP	5.0 x 10 ⁻²	1.9	5.7 x 10 ⁻¹	5.5 x 10 ⁻²	5.8 x 10 ⁻³
HCl	3.8 x 10 ⁻²	1.4	4.2 x 10 ⁻¹	4.1 x 10 ⁻²	4.4 x 10 ⁻³
VOC	<1.1 x 10 ⁻²	<4.1 x 10 ⁻¹	1.2 x 10 ⁻¹	<1.2 x 10 ⁻²	<1.3 x 10 ⁻³
CO	8.8 x 10 ⁻³	3.3 x 10 ⁻¹	9.9 x 10 ⁻²	1.0 x 10 ⁻²	1.0 x 10 ⁻³
P ₂ O ₅	6.3 x 10 ⁻³	2.3 x 10 ⁻¹	6.9 x 10 ⁻²	6.7 x 10 ⁻³	7.3 x 10 ⁻⁴
SO ₂	<6.3 x 10 ⁻³	<2.3 x 10 ⁻¹	<6.9 x 10 ⁻²	<6.7 x 10 ⁻³	<7.3 x 10 ⁻⁴
F	<6.3 x 10 ⁻³	<2.3 x 10 ⁻¹	<6.9 x 10 ⁻²	<6.7 x 10 ⁻³	<7.3 x 10 ⁻⁴
Cl ₂	<1.3 x 10 ⁻³	<4.8 x 10 ⁻²	<1.4 x 10 ⁻²	<1.4 x 10 ⁻³	<1.5 x 10 ⁻⁴
U	3.3 x 10 ⁻⁴	1.2 x 10 ⁻²	3.6 x 10 ⁻³	3.5 x 10 ⁻⁴	3.8 x 10 ⁻⁵
Pb	1.3 x 10 ⁻⁴	4.8 x 10 ⁻³	1.4 x 10 ⁻³	1.4 x 10 ⁻⁴	1.5 x 10 ⁻⁵
PCB	5.8 x 10 ⁻⁷	2.2 x 10 ⁻⁵	6.6 x 10 ⁻⁶	6.4 x 10 ⁻⁷	6.7 x 10 ⁻⁸
HCB	2.1 x 10 ⁻⁷	7.8 x 10 ⁻⁶	2.3 x 10 ⁻⁶	2.3 x 10 ⁻⁷	2.4 x 10 ⁻⁸
Furans	7.6 x 10 ⁻⁹	2.8 x 10 ⁻⁷	8.4 x 10 ⁻⁸	8.1 x 10 ⁻⁹	8.8 x 10 ⁻¹⁰
Dioxins	4.8 x 10 ⁻¹⁰	1.8 x 10 ⁻⁸	5.4 x 10 ⁻⁹	5.2 x 10 ⁻¹⁰	5.6 x 10 ⁻¹¹
Be	1.6 x 10 ⁻¹¹	5.9 x 10 ⁻¹⁰	1.8 x 10 ⁻¹⁰	1.7 x 10 ⁻¹¹	1.9 x 10 ⁻¹²

Sources as follows:

a See Table 4-5

b Computed by PTMAX; see Appendix H

c Computations based on Turner, 1970, see text.

d Computed by CDM; see Appendix H

detailed data on wind direction, wind speed, and other meteorological conditions to estimate average annual concentrations at any point and in any direction (see Appendix H). In modeling the emissions, it was assumed that the incinerator would operate continuously, rather than 7300 hours per year. The model showed the point of maximum annual average particulate concentration (0.05 ug/m^3) to be 0.8 km (0.5 mi) SW of the incinerator, within the ORGDP boundaries. The average concentration at the nearest residences (3.2 km NNW) was predicted to be 0.0022 ug/m^3 . For the residences 8 km NNE, the estimate was 0.002 ug/m^3 . Among all residences, the greatest annual average concentration was estimated to be 0.0058 ug/m^3 at the residences located 4 km (2.5 mi) SSW. The particulate concentrations for the point of highest annual average concentration and the most exposed residence were used to factor the dispersion of other emissions; the resulting concentrations, expressed as arithmetic means, are shown in columns 4 and 5 of Table 4-7. Figure 4-1 shows the location of those residences closest to the incinerator site.

In every case, the estimated changes in air quality due to the emissions from the proposed incinerator are very small and represent negligible and insignificant changes in the environment.

4.2.2 Solid Waste Disposal Impacts

In 1975, the burial operation for low-level radioactive waste was transferred to the more geologically suitable Y-12 site. The groundwater resource in the area of the Conasauga shale is small, and where it does exist, it is generally seasonal. Consequently, groundwater contamination from the use of the Y-12 site is not expected to occur. This is supported by testing of monitor well samples. Groundwater that does exist is generally in the relatively shallow material overlying the Conasauga. This soil cover is typically more permeable than the parent rock, and groundwater therefore normally moves in this soil and not the underlying rock (DOE/EA-0106). Thus the shallow groundwater likely discharges to surface drainage systems in the area. Analyses of water samples from a monitoring station on Bear Creek downstream of the Y-12 disposal site indicated that the uranium concentration in the stream was less than 0.1 percent of the concentration guide established by DOE and that concentrations of chemical parameters met Tennessee stream guidelines, except for nitrate-nitrogen (Y/UB-13).

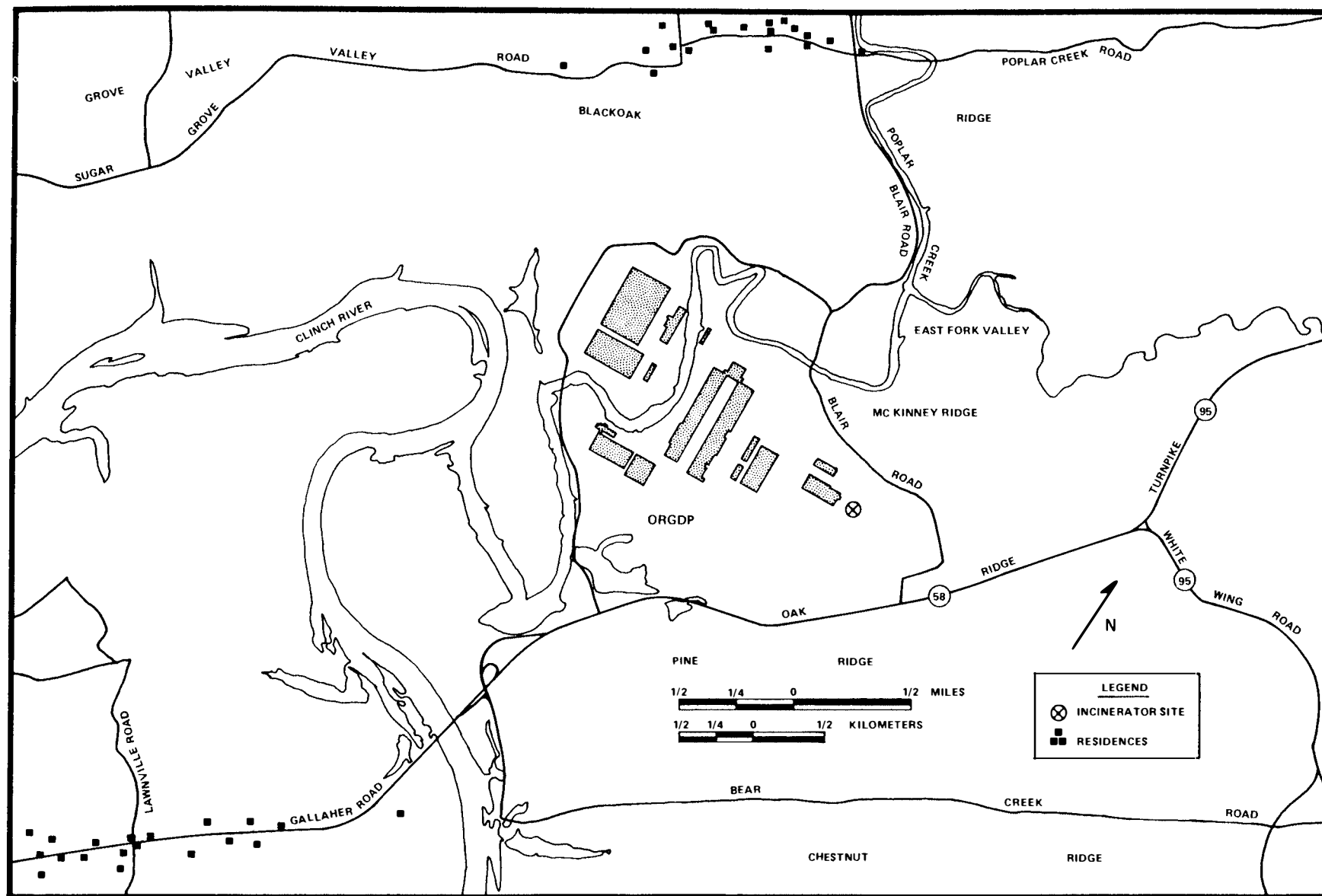


FIGURE 4-1. LOCATION OF RESIDENCES WITH RESPECT TO THE PROPOSED PLANT SITE

The Y-12 waste burial site is currently managing approximately 3600 metric tons (4000 tons) of waste per year and is projected to have a remaining usable life of at least 10 years with the addition of incinerator residue to the waste stream disposed at the site. The impact of the disposal of the incinerator residue should be minimal with the use of sound landfill operating practices, which will minimize the infiltration of precipitation and surface drainage into the waste and thus also reduce the risk of contaminant transport from the incinerator residue. Lead and beryllium, two toxic metals which could be low-level constituents of the waste, are both strongly immobilized in soil (EPA 600/2-77-020). The small amounts of PCB which could remain in the incinerator residue will also be relatively immobile in the landfill because of the low solubility of PCBs in water and its adsorption characteristics (EPA 600/2-80-027; EPRI FP 1207; EPA 600/9-78-016). The observed rate of PCB movement in soil has been about one thousandth of the theoretical rate of groundwater movement calculated from Darcy's law, which is an equation for the velocity of fluid movement in soil (EPRI FP 1207).

4.2.3 Water Quality Impacts

This section addresses the water quality effects of the proposed waste destruction alternative (also see Appendix I). In examining these effects, two modes of introduction of contaminants into the nearby water bodies were considered. The first mechanism of introduction is direct discharge of treated facility effluents into Poplar Creek. These effluents may be contributed by the normal plant operations or may come from fire or storm water discharges. Contaminants may also be contributed to water courses from erosion and runoff of soil particles. Elevated soil concentrations result from deposition of airborne contaminants.

4.2.3.1 Direct Impacts. Evaluation of direct impacts was accomplished by application of flow dilution factors to account for combining scrubber purge water and ash pit overflow with other ORGDP effluents treated in common. An additional factor was then applied to those pollutants known to form precipitates or to concentrate on particle surfaces. Estimated removal efficiencies of 57 percent for particulates have been calculated by Union

Carbide personnel for the ORGDP treatment system (Long, June, 1981). Incremental contributions from the incinerator were superimposed on the existing effluent quality to determine the projected changes. Finally, Union Carbide supplied flows and monitoring data for the discharge to Poplar Creek and for Poplar Creek discharge to the Clinch River (Long, June, 1981) which were used to estimate future effects of the facility on Poplar Creek and the Clinch River. Contaminants identified as being present in the effluent are chloride, fluoride, sulfate, phosphate, sodium, uranium, lead, beryllium, and suspended particulates. Temperature and pH are not expected to be significant issues due to the detention time and neutralization provided by the treatment system.

Organic contaminants, such as uncombusted PCBs, are likewise not expected to affect the quality of Poplar Creek or the Clinch River. As discussed in Section 4.1.3, the wastewater from the incinerator will be tested to determine contamination. Individual pollutants, such as polychlorinated biphenyls, hexachlorobenzene, benzofurans and dioxins, will not be discharged above their respective permit limits. In the case of PCBs, this limit will be about 1 part per billion (1 microgram per liter). At this concentration the quantity of PCBs discharged to Poplar Creek over the lifetime of the facility will be less than 0.9 kilograms (2.0 lbs). This represents an insignificant and nondetectible increase in the amount of PCB in the aquatic systems downstream of ORGDP (see Section 3.8.4).

Numerous investigations have been conducted on the fate and transport of PCBs in the aquatic environment (EPA 600/2-800-27; EPA 560/5-77-003; EPA 904/9-76-014; Dexter, et al., 1978; and EPA 560/6-76-005). All available knowledge supports the idea that PCBs are very strongly attached to sediment particles and that the concentrations on sediment in equilibrium with the water favor the retention in the sediments. An investigation of sediment transport of PCB in regulated river systems suggests that most of the PCBs will be concentrated in an area just above Watts Bar Dam in the reservoir. The other minor organic contaminants will behave in a similar fashion.

Results of the transport calculations for the other contaminants are shown in Table 4-8. In general, for several contaminants there are no significant differences in the Poplar Creek concentrations with and without the facility. In this category are sulfate (less than 0.1 percent change), lead

TABLE 4-8. EFFECTS OF FACILITY DIRECT AQUEOUS DISCHARGES ON WATER QUALITY IN POPLAR CREEK

Effect	Chloride	Fluoride	Sulfate (as SO ₄)	Phosphate (as P)	Sodium	Uranium	Lead	Beryllium	Total Dissolved Solids	Total Suspended Solids
Estimated Concentration to K1407 from incinerator (mg/l) ^a	5700	280	32	52	4100	10	2.4	3 x 10 ⁻⁷	10900	830
Precipitation/Adsorption Effects ^b	No	Moderately	No	Yes	No	Yes	Yes	No	Minor	Yes
K1700 Concentration (mg/l)										
Present ^d	37	0.86	116	0.85	52	0.32	0.01	<0.0004	367	<u>11</u>
Future ^c	184	6.18	114	1.46	157	0.43 ^k	0.04	<0.0004	612	<u>21</u>
Poplar Creek Concentration Downstream from K1700										
Present (mg/l) ^d	<u>6</u>	<u><0.2</u>	<u>34</u>	<u>0.25</u>	7	<u>0.006</u>	<u><0.01</u>	<u><0.0004</u>	<u>186</u>	7
Future (mg/l) ^d	<u>8</u>	<u><0.25</u>	<u>34</u>	<u>0.26</u>	8	<u>0.007^l</u>	<u><0.01</u>	<u><0.0004</u>	<u>188</u>	7
Increase (percent) ^e	26	25	0	4	19	17	Neq.	0	1	1
Standard or Guideline (mg/l)	250 ^h	1.0 ^f	250 ⁱ	0.10 ^m	--	37.8 ^{g,m}	.05 ^f	--	500 ^f	30 ^j
Future Percent of Standard or Guideline	3.2	25.0	13.6	260	--	<0.1	20	--	37.6	23

Note: The value for comparison to the standard is marked by underline

Sources: Computations based on sources given below

a Based on process mass balance.

b Used to correct concentrations for particulate removal during treatment.

c Based on 20 gal/min PCB facility inflow and 750 gal/min other inflows.

d Based on annual average 200.4 cubic feet/sec (1.79 x 10⁶ liters/year; 89,945 gal/min) flow in Poplar Creek near juncture with Clinch River (Long, June 26, 1981).

e Percent increases do not coincide with those for present and future concentration in this table. These are rounded to fewer decimal places than reflected in detailed calculations.

f-j Denotes following sources of benchmarks: f) Tennessee Stream Standard, g) Department of Energy Concentration Guideline, h) U. S. EPA Secondary Drinking Water Standard, i) U.S. EPA Water Quality Criterion (Red Book), or j) NPDES Permit Level. (See Y/UB-15).

k Equivalent to 3.38 x 10⁻⁷ uCi/ml based on a specific activity of 7.81 x 10⁻⁷ Ci/g for maximum enrichment level of 1.0 percent U-235 (Long, June 26, 1981).

l Equivalent to 0.55 x 10⁻⁸ uCi/ml based on above conversion between concentration and activity.

m Calculated from concentration guideline of 3 x 10⁻⁵ Ci/ml (DOE Manual, Appendix 0524, Annex A, Table II).

(no detectable change), beryllium (no change), total dissolved solids (1.0 percent increase), phosphate (4 percent increase), and total suspended solids (1.0 percent increase).

For the remaining constituents of the K-1700 discharge, the percentage increases are larger, but the absolute concentration increases are small. Uranium is projected to increase by 17 percent from 0.006 to 0.007 mg/l. This is well below the DOE guideline for mixed uranium isotopes. Sodium concentrations are expected to increase by 19 percent, but only 1 mg/l. The largest percentage increases will be chlorides and fluorides, 26 percent each; however, this represents concentration changes of only 2 and 0.05 mg/l, respectively.

The mixing zone volume in Poplar Creek will be measurably larger as a result of incinerator contributions. This result can be seen for most parameters when lines 3 and 4 in Table 4-8 are compared. Evaluation of the effects on the Clinch River showed that the discharge of aqueous contaminants from the incinerator would be negligible as an additional dilution factor of 19:1 could be applied (Long, June, 1981). Furthermore, the fate of those pollutants identified previously as being affected by precipitation or adsorption would be parallel to that of the PCBs. Specifically, the trapping of suspended particles in the downstream reservoirs will cause these contaminants to accumulate there.

4.2.3.2 Indirect Impacts. Annual emission rates of contaminants from the stack were used to calculate the indirect effects of the incinerator on water bodies. The annual quantity of contaminants was assumed to be deposited within a 52 sq km (20 sq mi) area around the facility. This area is within the Poplar Creek-Clinch River drainage basin. This sized area was selected based on the available estimates of dispersion of airborne contaminants around ORGDP. It was also assumed that the contaminants would be associated with fine particulates rather than being in a gaseous state.

Of the nine contaminants identified as being present in the air emissions, six (polychlorinated biphenyls, hexachlorobenzene, furans, dioxins, and beryllium) were controlled to such a high degree by the treatment train that it would require hundreds or thousands of years of releases before a signifi-

cant change in the surface soil concentrations occurred. These contaminants were, therefore, not considered further.

Phosphate deposition would annually result in an increase of 0.033 mg per kg soil in the uppermost 5 cm (2 in). The soils in the vicinity of the proposed facility are acid in reaction, low in organic matter, and low in mineral plant nutrients. It is inferred that deposition of phosphorus would be beneficial to the fertility of the soils.

Assuming that atmosphere releases of fluoride were immobilized in the soil by association with the indigenous minerals, the fluoride concentration would increase somewhat in the affected areas (Hsu, 1977). Mitigating factors are the modest increase above background levels that this represents and the fact that the affected area is only about 15 percent of the drainage area of Poplar Creek and 0.1 percent of the Clinch River drainage area. The effects on aqueous fluoride concentrations are expected to be negligible.

More detailed calculations were performed for the remaining two contaminants due to their toxicity and the level of current environmental concern. An estimated 3.4 kg (7.5 lb) of lead and 8.6 kg (18.9 lb) of uranium will be emitted annually. Both of these metals are very insoluble and are transported primarily in the particulate form (Jenne, 1979; Garrels and Christ, 1965). Increases in concentration were, therefore, assumed to be confined to the top 5 cm (2 in).

Under this scenario, lead concentrations in the soil in the affected area would increase by 0.04 mg/kg after 25 years of continuous operation (7300 hours per year). Lead concentrations in soils at ORDGP average 59 mg/kg, which compares to typical levels of 30 mg/kg and up to 20,000 mg/kg near highways (EPA 600/2-75-004). Since the incinerator will cause only about a 0.1 percent increase and since only about 15 percent of the eroded soil from the affected area will reach a water body, the increase in water-borne lead concentrations due to atmospheric releases will not significantly differ from the current situation. Even though heavy metal accumulation in area streams has been cited by the Tennessee Department of Health (1979) as a significant concern, the additional inputs from the proposed incinerator should not significantly increase this problem.

Water quality effects of uranium releases were evaluated by considering that 25 years of incinerator operation would increase soil concentrations in the affected area by approximately 0.10 mg/kg. Converting these concentrations to radiological activities results in an increase of 0.078 pCi/g or about 8 percent relative to soil data supplied for 1979 (Y/UB-13). To assess the effects on the water environment, estimates of net soil erosion to Poplar Creek were made using the soil loss equation technique (EPA 430/9-73-014). Reasonable but conservative values for suspended sediment concentrations in the creek were obtained for an estimated 1.8 metric ton per hectare (5 ton per acre) annual loss and 15 percent transport efficiency factor. Under these conditions the radioactivity contribution of the incinerator facility is expected to increase the activity in Poplar Creek due to soil contributions by 0.1 percent from the current $0.5 \pm 0.2 \times 10^{-8}$ uCi/ml.

In conjunction with direct aqueous releases, the total number of curies of uranium radiation will increase by 20 percent relative to 1979 releases of 0.6 curies. However, this increase will result in at most a 10 percent increase in concentration of radioactivity in Poplar Creek relative to existing conditions. Future concentrations will be virtually indistinguishable from current levels and will remain less than 0.1 percent of the Department of Energy concentration guideline. The radioactivity contributed by the facility will eventually concentrate in the sediments of the reservoirs in the TVA system (BNWL-2227).

Contributions of radioactivity or other contaminants to water from the disposal of ash are expected to be negligible. Careful attention to proper engineering of the landfill will minimize the contact between the ash and precipitation thereby limiting leachate production. The insolubility of many of the contaminants should further reduce the risk of migration. Sections 4.1.3 and 4.2.2 should be consulted for further information on solid waste.

4.2.4 Impact on Groundwater

The proposed incinerator facility will have no direct discharge to groundwater; thus, impacts to groundwater can only arise from the disposal of solid wastes (ash) from the incinerator, from air emissions, and from spills

and leaks. Solid waste disposal impacts have been addressed in Sections 4.1.2 and 4.2.2. This section addresses the potential for groundwater impacts from air emissions and from leaks and spills.

Air emissions contaminants from the incinerator which are of concern with respect to groundwater quality, such as heavy metals and fluoride, will be emitted in very small quantities (Section 4.1.1) and will be dispersed over a large area (Section 4.2.1). The concentration changes in soils are expected to be small, as described in the previous section. In addition, the contaminants involved are relatively immobile in soils of the type found in the immediate vicinity, and are not expected to migrate to groundwater supplies. Thus, no significant impact on groundwater quality is expected to result from air emissions from the proposed incinerator.

The incinerator facility will be designed to minimize the possibility that spilled materials could reach the soil or groundwater. Floor curbs and seals, roofs, and other design features will operate to contain a spill should one occur, and spilled materials will be removed should a spill occur. Thus the likelihood of a spill reaching the soil or groundwater is small. However, even should a spill reach the soil, the likelihood of significant impacts on groundwater is small, as detailed below.

First, it may be possible to contain a spill that reaches the soil by removing the contaminated soil and incinerating it; this approach is supported by the low soil mobility of many of the materials in the waste inventory. Second, there is no withdrawal of groundwater in the immediate vicinity of the proposed site, and groundwater feeds a small stream which arises just below the site and flows to the K-1700 discharge, which is monitored. Should a spill or leak reach the groundwater at the proposed site, it would likely migrate to the stream, rather than affect the quality of groundwater in the surrounding area. Of course, should a spill migrate to the stream, monitoring of the K-1700 discharge would detect any significant change in water quality.

Thus, no significant impacts on groundwater quality are expected to result from the proposed action, due to the small probability of a spill reaching the groundwater and the low levels of air emissions contaminants expected to reach the soils.

4.2.5 Noise Impacts

The impact of noise from the proposed incinerator will be negligible. This conclusion is based on three factors which apply to the situation.

1) The noise contribution of the proposed plant will be significantly lower in level than existing noise levels everywhere, except in the immediate vicinity of the incinerator (see Appendix G).

2) There are no residential or institutional land uses within the area subject to noise from the incinerator.

3) Sound from the existing ORGDP, while quite low in level, is of such a nature and level that it provides an effective masking background.

4.3 Effects of Construction on the Physical Environment

Construction of the proposed incinerator will also have the potential to cause changes in the quality of the physical environment, that is, to change air quality, water quality, and the sound environment. This section analyses the sources and extent of those impacts.

4.3.1 Construction Activities

For the proposed facility, construction activities can be divided into two phases, land improvements and actual construction. Land improvements are not expected to be extensive, since the proposed site is a clear, nearly-level area without significant vegetation, rock outcroppings, or other features requiring removal before construction. The site is adjacent to an existing roadway and fenceline; a new patrol road and fence will be constructed around three sides of the proposed site.

Construction activity will include the assembly of the incinerator and its auxiliary equipment, and the construction of other facilities. These will include two single story buildings totalling about 670 m² (7200 sq ft), an unloading and storage area (1200 m² or 12,750 sq ft), and wastewater holding tanks. Connections to existing ORGDP utilities and to the existing wastewater treatment facility will also be made.

These construction activities will involve only a small area (2 ha or 5 acres) and the commitment of limited resources. The total capital cost at ORGDP of the proposed action is estimated to be \$29,000,000 (K/D-5222).

4.3.2 Impacts to Air Quality from Construction Activities

Construction activities will result in emissions of dust and gases. Sources of these emissions are land grading and excavation, storage of excavated materials, and equipment and vehicle operations. The quantity of dust emissions from construction operations are proportional to the area of land being worked and the level of activity. It is also probable that emissions from heavy construction operations are directly proportional to the silt content of the soil (that is, particles smaller than 75 μm in diameter) and inversely proportional to the square of soil moisture (AP-42). Watering is the most often selected control method because water and necessary equipment are usually available at construction sites. The effectiveness of watering for control depends greatly on the frequency of application.

EPA (AP-42) has estimated fugitive dust emissions to be approximately 2.7 metric tons per hectare (1.2 tons per acre) of construction per month of activity. Based on this estimate, the approximate 2 hectare site, if entirely involved in construction, would emit approximately 5.4 metric tons (6.0 tons) of dust per month of activity. Appropriate control measures, such as watering, will mitigate this impact.

Gaseous emissions of concern arise from construction machinery and other construction operations such as welding. The emissions from the construction activities at the proposed site should not represent a significant decrease in air quality, given the level of traffic in vicinity of the ORGDP.

4.3.3 Impacts to Water Quality from Construction Activities

Construction activities at the proposed site may affect the water quality of Poplar Creek. The primary effect would be an increase in the sediment load to the Creek. The increase in loading would result from erosion by precipitation of soils disturbed by construction activities. Surface runoff

transports increased quantities of soils to the Creek. The increased sediment load in the Creek could raise turbidity and nutrient levels, and could have negative impacts on aquatic organisms, particularly fish. In addition to sediment loads, minor amounts of other materials found on construction sites can be carried to nearby waterways by surface runoff. The impacts of such loadings depend on the materials and the quantities involved.

Mitigative measures should minimize the potential impacts of soil erosion and materials runoff. For areas of less than half an acre, temporary straw or hay bale barriers installed around disturbed soil and materials storage areas should be effective in containing the surface runoff and allowing sediments to settle. Detention basins and ditches or dikes should be used with larger areas to allow sediment settling. Potentially toxic or hazardous materials should be controlled on-site to minimize spills and transport by surface runoff. If these and other measures are followed, construction activity impacts on water quality in Poplar should be minimal.

4.3.4 Noise Impacts of Construction

The nature of the work required for site preparation and construction will be such that noise emissions resulting from these activities will be within acceptable community noise limits at off-site locations. On-site, workers could be exposed to excessive noise levels due to the close proximity of equipment. Implementation of recognized administrative noise exposure control methods, however, should be effective in preventing noise-induced hearing loss. Such measures include limitation of employee time spent in close proximity to equipment, use of adequate hearing protection devices where it is necessary to have people working in high noise level areas, and maintenance of noise control devices on construction equipment.

4.4 Impacts on Terrestrial and Aquatic Ecology

Impacts to the non-human biota due to the proposed action may arise through two mechanisms, destruction of habitat at the site, and changes in the physical characteristics (air quality, water quality, noise) of the

environment. The analysis of ecological impacts derives from the discharges identified in Section 4.1 and 4.3, and the effects on the physical environment described in Sections 4.2 and 4.3.

4.4.1 Habitat Destruction

The loss of habitat due to construction on the proposed site will be minimal. The site is small and essentially clear of vegetation except for grasses which have arisen since the site was graded some time in the past. No rare habitat exists on the site. Thus, clearing the site will not have a significant impact on habitat availability.

4.4.2 Ecological Impacts of Changes in the Physical Environment

The changes in the physical environment identified in Sections 4.1, 4.2, and 4.3 were reviewed to assess the degree of impact upon plant and animal species in both the terrestrial and aquatic environments.

Emissions to the air and the corresponding change in air quality which have been estimated are well below potentially relevant standards and represent minimal changes in the character of the environment. Therefore, due to the small amount and low concentrations of pollutants emitted by the proposed incinerator, no significant ecological impacts are expected from emissions to the atmosphere.

The small changes in water quality identified in Section 4.2.3 are not expected to have a significant impact upon aquatic species in either the Clinch River or in Poplar Creek.

Changes in noise levels due to the proposed incinerator are not expected to have an ecological impact. This is supported by the fact that the noise contribution of the proposed incinerator will be below existing levels everywhere but in the immediate vicinity of the proposed site.

In summary, the changes in the physical environment which would result from the proposed action would not be expected to have a significant impact on the terrestrial or aquatic ecology.

4.5 Impacts on Public Health and Mitigation

Emissions from the proposed facility were estimated using methods and assumptions described in Section 4.2.1. Table 4-9 presents annual arithmetic mean exposure for the most exposed residence (about 5.2 km or 3.25 mi southwest of the proposed site), together with established standards where applicable. Radionuclides, PCBs, dioxins, and furans were chosen for detailed

TABLE 4-9 SUMMARY OF PUBLIC EXPOSURES
FROM STACK EMISSIONS

Pollutant	Annual Arithmetic Mean Exposure at Most Exposed Residence (ug/m ³) ^a	Applicable Standards (ug/m ³) ^b
NO _x	1.0 x 10 ⁻²	282 ^c
TSP	5.8 x 10 ⁻³	260 ^c
HC1	4.4 x 10 ⁻³	
VOC	<1.3 x 10 ⁻³	160 ^d
CO	1.0 x 10 ⁻³	10,000 ^e
P ₂ O ₅	7.3 x 10 ⁻⁴	
SO ₂	<7.3 x 10 ⁻⁴	365 ^c
F	<7.3 x 10 ⁻⁴	
Cl ₂	<1.5 x 10 ⁻⁴	
U	3.8 x 10 ⁻⁵	
Pb	1.5 x 10 ⁻⁵	1.5 ^f
PCB	6.7 x 10 ⁻⁸	
HCB	2.4 x 10 ⁻⁸	
Furans	8.8 x 10 ⁻¹⁰	
Dioxins	5.6 x 10 ⁻¹¹	
Be	1.9 x 10 ⁻¹²	

Sources: ^aTable 4-7; ^bClayton and Clayton, 1978.

^c Primary National Ambient Standards--24 hour average

^d Primary National Ambient Standards--3 hour average

^e Primary National Ambient Standards--8 hour average

^f Primary National Ambient Standards--3 month average

assessment due to the serious nature of the potential effects associated with them and the uncertainty involved in deriving a dose-response relationship at the very low exposure concentrations expected to result from the proposed action. It is generally assumed that some minimal amount of risk in excess of that which would occur naturally can be expected in response to any increment in exposure, no matter how small. A brief evaluation of the hazard of each follows. Reviews of the associated health effects may be found in Appendix J along with a description of techniques and uncertainty involved in quantifying risk of adverse effect from exposure to very low levels of these substances.

4.5.1 Public Health Impacts from Radionuclides

Oak Ridge National Laboratory has developed computer programs for estimating dose to man from radionuclide exposure via air (AIRDOS II, EPA 520/7-79-009) and water (AQUAMAN; ORNL/TM-6618). These programs were applied to emissions estimates for the proposed incineration facility and to emissions from ORGDP to derive population dosages in millirems. Both facilities were considered since it is the increment to total dose added by the proposed facility that is of concern.

Exposures from aqueous emissions of radionuclides were calculated for 75 year dose commitments. The computer data base includes internal and external dose conversion factors and bioaccumulation factors for each radionuclide. Dose and cumulative exposure index (CUEX) were calculated for the total body, GI tract, bone, thyroid, lungs, liver, kidneys, testes, and ovaries. Three exposure pathways were considered: water ingestion, fish ingestion and submersion. It was assumed that 1.2 liters of water from the Clinch River were consumed per day; that 47 grams of fish from Poplar Creek were consumed per day; and that 5 percent of the year would be spent swimming in Poplar Creek. Totals of CUEX fractions are based on data from ICRP 30 (NUREG/CR-0150, Vol. 2). This analysis represents a worst case and the results presented in Table 4-10 would therefore overestimate the dose which would actually be received by any individual.

TABLE 4-10. 75-YEAR DOSE COMMITMENT DUE TO LIQUID EFFLUENTS
TO THE CLINCH RIVER

<u>Organ</u>	<u>ORGDP (1980)^a</u>	<u>Proposed Facility^a</u>
Total Body	0.90	0.24
GI Tract	0.08	0.02
Bone	0.95	0.24
Thyroid	0.39	0.08
Lung	<0.01	<0.01
Liver	0.38	0.08
Kidneys	0.45	0.12
Testes	0.30	0.08
Ovaries	0.30	0.08

Source: Computation by the Oak Ridge National Laboratory.

^a Dose commitment in millirems.

Doses due to air discharges were calculated for 50 year commitments with the aid of the AIRDOS program. They were also based on ICRP 30 data. Exposure was calculated for the nearest residence which is 3200 meters southwest of ORGDP. It was assumed that the person ate only food grown and processed in the same area. This is unlikely and makes the estimates conservative, that is, likely to be higher than would actually occur. Table 4-11 presents dose commitments for the two facilities from air discharges.

Several governmental agencies have recommended standards for radiation protection of the general population. Recommendations by the Nuclear Regulatory Commission (NRC) and the National Commission on Radiological Protection are as follows:

Permissible levels of radiation received by an individual in unrestricted areas, as specified by the NRC, are 0.5-rem dose to a whole body in a calendar year, 2 mrem in any one hour if the individual is continuously present in the area, and 100 mrem in any 7 consecutive days, if the individual is continuously present in the area. The recent ruling by the NRC requires that special protection be afforded the fetus by keeping the exposure of pregnant females to a maximum of 0.5 rem during the period of gestation.

TABLE 4-11. 50-YEAR DOSE COMMITMENTS DUE TO AIR DISCHARGES
FOR ONE YEAR (MILLIREM)

<u>Organ</u>	<u>ORGDP (1980)^a</u>	<u>Proposed Incinerator^a</u>	
Total Body	1.6	0.28	.042
Red Marrow	2.5	0.28	
Lungs	0.28	0.03	.01
LLI Wall	15.0	0.02	
Thyroid	66.0	0.01	.002

Source: Computation by the Oak Ridge National Laboratory.

^a Dose commitment in millirems.

Dose Limits for the Public, or Occasionally Exposed Individuals

Individual or occasional	0.5 rem in any one year
Students	0.1 rem in any one year
Population dose limits	
Genetic	0.17 rem average per year
Somatic	0.17 rem average per year

The EPA limits for doses to any off-site individual from uranium fuel cycle operations are 75 mrem per year for the thyroid and 25 mrem per year for all other organs (45 FR 2861). As can be seen from Tables 4-10 and 4-11, projected dose commitments from these facilities are within suggested limits. However, as discussed in Appendix J, radiation carcinogenesis is assumed to be a no-threshold effect. That is, any measurable exposure involves some amount of risk. Factors derived for associating exposure levels with quantitative measures of risk are presented in Table 4-12. The product of the dose commitment and the risk factor is the risk that an individual will develop cancer as a result of exposure to a given radiation dose.

TABLE 4-12. RISK FACTORS OF CANCER MORTALITY

<u>Organ</u>	<u>Risk of Total Cancer (per person-rem)</u>
Total Body	2×10^{-4}
Lungs	4×10^{-5}
Thyroid ^a	1×10^{-6}

Source: EPA 520/7-79-009.

^a Nonfatal cancer risk of 1×10^{-5}

These factors yield conservative estimates. Effects of age, latency, and other parameters are included in such a way as to overestimate, rather than underestimate, the risk. For example, a lifetime risk of 6.2×10^{-6} indicates that in a population of one million, 6.2 individuals will develop fatal cancers during a seventy-five year period. Table 4-13 presents individual lifetime risk of the closest individual developing fatal cancer for the total body, the lungs, and the thyroid. The risk of developing nonfatal cancer of the thyroid is also calculated. Doses were obtained by summing dose commitments due to liquid effluents (diluted by Clinch River) and air discharges from the proposed incinerator (Table 4-10 and 4-11), correcting the air discharge dose to 75 years. These doses were multiplied by the risk factors in Table 4-12 to obtain the risks.

These risks of approximately 4×10^{-10} to 3×10^{-7} can be compared to individual lifetime risk of fatal cancer for a maximally exposed individual due to low level ionizing radiation from various other more familiar types of facilities. For example, a similar risk estimate is 1×10^{-5} to 6×10^{-5} for a coal-fired power plant and 2×10^{-5} to 2×10^{-2} for a metal mining and milling operation (EPA 520/7-79-006).

The calculated risks are considered excess risks, that is, above the normal rate of cancer. Current U.S. mortality for all types of cancer indicates a risk of 1.64×10^{-1} to an average individual. The added risk due to the proposed facility is negligible in comparison to this value. The

TABLE 4-13. INDIVIDUAL LIFETIME RISK OF CANCER MORTALITY

<u>Organ</u>	<u>Dose Commitment (rem)</u>	<u>Risk of Cancer Mortality</u>
Total Body	1.32×10^{-3}	2.64×10^{-7}
Lungs	0.06×10^{-3}	2.40×10^{-9}
Thyroid	0.41×10^{-3}	4.10×10^{-10} (4.10×10^{-9}) ^a

Source: Computed from Tables 4-10, 4-11, and 4-12; see text.

^a Risk of nonfatal cancer.

radioactive emissions from the proposed facility will not significantly increase the risk of cancer.

4.5.2 Public Health Impacts from Polychlorinated Biphenyls (PCBs)

Health effects of PCBs are described in Appendix J. Very little quantitative dose-response data exists and that which is available involves much higher exposures than the general public will encounter as a result of the proposed facility. For example, chloracne has been found to occur with occupational exposure to PCB vapor concentrations of 0.1 mg/m^3 over a period of several months. This is ten orders of magnitude above the annual mean exposure level of $6.7 \times 10^{-8} \text{ ug/m}^3$ projected by the dispersion modeling for the most exposed residence.

It is the potential for carcinogenic activity in humans that causes concern over any additional exposure to this already ubiquitous chemical. Animal studies and preliminary results of studies of human exposures indicate that PCBs are potentially carcinogenic and possibly teratogenic. It is impossible to attribute quantitative values of risk to PCB exposures similar to those for exposure to low level ionizing radiation. The data is insufficient to relate dose and effect for exposure to such low concentrations. Careful monitoring of PCBs at various distances from the facility will be conducted to insure that PCB exposure levels are below acceptable limits.

4.5.3 Public Health Impacts from Polychlorinated Dibenzo-dioxin (PCDD) and Dibenzofurans (PCDF)

Health effects of PCDDs and PCDFs are reviewed in Appendix J. As with PCBs, the reason for concern with the low levels which might be experienced by the general public as a result of this facility are the potential for carcinogenic or teratogenic effects.

The Carcinogen Assessment Group of the Environmental Protection Agency has derived a risk factor for quantitatively associating risk of cancer with exposure to PCDD (EPA Region VI, 1981). They estimate that the risk factor is 0.091 per ng/m^3 throughout a 70-year lifetime. This relationship is based on data from animal studies and a series of assumptions listed in Table 4-14. The assumptions were chosen to be conservative, that is, to overestimate the risk. Each assumption involves a degree of uncertainty, which must be kept in mind in weighing the results of such a risk assessment. Since the carcinogenicity of PCDD and PCDF are assumed identical, the concentrations of each chemical are summed and the risk factor applied. For the proposed facility, this results in a risk of 8.5×10^{-8} for the most exposed residence. This is far less than the 1.64×10^{-1} risk of cancer mortality for the average individual based on U.S. mortality data. This risk represents an insignificant increase and an insignificant impact of the proposed action.

4.6 Impacts on Occupational Health

The protection of worker health and safety at the PCB incineration facility will be part of the safety and health program of the Oak Ridge Gaseous Diffusion Plant. The ORGDP Safety and Health program consists of the following organizations: 1) operational safety, 2) industrial hygiene, 3) health physics, 4) fire protection engineering, 5) equipment test and inspection, 6) environmental protection, and 7) ORGDP-OSHA coordinator. The health and safety program for the PCB incineration facility will be implemented by these organizations. The functions and activities of each safety and health related organization are outlined below and will be extended to include the PCB incineration facility.

TABLE 4-14. ASSUMPTIONS USED IN DEVELOPING DIOXIN
(PCDD) CANCER RISK FACTOR

- The carcinogenic potential of all dioxins (PCDDs) and furans (PCDFs) are assumed equal to the most toxic furan - 2,3,7,8-TCDF
 - All particulate emissions containing PCDF and PCDD are of respirable size
 - All PCDD and PCDF that is respired is retained in the body and is biologically available to the individual
 - The composition of chemicals exiting the stack is the same as those found at ground level (no transformation or degradation of the chemicals occurs in the atmosphere)
 - Combustion of PCBs would continue 24 hours per day for 70 years
 - Air dispersion modeling of emissions is representative of the sites studied
 - The entire at-risk population is exposed to the estimated maximum annual average concentration
 - A multi-stage, one-hit, linear extrapolation method of cancer risk assessment was used
 - Laboratory animals used in carcinogenic testing studies are surrogates for humans
 - Other cancer risk assumptions used were found in 44 FR 131, July 6, 1979
 - The assumptions made by the Cancer Assessment Group in determining unit risk are valid
-

Source: U.S. EPA Region VI, 1981.

The operational safety department responsibilities will include establishing an effective, comprehensive accident prevention program and maintaining the necessary safety staff to assist line supervision in fulfilling responsibilities for the safety of employees and equipment. Specific activities of the department will include accident and injury investigation, inspections, safety meetings, safety training, procurement and use of personal protective equipment, job safety analysis, and additional supporting services which promote plant safety.

The industrial hygiene department will provide the necessary programs to identify occupational health risks at ORGDP. The department will also provide plant management with the necessary technical support and services to implement protection and control programs including monitoring the effectiveness of ongoing programs and advising plant employees of occupational health risks. Specific activities of the department will include monitoring of workplace exposures to chemical and physical agents; reviewing facility design; investigating occupational illnesses; conducting programs in hearing conservation, toxic chemicals, heat stress, and respirator maintenance; surveying industrial ventilation; inspecting facilities; and additional support services which assure worker health and safety.

The health physics department will ensure that exposures of workers to radioactive materials or ionizing radiation are below applicable radiation protection guide values. This will be accomplished through evaluation of exposure levels and potentials, with appropriate recommendations to plant management. Specific activities will include surveys of the workplace for radiation levels, education and training of workers, biological monitoring (urinalysis) of workers, dosimetry and related activities which assure worker health and safety.

The fire protection engineering department will provide staff and facilities for effective fire protection services to safeguard personnel and property. The department will develop procedures to insure prompt and efficient emergency response to fires, rescues and ambulance service. Specific activities of the department will include a review of new facilities, the development of emergency response procedures and related activities which assure plant safety and protection of plant employees.

The equipment test and inspection department will establish and maintain a mechanical safety program to ensure that plant equipment and facilities are at a level of performance consistent with national safety codes, standards, and Federal Regulations.

The environmental protection department will provide continuous surveillance over plant operations to assure that discharges of pollutants are consistent with or less than established standards. The department will assure that plant personnel, the general public and the environment are protected against hazardous materials.

The ORGDP-OSHA coordinator maintains a program which maximizes the safe working environment of the plant employees. Unsafe working conditions within the plant will be identified and corrected in accordance with rules established by the Occupational Safety and Health Act of 1970.

4.6.1 Potential Exposure

The potential for exposure of workers to chemical and physical agents during normal process operations is dependent upon the process encountered and the control technology employed to mitigate environmental releases. A brief process description of the proposed PCB incineration facility is given in Appendix K. The chemical agents that workers could potentially be exposed to during the incineration process include PCB and non-PCB waste materials as listed in Table 4-15. These agents include solids, sludges and liquid wastes which may contain varying concentrations of PCBs and/or radionuclides.

TABLE 4-15. INVENTORY OF HAZARDOUS MATERIALS

Acetone ^a	Methylene chloride
Benzene	Polychlorinated biphenyls
Carbon tetrachloride	Tetrachloroethylene
Chloroform	Tributylphosphate
Diesel fuel	1,1,1-Trichloroethane
Freon 11	Biological wastes
Freon 113	Cutting oils
Fullers Earth	Degreaser sludges
Furfuryl alcohol	Lubricating oils
Hexane	Mineral oils
Isopropyl alcohol	Photographic wastes
Kerosene	Waste oils
Methanol	Waste paint sludges
Methyl chloroform	

Source: K/D-5222.

^a Materials listed above may contain varying concentrations of PCBs and/or radionuclides.

4.6.2 Review of Proposed Industrial Hygiene and Control Technology/Mitigative Measures

Control technology used to mitigate worker exposures to chemical and physical agents consist of: (1) engineering controls for the elimination or control of chemical and physical agents, (2) work practices which lessen worker contact with the agents, (3) process or operation monitoring systems for warning of a process or control failure which would create a health hazard, and (4) personal protective equipment for individual worker protection from uncontrolled chemical and physical agents.

Engineering controls include the following:

- Substitution of a chemical agent with a less toxic agent
- Process design or modification
- Equipment design or modification
- Isolation of a process or worker
- Dilution, local or general exhaust ventilation
- Maintenance procedure of the above.

Work practices used to limit worker exposures include specific work and management techniques which minimize generation and subsequent exposure of the worker to the agent.

Monitoring devices are used to warn against a process or equipment failure. Such devices include:

- Exhaust system monitors
- Continuous workplace environment monitors
- Warning devices which indicate process or equipment failure

Personal protective equipment includes the following:

- Respirators
- Protective clothing - boots, gloves, aprons, coveralls
- Hearing and eye protection.

Control technology methods to prevent worker exposures to chemical and physical agents have been developed for normal process operations and accident situations. Current programs in the areas of industrial hygiene, safety, health physics, fire protection and environmental protection which exist at ORGDP will be extended to the cover the PCB incineration facility.

Plans have also been developed for spill prevention and control of hazardous wastes at the incineration facility and during transportation of wastes to the facility. These control measures are outlined below.

Control methods which have been established for the PCB incineration facility are detailed in Table 4-16. These control methods include engineering controls, worker protection, and administrative controls. Engineering controls which have been included in the facility design include containment systems, line transfer of wastes, local exhaust ventilation, and enclosure of operations. Specific controls include enclosure and local exhaust ventilation of the drum unloading station, enclosure of purged drums with plastic covers during transfer of drums to the drum shredder, and interlock systems to control combustion.

Worker protection will include personal protective equipment, hearing conservation, heat stress protection, and continuing evaluation of worker exposures to chemical and physical agents in the work place, inspection of the facility and investigation of accidents and occupational illnesses.

Administrative controls will include the utilization of an emergency response team with an installation director on the ORGDP site 24 hours per day; training programs for workers in the areas of spill prevention and control, safety, and worker protection; change rooms with showers; and an inventory of materials present at the site. All workers at ORGDP are required to have medical check-ups on a routine basis every 18 months.

Plans have been developed for spill prevention and control of hazardous materials at the incineration facility and during transportation to the facility. Materials will be shipped to the incineration facility in full compliance with U.S. Department of Transportation and U.S. Environmental Protection Agency regulations. Emergency response teams will be on call for immediate response to transportation emergencies. The Chemical Transportation Emergency Center (CHEMTREC) will be notified of any accidents involving hazardous waste shipments.

4.6.3 Review of Regulations and Guidelines

The American Conference of Governmental Industrial Hygienists (ACGIH, 1980) has established Threshold Limit Values (TLVs) for chemical substances in

TABLE 4-16. REVIEW OF CONTROL TECHNOLOGY FOR PROPOSED PCB INCINERATION FACILITY, ORGDP

Activity	Hazard	Mitigative Measures		
		Engineering Controls	Worker Protection	Administrative Controls
Drum Handling/Storage	Delivered Wastes	- Equipment test and inspection program established - Receiving and Storage area constructed per 40 CFR 178, 761.42, 49 CFR 178.80, 178.82, 178.102, 178.115, 178.116 - Curbed containment area, impervious floor with minimum 6 inch curb, spill prevention control and counter measure (SPCC) plan - Labeling of all drums, drum inspection for radioactive contamination of drum surface, recordkeeping and site inventory - Monitoring for radioactive contamination	- Safety, industrial hygiene, health physics, fire protection, environmental protection programs established - Protective clothing required depending on activity - neoprene gloves, apron, boots, goggles - Respiratory protective equipment may be used when handling, transferring or working with PCBs. Full face or half face respirators with GMR canisters - Standard procedures established for PCB removal from exposed workers - Washing before eating, smoking and similar activities. Food or drink not allowed in area	- Emergency Squad - Worker training - spill control - Emergency response teams on call - Training of drivers for spill control - Installation Emergency Director responsible for on-site accident prevention, clean-up, investigation, on ORGDP site 24 hours - Inventory of chemicals on-site available for emergency response - Labeling of drum contents - Inspection of containers--radioactive contamination, leaks, spills

TABLE 4-16. (Continued)

Activity	Hazard	Mitigative Measures		
		Engineering Controls	Worker Protection	Administrative Controls
Drum Handling/Storage (Continued)	Delivered wastes (Continued)			• Shipment must agree with shipping manifest • Inspection for transport vehicle for leakage • Change rooms with showers, work clothes provided • Pre-placement medical examination
Tank Truck Unloading	Delivered wastes, 50 percent caustic, Fuel Oil, Nitrogen	• Receiving and storage area constructed per 40 CFR 761.42, 29 CFR 1910.106 • Nitrogen purge of pumping lines	• General Worker protection as indicated above	
	Delivered wastes, 50 percent caustic, Nitrogen	• Storage area constructed per 40 CFR 761.42, 29 CFR 1910.106 • Four tanks of 25,000 gallons within diked area	• General Worker protection as indicated above	• General administrative controls as indicated above
Drum Unloading	Delivered wastes	• Tanks vent to the atmosphere	• General worker protection as indicated above	• General administrative controls as indicated above

TABLE 4-16. (Continued)

<u>Activity</u>	<u>Hazard</u>	<u>Mitigative Measures</u>		
		<u>Engineering Controls</u>	<u>Worker Protection</u>	<u>Administrative Controls</u>
		● Agitation of tank contents ● Automatic pumping of drums in enclosed unloading station ● Local exhaust ventilation in unloading station ● Differential pressure indicators to monitor exhaust system performance ● Shroud with nitrogen purge used during opening of drums ● Separate unloading stations for PCB and non-PCB wastes		
Liquid Waste Blending	Delivered wastes	● Agitation of tank contents ● Vent to the atmosphere	● General worker protection as indicated above	● General administrative as indicated above
Drum Shredding	Delivered wastes, absorbent material, noise, vibration	● Absorbent added by screw conveyor to shredder conveyor belt ● Shredder will not operate during loading ● Combustion air drawn across conveyor belt to rotary kiln	● General worker protection as indicated above	● Accepts only empty drums or drums containing solids. Liquid wastes not accepted at shredder ● General administrative controls as indicated above

TABLE 4-16. (Continued)

Activity	Hazard	Mitigative Measures		
		Engineering Controls	Worker Protection	Administrative Controls
Incineration	Combustion pollutants, dust-fly ash, heat, noise	• Master interlock to control combustion process assuring destruction of PCBs - control of combustion temperature, combustion air • Safety relief valve to vent flue gases in the event of malfunction • Portable ash box serves as collection vessel and transportation carrier	• General worker protection as indicated above	• General administrative controls as indicated above
Off-Gas Treatment	Combustion pollutants, caustic	• Quenching chambers, venturi scrubber (VS) and wet electrostatic precipitator (ESP) • Monitoring of off-gas in stack-PCB, CO, CO₂, HCl, NO, U-235, HF, O₂, total organic Cl, total suspended particulates, Be	• General worker protection as indicated above	• General administrative controls as indicated above
Solid aqueous Waste Management	Combustion pollutants spent activated carbon with absorbed combustion products	• Master interlock-high temp alarms, low water level alarms, pressure drop alarms for VS, ESP, power alarms for ESP	• General worker protection as indicated above	• General administrative controls as indicated above

Sources: K/D-5222, PSAR, and K-55-1.9

TABLE 4-17. THRESHOLD LIMIT VALUES AND SHORT-TERM EXPOSURE LIMITS OF CHEMICAL AGENTS ENCOUNTERED IN THE PROPOSED PCB INCINERATION FACILITY

AGENT	TLV ^a		STEL ^b	
	ppm	mg/m ³	ppm	mg/m ³
Acetone	750	1780	1000	2375
Benzene ^c	10	30	25	75
Carbon Tetrachloride ^c	5	30	20	125
Chloroform ^c	10	50	50	225
Freon 113	1000	7600	1250	9500
Freon 11-Ceiling	1000	5600		
Furfuryl Alcohol-Skin	10	40	15	60
Hexane (n-Hexane)	50	180		
Isopropyl Alcohol-Skin	400	980	500	1225
Methanol-Skin	200	260	250	310
Methylene Chloride	100	360	500	1700
Polychlorinated Biphenyls-Skin				
42 percent chlorine	--	1	--	2
54 percent chlorine	--	0.5	--	1
Tetrachloroethylene	50	335	--	--
1,1,1-Trichloroethane	350	1900	450	2450
Trichloroethylene-Skin	50	270	150	805

Source: American Conference of Government Industrial Hygienists, 1980.

a Threshold Limit Value (TLV)

b Short-Term Exposure Limit (STEL). Short term means no more than 4 exposures at least one hour apart, each lasting no more than 15 minutes.

c Identified as suspect human carcinogens by American Conference of Governmental Industrial Hygienists, 1980.

the workroom air. Threshold Limit Values for those agents identified in the preliminary waste inventory are given in Table 4-17. The TLVs represent the time-weighted average concentration for a normal 8-hour workday or 40-hour workweek to which nearly all workers may be repeatedly exposed, day after day, without adverse effect. The TLVs are only recommendations and have the force or effects of law only where they have been purposely used or included as such.

The U.S. Department of Labor, Occupational Safety and Health Administration utilized ACGIH recommendations in establishing federal regulations. Worker exposure limits to chemical agents are defined in 29 CFR 1910. The OSHA regulations differ from ACGIH recommendations in that the ACGIH recommendations are updated annually, as warranted by relevant toxicological and epidemiological studies.

The National Institute for Occupational Safety and Health (NIOSH, 1977) published recommended guidelines for occupational exposure to PCBs. NIOSH recommendations are outlined in Table 4-18. The NIOSH recommendations generally meet or exceed published federal regulations (29 CFR 1910). These recommendations provide a basis for evaluating the occupational health and safety program of the proposed facility as given by the ORGDP.

TABLE 4-18. NIOSH GUIDELINES FOR OCCUPATIONAL
PROTECTION FROM EXPOSURE TO PCBs

- 1.0 Environmental concentrations of PCBs of 1.0 ug/m^3 as a time-weighted average (TWA) concentration
 - 2.0 Medical surveillance recommended for all employees
 - Preplacement medical exam and comprehensive physical examination to emphasize hepatic function, skin condition and reproductive history
 - Judgement of workers ability to use positive pressure respirator
 - 3.0 Labeling and posting of warning labels indicating PCB hazardous work areas
 - 4.0 Personal protective equipment (PPE)
 - Protective clothing - gloves, boots, overshoes, aprons
 - Eye protection - goggles, safety glasses per 29 CFR 1910.1333 and ANSI-Z-87.1-1968
-

- Respiratory Protection - engineering controls preferred. Respiratory protection only for emergencies, nonroutine maintenance or repair, and during installation or test of required engineering controls. At levels greater than 1 ug/m^3 SCBA or Combination Type C supplied air respirator positive pressure or pressure demand with auxiliary SCBA required

5.0 Informing employees of hazards

- Inform employees of hazards, symptoms and effects of exposure to PCBs, tumorigenic and reproductive effects
- Continuing education program of job hazards, maintenance and clean up procedures, use of personal protective equipment

6.0 Work Practices and Engineering Controls

- Limited access to area
- Operating instructions formulated
- Transportation compliance with federal regulations
- Storage of containers in ventilated area
- Valve protection covers on drums
- Storage area should provide containment of spills
- Process valves/pumps readily accessible
- Protective clothing when opening, connecting, disconnecting PCB containers/systems
- Daily inspection of equipment for leaks
- Control of airborne PCBs through suitable engineering controls - complete enclosure and/or local exhaust ventilation
- Exhaust systems should comply with local regulations
- Maintenance and checking of ventilation systems at least semi-annually or monthly with log of ventilation measurements
- Marked exits
- Confined space entry into spaces which contained PCBs requires ventilation, personal protective equipment and standby worker
- Emergency Procedures - Evacuation of personnel, ventilation of area, sorption of spilled liquid. Only personnel with adequate PPE allowed in area. Safety showers, eyewash stations, washrooms maintained and readily accessible.

7.0 Sanitation Practices

- Separate lockers, showers, clothing provided
- Work clothes shall not be worn home
- Washing of hands and exposed skin prior to eating, drinking, smoking
- Food, drink, smoking not permitted in area.

8.0 Monitoring and Record Keeping

- Conduct industrial hygiene survey to determine occupational exposures to PCBs. Repeat survey once each year and within 30 days of any process change
- Survey records must be maintained

- Personal monitoring required of workers breathing zone
- Each operation sampled once every three months
- Exposures above TWA requires, initiating control measures to limit exposures. Employee monitored every 30 days until levels below TWA.
- Environmental monitoring records maintained for 30 years. Data specifications per NIOSH, 1977, and 29 CFR 1910.

Source: NIOSH, 1977.

4.7 Socioeconomic Impacts and Mitigation

The study region includes Anderson and Roane Counties, including the City of Oak Ridge, which are within the Knoxville Standard Metropolitan Statistical Area in the eastern part of Tennessee. The population of the two-county area exceeds 100,000 persons and is shown in Table 4-19.

TABLE 4-19. POPULATION OF OAK RIDGE,
ANDERSON COUNTY AND ROANE COUNTY 1960 - 2000

<u>Year</u>	<u>City of Oak Ridge</u>	<u>Anderson County</u>	<u>Roane County</u>
1960	27,169 ^a	60,032 ^a	39,133 ^a
1970	28,319 ^b	60,300 ^b	38,881 ^b
1980	27,552 ^b	66,878 ^b	47,715 ^b
1990 (projected)	32,500 ^c	74,998 ^d	44,800 ^d
2000 (projected)	32,500 ^c	NA	45,400

Sources as follows:

- a U.S. Bureau of the Census, 1960.
 - b U.S. Bureau of the Census, 1980.
 - c Oak Ridge Planning Department, 1979.
 - d East Tennessee Development District, 1979.
-

Labor market information for Anderson and Roane Counties reveals that 1981 unemployment rates were 5.4 percent for Anderson County and 11.4 percent for Roane. This compares to a statewide average of 5.7 percent for the same

time period. The expected change in employment resulting from the proposed facility (25 persons) will have no appreciable effect in the Anderson/Roane County labor market.

In the housing market, 1980 data reveal multifamily unit vacancy rates to be 4.6 percent and 2.6 percent for Anderson and Roane Counties, respectively. These vacancy levels seem to be more than adequate to absorb the projected employment increase of 25 people.

Income levels in the City of Oak Ridge are significantly higher than in the rural areas of Anderson and Roane Counties. The 1977 per capita income level in Oak Ridge was \$7,240, whereas for Anderson and Roane Counties the levels were \$5,587 and \$4,814, respectively, according to the U.S. Bureau of the Census (1980).

4.7.1 Socioeconomic Impacts Related to Construction

The construction related employment requirements are shown in Table 4-20, for each labor category. Considering that construction will occur over

TABLE 4-20. CONSTRUCTION EMPLOYMENT REQUIREMENTS -
TOTAL DURING CONSTRUCTION

<u>Labor Category</u>	<u>Number in Person Years^a</u>	<u>Labor Category</u>	<u>Number in Person Years^a</u>
Welder	5	Painter	4
Asbestos Worker	2	Pipefitter	10
Mason	5	Roofer	1
Carpenter	13	Sheet Metal Worker	3
Finisher	1	Sprinkler Fitter	1
Electrician	15	Truck Driver	10
Iron Worker	10	Laborer	30
Millwright	2		
Operator	10	Total	122 person years

Source: Engineering estimates provided by Oak Ridge Operations.

^a Assumes 2000 hours/person year

a 33 month period, it is likely that at any one time, the number of workers will not exceed 75-80, due to the phasing of construction. The initial phase of construction, site preparation, will begin in July, 1984 and last through January, 1986. During this 18 month period, underground utilities will be installed and the site prepared for facility construction. In September 1985, facility construction will begin, with expected completion by March 1987.

Assuming a peak construction work force of 75-80 workers, the socioeconomic impacts on the Oak Ridge area would be minimal even if the need for certain skills could not be met from within the local labor market, and some workers immigrated to the area.

4.7.2 Socioeconomic Impacts Related to Operation

Because the proposed facility will employ only 25 people, the socioeconomic impact is felt to be insignificant. The increase in employment, if all new employees moved in from outside the area and had an average family size of three, would generate a population increase of only 75, which represents only 0.065 percent of 1980 population in the study area. Because of this extremely small employment impact, detailed analyses and mitigation strategies pertaining to labor conditions, housing, public finance, utility impact, and other socioeconomic factors are not warranted.

4.8 Accident Analysis

The key element in the evaluation of process accidents is the amount or degree of risk any potential accident has associated with it. Risk is generally defined as the probability or danger of suffering loss by an individual or the public. It is, therefore, composed of two elements: the probability that a hazardous situation or accident will occur, and the extent or magnitude of the loss incurred as a result of the hazard or accident.

The analysis of accidents first requires the postulation of feasible accidents which are then evaluated with respect to their risk. Reduction in risk is possible for most accidents by taking steps which lower either the probability of occurrence or the consequences of the hazard. Both of these measures have been employed for reducing risk in both the process design and transportation plans.

4.8.1 Process Accidents^a

In the analysis of the proposed process design, numerous accident scenarios were postulated based on the historic record of chemical handling industries, incinerator facilities, and other facilities with handling, storage, or process similarities to the proposed incinerator. Many of these postulated accidents were eliminated based on the evaluation of the risk of these accidents which could be associated with the proposed process. Safety features in the conceptual design were found to adequately reduce the risk associated with most of these accidents to an acceptable level. Of the numerous accidents evaluated during the preparation of the PSAR, only three were found to have a risk which was not clearly acceptable. These three accidents all involved fire at some point in the process. The safety measures which exist in the process design to prevent each accident are discussed along with the sequence of events which must occur for each accident. No other process (incinerator site) accidents were found to have both a reasonable probability of occurrence and significant adverse consequences, either on-site or off-site (PSAR). In addition, the radiological consequences of the accidents were all insignificant; the concentration of uranium in the material to be incinerated is approximately 200 ppm, of which less than one percent is the uranium-235 isotope. At these levels, the hazard which can be attributed to the uranium contamination is insignificant (PSAR).

^a Material in this section has been extracted from the PSAR for the purpose of presenting an overview of the accident analysis process. For details, the reader is referred to the PSAR.

4.8.1.1 Accident No. 1: Fire in Incinerator Shredder. A fire was assumed to occur in the incinerator shredder as a result of mistakenly feeding a 55 gallon drum of waste oil with 6000 ppm PCBs into the shredder. Generally, waste oil will only contain 500 ppm PCB, and the larger the concentration of PCB, the lower the probability that a fire would occur.

4.8.1.1.1 Sequence of Events. In order for the accident to occur, the following events must occur:

- Administrative controls fail and a liquid containing drum is fed directly to the shredder. This violation of administrative controls may begin at the site of drum loading as a result of mislabeling a package or placing one or more drums into an incorrect group. The liquid containing drum must also escape incinerator site sampling or be mistakenly placed with solids containing drums after correct sampling.
- A liquid containing drum may be mistakenly only partially emptied and subsequently fed to the incinerator.
- Failures which could exacerbate the fire include the failure to add absorbent to the shredder and/or the failure or reduction of air flow through the shredder.
- An ignition source must be available such as a spark generated by the shredder or associated electrical equipment, or a flashback from the rotary kiln.

4.8.1.1.2 Preventative Features. Various preventative measures will exist to prevent, or lessen, the probability of occurrence of shredder fire:

- Administrative controls and sampling procedures will greatly assist in preventing a liquid drum from being fed.
- Absorbent material will be added to the shredder conveyor belt when drums are being fed.
- A shredder damper controller will normally maintain sufficient air flow through the shredder to lessen the likelihood of flashback.

4.8.1.1.3 Mitigation Measures. Accident mitigation features will also exist to lessen the severity of a shredder fire:

- Automatic sprinklers will be provided in the shredder which will be activated by a high temperature alarm.

- A redundant high temperature alarm will exist for the sprinkler system.
- A large pressure relief vent will prevent excessive pressures from building up inside the shredder.

4.8.1.1.4 Probability. Incinerator shredder fires have occurred in the past, particularly in municipal refuse incinerator shredders. Fires have also occurred in solvent incinerator feed systems. Because of past occurrences of fire in incinerator shredders, the probability of an incinerator shredder fire at the proposed toxic chemical incinerator facility was estimated to be between 1 in 10 and 1 in 100 that this event will occur during a twenty-five year period of operation.

4.8.1.1.5 Impacts. An incinerator shredder fire has the potential to produce moderate consequences on the health of operating personnel. These health effects will be due primarily to potential smoke inhalation and short term PCB exposure. There is little likelihood of burns to operating personnel or of significant exposure to uranium.

Consequences to the public from an incinerator shredder fire were estimated. For the purpose of this analysis the following assumptions made:

- 50 gallons oil in drum fed to incinerator shredder.
- Oil contains 6000 ppm PCBs.
- Five gallons oil burns.
- Sprinkler will activate after 5 gallons of oil burns and extinguishes fire.
- Burned oil, containing PCBs, will exit a 1 m x 1 m pressure relief vent on the shredder and form a cloud 1 m x 1 m x 12 m above the vent.
- Pressure relief vent will be 7 m above the base of the building.

Calculations of PCB concentrations were made following the procedures for instantaneous sources presented by Turner (1970). Details of the PCB dispersion calculations can be found in the PSAR. The maximum PCB concentration was calculated as a function of distance downwind from the shredder.

The short-term exposure occupational exposure limit is 1000 ug/m^3 , and this criterion is applicable to the postulated shredder fire conditions. The following conclusions were made in the PSAR:

- Under unstable atmospheric conditions, people within 100 m of the shredder, in the path of the smoke/PCB cloud, would receive a short-term PCB exposure in excess of 1000 ug/m^3 .
- Under neutral atmospheric conditions, people within 650 m of the shredder, in the path of the cloud, would receive a short-term PCB exposure in excess of 1000 ug/m^3 .
- Under very stable atmospheric conditions, beyond 100 m, downwind concentrations are less than 1000 ug/m^3 .

As mentioned above, operating personnel in the path of the smoke/PCB cloud would be exposed to a short-term exposure exceeding 1000 ug/m^3 . No significant exposure to the general public would occur as a result of this accident.

4.8.1.2 Accident 2: Fire in Liquid Receiving/Storage/Blending Tanks. A fire in the tank farm could occur in two ways: flammable liquids leak from a tank and are ignited, or flammable liquids are ignited in a tank. The types of liquids considered for the fire were limited to those which contain PCBs, namely waste oils and kerosene. Other highly flammable liquids, such as acetone or alcohol, will be stored separate from the PCB containing liquids, and do not appear to be a threat to dispersing PCB containing liquids.

4.8.1.2.1 Sequence of Events. In order for the accident to occur, the following events must occur:

- A relatively large leak must occur in a tank, or associated piping. The leak must be large enough to provide a significant source of flammable liquid before being detected by operating personnel.
- An ignition source must be present exterior to the tank.
- Or, an ignition source must exist interior to the tank plus, the nitrogen blankets must leak away and be replaced by air.

4.8.1.2.2 Preventative Measures. The following preventative measures exist to prevent this accident:

- All tanks will meet applicable ASME standards.
- All tanks will be nitrogen blanketed, have flame arresters, and rupture discs.
- All tanks containing stirrers will have low-level alarms to shut off stirrers to prevent friction sparks.
- All associated electrical equipment will be designed to meet applicable electrical and fire safety codes.

4.8.1.2.3 Mitigating Measures. One mitigating feature will exist with respect to the postulated accident:

- A fire crew from the ORGDP site will be available to quickly respond to a fire. Routine portable fire extinguishing equipment will be available on-site.

4.8.1.2.4 Interior Tank Fire. It was assumed that the fire occurs in the 5000 gallon capacity dilute PCB receiving tank, that the tank is half-full of oil containing 500 ppm PCB, that the N₂ blanket is replaced by air, and that the fire is initiated by a spark internal to the tank. Finally, it was assumed that the fire is oxygen limited to the available oxygen in the tank, that the arriving fire-fighting crew prevents the fire from spreading, and that the burned oil moves as a cloud offsite.

An estimate of the amount of oil burned was made as follows:

- Total tank capacity: 5000 gallons
- Oil assumed in tank: 2500 gallons
- Air in tank: 2500 gallons or 9460 liters
- O₂ in tank: 1987 liters (or 88.7 moles O₂)
- Assumed fire reaction: $\text{CH}_2 + \text{O}_2 \rightarrow \text{CO} + \text{H}_2\text{O}$
- Amount of oil burned: 0.33 gallons.

The probability that this accident would occur was estimated to be between 1 in 100 and 1 in 10,000 during a twenty-five year period.

Offsite effects of 0.33 gallons of oil, containing 500 ppm PCB, vaporized and moving as a cloud would be small. Only 0.6 grams of PCB would be dispersed in the cloud.

4.8.1.2.5 Exterior Tank Fire. It was assumed that the fire occurs due to a leak of 1 liter/minute of oil containing 500 ppm PCB, that the fire is initiated when 10 liters of oil have leaked out, that the fire continues to be fed by 1 liter/minute of oil, and that the ORGDP fire crew arrives in 10 minutes after fire initiation and extinguishes the fire. Thus, 20 liters or 5.3 gallons of oil are burned and travel as a cloud offsite.

The probability that this accident would occur was estimated to be between 1 in 100 and 1 in 10,000 during a twenty-five year period.

The quantity of PCB, at 500 ppm, in 20 liters of oil is 10 grams. Depending on weather condition, the dispersal of 10 grams of PCB by the fire could raise airborne concentrations of PCB to levels exceeding the permissible short-term concentration of 1000 ug/m^3 for short distances from the fire.

4.8.1.2.6 Impacts. Based on the analysis presented for Accident 1, offsite consequences would be minor, for both interior and exterior tank fires.

4.8.1.3 Accident No. 3: Explosion in Incinerator Shredder. It was assumed that a drum of highly flammable liquid, such as acetone, is mistakenly fed into the incinerator shredder and explodes. Since the acetone will have very little or no PCB associated with it, dispersion of PCB is not of concern. The similarities between this accident, Accident 1 and Accident 2 are obvious. Therefore, the same accident initiators and preventative measures apply. Mitigating measures, namely the sprinkler system, will not have a significant effect of reducing consequences unless a fire occurs as a result of the explosion.

It is difficult to estimate the probability of an incinerator shredder explosion, but it clearly appears to be less probable than an incinerator

shredder fire. The probability has been estimated to be between 1 in 100 and 1 in 10,000 that the event could occur during twenty-five years of operation.

Consequences of an incinerator shredder explosion will be localized. Greatest concern exists for operating personnel who may still be in the area loading the shredder. Such individuals may receive relatively serious injury, or burns. Consequences of an incinerator shredder explosion on the public will be minor or negligible.

4.8.1.4 Natural Phenomena. Natural phenomena were not considered to be significant factors in the safety of facility operation. The following comments were based on available site information.

4.8.1.4.1 Earthquakes. Scattered earthquakes occur in the region, but there are no identifiable capable faults that could be expected to produce surface displacements or differential ground motion anywhere within 200 miles of the site. The DOE Reservation lies in Seismic Zone 2, which is an area of moderate activity. Several studies of facility sites in the Oak Ridge area have been made to determine likely peak horizontal ground acceleration values and their differential ground motion anywhere within 200 miles of the site. Since this information is known, the facility structures will be designed for seismic loads expected in the region. Therefore, earthquakes were not considered to be an important factor in the safe operation of the facility.

4.8.1.4.2 Tornadoes and Extreme Winds. Tornadoes and high winds are rare in the region of the facility; the calculated probability that a tornado will strike a particular site is 3.65×10^{-5} per year.

4.8.1.4.3 Floods. There is no risk of material releases due to flooding. The computed Probable Maximum Flood for ORGDP is elevation 767.5 feet at Poplar Creek Mile 5.0, Point 0; the elevation of the proposed incinerator site is approximately 800 feet.

4.8.2 Transportation Accidents and Releases

PCBs are classified by the Department of Transportation (DOT) as Other Regulated Material; hazardous material type ORM-E. Surveys of the traffic accidents over the last 11 years for the preferred routes revealed that PCBs were not involved in any highway accidents. Since ORM-E is a new classification, little accident data is available. As a result, accident statistics were compiled for Type B poisons which utilize the same DOT containers, and represent a significant percentage of all hazardous material shipments. These statistics provide a generalized understanding of the potential risks associated with transportation.

4.8.2.1 Routing. The proposed routes are presented in Appendix B, together with an analysis of the accident statistics for each route. The routes were selected with the goal of minimizing both the probability that an accident would occur and the potential impact of an accident. For this reason, the proposed routes minimize passage through populated areas, over narrow roads, and near bodies of water, while maximizing the percentage of four lane divided highway. Coupled with careful scheduling and other transportation safety considerations, these routes should result in the minimum risk of significant adverse environmental impact.

4.8.2.2 Scenarios. Accidents during transport are grouped generically as follows:

- Single vehicle accident
- Multiple vehicle accident
- Noncollision incident

The single vehicle accident includes those incidents in which the transportation vehicle (truck) is the only vehicle involved. These types of accidents include striking obstructions such as fallen rocks or cargo, parts of other vehicles on the road, or animals. These accidents also include incidents in which the truck leaves the road and may or may not upset, or in which it strikes an immovable object such as a bridge abutment. A fire to the vehicle and/or cargo may follow the accident.

Multiple vehicle accidents include those in which the transport vehicle strikes or is struck by one or more other vehicles. These accidents may also include the truck subsequently leaving the road, upsetting, etc. As with the single vehicle accident, the multiple vehicle accident may be followed by a fire. The noncollision incidents include those occurrences in which an impact does not occur. Typical incidents would be a load shift or a fire on the truck not produced by an impact accident.

All these types of generic accidents could result in failure of the PCB container. The first two are more likely to produce a severe failure since a more severe blow to the container would be expected from an impact accident than from a noncollision incident.

The accidents may be attributed to one or more contributing factors as presented in Table 4-21. Human error was a contributing factor in 65

TABLE 4-21. POSSIBLE CONTRIBUTING FACTORS TO ACCIDENTS

Human Error

Poor judgment
Assured clear distance
Speeding
Inattention (drowsiness)

Driving Condition

Congestion
Slippery road (rain or ice)
Rough road
Obstructions
Visibility (fog, rain, hills, curves)

Equipment Failure

Tire blowout
Mechanical failure

Emergency Situations

Evasive maneuver
Sudden braking

percent of the accidents involving hazardous materials (Information Sciences Corporation, 1981). This includes both drivers of trucks as well as drivers of other vehicles which are involved in accidents. Careful scheduling to avoid adverse driving conditions and management practices to ensure safe driving and effective maintenance will operate to reduce the likelihood of an accident.

A transportation accident would probably result in a spill, based on an evaluation of transportation statistics for Ohio, Kentucky, and Tennessee. While accidents involving semi-trailers carrying hazardous materials represent less than 6 percent of the total semi-trailer accidents over the last 10 years, the majority of those accidents resulted in spills (Information Sciences Corp., 1981). Reported accidents involving fire during a hazardous materials transportation accident are negligible even for flammable materials.

4.8.2.3 Accident Risk and Impacts

The risk of significant environmental impact from transportation of PCB contaminated material is relatively low. First, the quantities of materials to be transported are small, requiring only a few shipments per year. Second, the proper routing of shipments minimizes the potential for accidents in critical environments such as population centers or in water courses. Third, the capability to quickly respond to and clean up a spill will be an integral part of transportation activities. And, finally, the behavior of PCBs in the environment at a spill site, with few exceptions, does not preclude cleanup to acceptable levels. Materials such as soils or sediments contaminated by a spill can be removed and incinerated. Some loss of environmental productivity could be expected under these circumstances commensurate to the amount of material removed; however, in EPA studies of a PCB spill area, no evidence of permanent damage to the environment was detected 2 years after the spill was cleaned up (EPA 904/9-76-014).

Under a worst case scenario, a spill could occur into the surface water upstream from a public water supply intake during critical flow. The primary effect would be an increase in the waste contaminants at the spill location. Although the fate and transport of contaminants would be a function

of the waste composition and local stream conditions, it is likely that the waste would not migrate far from the spill site based on low flow conditions and the known fate and transport of PCBs and other minor organic contaminants (see Section 4.2.3.1). Coupled with the small waste quantity potentially released and appropriate mitigative measures, the public health impacts emanating from this worst case situation would be minimal.

4.8.3 Accident Prevention Measures

The conceptual design of the facility and the preliminary plan for its operation include a number of features which will reduce the likelihood of an accident or abnormal operating condition and limit the potential impact of such conditions should they occur. These features are summarized in Appendix L. Such features include alarms, interlock systems, fire protection systems, pressure release systems, and general system design features, as well as management controls and procedures, including testing of materials received before blending and scheduling to avoid adverse shipping conditions. In the PSAR, many of these features were analyzed and found to be effective in reducing the probability of most accidents below criterion levels.

4.8.4 Spill Prevention and Contamination Control

The proposed incinerator facility will operate under a spill prevention control and countermeasure plan which will comply with the applicable federal regulations (see Appendix L). The measures planned for the proposed action, in addition to those identified above, include:

- Emergency response teams on call for immediate response to transportation emergencies, with appropriate equipment on a stand by availability.
- Trained drivers and manifests which indicate appropriate emergency response measures.
- Shipment only when both the shipping and receiving site emergency coordinators have been alerted.
- Detailed training and administrative procedures for incinerator operators.

Design features to minimize leaks, spills, or releases and to capture any material so released.

These measures are described in more detail in Appendix L. In general, they should be effective in preventing accidental contamination of the environment and in recovering the material should a spill or leak occur.

4.8.5 Impacts of the Maximum Credible Accident

As part of the assessment of the likely environmental impact of the proposed action, this section describes the impact of the most severe accident which reasonably could be expected to occur. For the proposed action, the maximum credible accident is a fire in the incinerator shredder, which was described in Section 4.8.1.1. This accident is both the most probable and most severe in effect of any of the potential accidents. It should be noted that this accident is not a highly likely event, with a probability of between 1 in 10 and 1 in 100 during the estimated lifetime of the incinerator.

The maximum credible accident would result in an atmospheric release of approximately 0.1 kg (0.2 lb) of PCB in a brief period of time. Workers and others up to 650 m from the shredder and in the path of the smoke/PCB cloud would be exposed to short-term atmospheric concentrations above 1000 $\mu\text{g}/\text{m}^3$, the level established for four 15 minute occupational exposures to the skin per day. The effects of exposure to PCBs are described in Appendix J.

Other than individuals directly exposed to the smoke/PCB cloud or in its path, impacts to the environment would follow from the amount of PCB released and its dispersion. In general, since the PCB could not be recovered in this case, effect of the PCB on the environment would vary directly with the volume and inversely with the area of dispersion. Both the small volume and the likely rapidity of dispersion under local atmospheric conditions suggest that no significant long-term changes in the environment would be observed as a result of a single release of this type.

4.9 Unavoidable Adverse Impacts on the Environment

Unavoidable adverse environmental impacts expected during the operation of the proposed incinerator are, except as noted, considered to be minor and negligible. These impacts are discussed below.

4.9.1 Air Resources

The generation of some fugitive dust during construction of the proposed incinerator is unavoidable, but would be controlled by water and/or dust suppressants. The remoteness of the site would minimize off-site impacts. The stack gases would contain several environmental pollutants of which oxides of nitrogen, particulates, hydrochloric acid, and volatile organic compounds (VOC) are the most important in terms of emissions rates. These emissions would increase prevailing ambient concentrations, but not to harmful levels, as defined by the ambient air quality standards.

4.9.2 Water Resources

Unavoidable adverse impacts upon the water resources would be minimal, represented principally by the temporary increase in dissolved solids from the wastewater treatment facility. Contaminants identified as being present in the effluent are chloride, fluoride, sulfate, phosphate, sodium, uranium, lead, beryllium and suspended solids. Contaminants may also be contributed to water courses from erosion and runoff of soil particles. Organic contaminants, such as uncombusted PCBs, are not regarded as an unavoidable adverse impact and have been designed against (see Section 4.1.3). Contamination of the ground water by leachate is not regarded as an unavoidable adverse impact and has been designed against (see Section 4.2.2).

4.9.3 Noise

The impact of noise from the proposed incinerator would be negligible. The noise contribution level of the proposed facility would be

significantly lower in level than existing levels in the area, except in the immediate vicinity of the incinerator.

4.9.4 Ecology

No significant adverse impacts are expected to result to either the terrestrial or the aquatic ecology as a result of the proposed action.

4.9.5 Human Health

No significant impacts on public health are expected to result from the proposed action. The expected discharges of pollutants (including radioactivity) are so low that increases in risk to the public are insignificant and orders of magnitude below normal risk levels.

The possibility of significant impact to the health of facility employees can be avoided by the implementation of the control measures planned for the facility and described in Section 4.6.

4.9.6 Socioeconomic Impacts

The socioeconomic impacts of the proposed action will be a small increase in employment in the Oak Ridge area. This is an unavoidable beneficial impact.

4.9.7 Accident Risk Impacts

An unavoidable adverse impact of the proposed action is the risk of an accident either at the incinerator or during transportation. However, the impacts of such accidents are not excessive and the risk must be compared to the potential risk associated with continued storage of the hazardous materials involved.

4.10 Short-term Use Versus Long-term Productivity of the Environment

There are trade offs between the short-term and long-term benefits and costs. "Short-term" is used here to denote the construction period and the operating life time of the proposed incinerator. "Long-term" refers to the time after retirement of the proposed incinerator. The local short-term uses of man's environment are those generally associated with the construction and operation of an incinerator. There will be an environmental gain as the PCB contaminated wastes are destroyed. The incinerator will reduce the amount of PCBs that may enter the environment through accidental spills and or leaks and provide for environmentally acceptable disposal of PCB contaminated wastes.

Construction of the incinerator would remove approximately 5 hectares (2 acres) of land from its present use and commit it for the lifetime of the project. This site has been owned by the federal government for many years. It has been restricted from public use since the 1940s and designated for industrial development, but the land is presently idle, unsettled and cleared. Although the plant life is estimated at about 25 years, it is likely that the site would be dedicated to incineration of organic wastes for the foreseeable future. Therefore, the predominant effect of the proposed project must be viewed as a long-term use of man's environment.

4.11 Irreversible or Irretrievable Commitments of Resources

The construction and operation of the proposed incinerator would result in the commitments of various natural resources and man-made resources. Some of these commitments of resources are irretrievable by virtue of duration of commitment or cost of reclamation. In other cases, commitments of resources are irreversible since the resource is consumed during construction or operation of the proposed incinerator.

A minor irreversible and irretrievable commitment of resources would be the burning of natural gas for the pilot light operation in the incinerator. The No. 2 fuel oil and propane also would be used during start-up and shut-down operations, or as required to maintain the required incineration

temperatures. Other finite resources include chemicals used in the scrubber systems and waste-water treatment.

The construction and operation of the proposed facility would require an expenditure of labor which would be irretrievable.

Certain man-made or processed resources used for construction may not be recoverable. Such resources include finished steel, aluminum, copper, plastics, lumber, concrete, sand and gravel. Most of this material would be incorporated in foundations, buildings, and machinery.

4.12 Decommissioning and Decontamination

The decommissioning and decontamination of the proposed incinerator facility would not occur until sometime after all of the PCBs and PCB contaminated materials have been removed from service at the five Department of Energy Oak Ridge Operations plants. The time at which this action would take place is indefinite, since the expected life of PCB containing transformers and capacitors is unknown. In addition, the proposed incinerator would serve in decommissioning of the Oak Ridge Gaseous Diffusion Plant and the other DOE Oak Ridge Operations plants, since the final PCB equipment would not be eliminated until those plants were entirely decommissioned.

The decontamination of the incinerator facility will not represent a significant adverse impact upon the environment. The procedure for scheduled shutdowns will involve burning clean fuels to purge the kiln, combustion chamber and off-gas treatment system; this procedure will be followed some time each year after the incinerator is in operation. If the facility were to be permanently decommissioned, the tanks and related feed systems would be purged with solvents with the solvents being incinerated in the incinerator. Then the feed system would be dismantled and incinerated, followed by a substantial clean fuel purge of the incinerator. The incinerator would then be dismantled and removed from the site, together with the remaining auxiliary facilities.

As indicated above, the proposed incinerator would be used in the decontamination and decommissioning of the ORGDP, should a decision be made to decommission the ORGDP. Before such a decision would be made, the environmental impacts of decontamination and decommissioning would be fully described, including those associated with the proposed incinerator, in an environmental support document such as an environmental impact statement.

4.13 References

Ahling, B., and Lindskog, A. Thermal Destruction of PCB and Hexachlorobenzene, The Science of the Total Environment, 1978, 10, 51-99.

ACGIH. American Conference of Governmental Industrial Hygienists. Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment with Intended Change for 1980. Cincinnati, 1980.

AP-42. Compilation of Air Pollution Emission Factors. (3rd ed.) U.S. Environmental Protection Agency, Washington, D.C., 1980.

BNWL-2227. Finite Models for Sediment and Contaminant Transport in Surface Waters - Transport of Sediment and Radionuclides in the Clinch River. Battelle Northwest Laboratories, 1977.

Burr, D., and Moody, W. U.S. Environmental Protection Agency and TRW (respectively). Personal communication, May 10, 1981.

Clayton, G. D., and Clayton, F. E. Patty's Industrial Hygiene and Toxicology. John Wiley and Sons, New York, 1978.

Dexter, P. N., Hines, W. G., Quinlan, E. Pavlou, S. P. Dynamics of Polychlorinated Biphenyls in the Upper Mississippi River. NTIS No. PB-290 463, 1978.

DOE/EA-0106. Environmental Assessment of the Oak Ridge Gaseous Diffusion Plant Site. Department of Energy, 1981.

East Tennessee Development District. Land Use Plan, 1979-2000. Knoxville, Tennessee, 1979.

EPA Region VI. Incineration of PCBs -- Summary of Approval Actions: Energy Systems Company (ENSCO), El Dorado, Arkansas. Environmental Protection Agency, 1981.

EPA Region VI. Incineration of PCBs -- Summary of Approval Actions: Rollins Environmental Services, Deer Park, Texas. Environmental Protection Agency, 1981.

EPA 430/9-73-014. Methods for Identifying and Evaluating the Nature and Extent of Non-Point Sources of Pollutants. Environmental Protection Agency, 1973.

EPA 520/7-79-006. Radiological Impact Caused by Emissions of Radionuclides into Air in the United States. Preliminary Report. U.S. Environmental Protection Agency, August, 1979.

EPA 520/7-79-009. AIRDOSE-EPA: A Computerized Methodology for Estimating Environmental Concentrations and Dose to Man from Airborne Releases of Radionuclides. Environmental Protection Agency, 1979. Also Oak Ridge National Laboratory Report No. ORNL-5532.

EPA 530/SW 122C.5. Destroying Chemical Wastes in Commercial Scale Incinerators, Facility Report No. 6 Rollins Environmental Service, Inc., Deer Park, Texas. U.S. Environmental Protection Agency, 1977.

EPA 530/SW 155c. Destroying Chemical Wastes in Commercial Scale Incinerators. U.S. Environmental Protection Agency, 1978.

EPA 560/5-77-003. Review of the Environmental Fate of Selected Chemicals. Environmental Protection Agency, 1977.

EPA 560/6-76-005. PCBs in the United States Industrial Use and Environmental Distribution. U.S. Environmental Protection Agency, 1976.

EPA 600/2-75-004. Contributions of Urban Roadway Usage to Water Pollution. Environmental Protection Agency, 1975.

EPA 600/2-77-020. Movement of Selected Metals, Asbestos, and Cyanide in Soil: Applications to Waste Disposal Problems. U.S. Environmental Protection Agency, 1977.

EPA 600/2-80-027. Attenuation of Water-Soluble Polychlorinated Biphenyls by Earth Materials. U.S. Environmental Protection Agency, 1980.

EPA 600/9-78-016. Disposal and Removal of Polychlorinated Biphenyls in Soil. In: Land Disposal of Hazardous Wastes - Proceedings of the Fourth Annual Research Symposium. U.S. Environmental Protection Agency, 1978.

EPA 904/9-76-104. Study of the Distribution and Fate of Polychlorinated Biphenyls and Benzenes after a Spill of Transformer Fluid. Environmental Protection Agency, 1976.

EPRI FP 1207. Disposal of Polychlorinated Biphenyls (PCBs) and PCB Contaminated Material. Electric Power Research Institute, 1980.

Garrels, R. M., and Christ, C. L. Solutions, Minerals and Equilibria. Harper and Row: 1965.

Hsu, P. H. Aluminum Hydroxides and Oxyhydroxides. Minerals in Soil Environments, Dixon, J. B. and Weed, S. B., eds., Soil Science Society of America, 1977.

Information Sciences Corporation. Oil and Hazardous Materials -- Technical Assistance Data System (OHM -- TADS). NIH-EPA Information System, 1981.

Jenne, E. A. Chemical Modeling in Aqueous Systems. American Chemical Society, ACS. Symposium Series No. 93, 1979.

K/D-5222. Conceptual Design Report for Compliance with the Toxic Substances Control Act (TSCA), No. 83-OR-14. Goodyear Atomic Corporation and Union Carbide Corporation -- Nuclear Division, 1981.

Long, L. W. Environmental Management Group, Union Carbide Corporation -- Nuclear Division, Oak Ridge Gaseous Diffusion Plant. Letter to Battelle, April, 1981.

Long, L. W. Environmental Management Group, Union Carbide Corporation -- Nuclear Division, Oak Ridge Gaseous Diffusion Plant. Letter to Battelle, May, 1981.

Long, L. W. Environmental Management Group, Union Carbide Corporation -- Nuclear Division, Oak Ridge Gaseous Diffusion Plant. Letter to Battelle, June, 1981.

NIOSH. National Institute for Occupational Safety and Health. Criteria for a Recommended Standard, Occupational Exposure to Polychlorinated Biphenyls (PCBs). Cincinnati, 1977.

NIOSH. National Institute for Occupational Safety and Health. Registry of Toxic Effects of Chemical Substances. Vol. I. Chapter 2. Cincinnati, 1977.

NUREG/CR-0105. Estimates of Internal Dose Equivalent to 22 Target Organs for Radionuclides Occurring in Routine Releases from Nuclear Fuel-Cycle Facilities. Volume II. Nuclear Regulatory Commission, 1979.

Oak Ridge Planning Department. Oak Ridge Land Use Plan. Oak Ridge, Tennessee, 1979.

Oku, A. A Complete Dechlorination of Polychlorinated Biphenyl by Sodium Naphthalene. Chemistry and Industry, 1978, 841-842.

ORNL/TM-6618. Aquaman - A Computer Code for Calculating Dose Commitment to Man from Aqueous Releases of Radionuclides. Oak Ridge National Laboratory, 1979.

ORNL-4992. A Methodology for Calculating Radiation Doses from Radioactivity Released to the Environment. Oak Ridge National Laboratory, 1976.

Preliminary Safety Analysis Report for Compliance with the Toxic Substance Control Act (TSCA) ORGDP Project No. 83-OR-14. Prepared for Union Carbide Corporation, Nuclear Division, Oak Ridge, Tennessee by Battelle Columbus Laboratories, Columbus, Ohio, June 1981.

Rollins, Env. The PCB Incineration Test Made by Rollins Environmental Services (TX) at Deer Park, Texas, November 12, 16, 1979: A Report to the United States Environmental Protection Agency, Region 6, Dallas, Texas. Rollins Environmental Services, 1979.

Tennessee Department of Health, Water Quality Management Plan for the Clinch River Basin. 1979.

Turner, D. B. Workbook of Atmospheric Estimates. Department of Health, Education and Welfare, NTIS No. PB-191482, 1970.

Union Carbide Corporation, Nuclear Division. Maintenance Engineering Procedures Handling and Disposal of Askarel (PCB or Pyranol for Transformers and Capacitors). Oak Ridge, 1980.

U.S. Bureau of the Census. Characteristics of the Population, 1960. U.S. Department of Commerce, 1960.

U.S. Bureau of the Census. Current Population Reports, No. 885. U.S. Department of Commerce, 1980.

U.S. Bureau of the Census. 1980 Census of Population and Housing: Preliminary Reports. U.S. Department of Commerce, 1981.

Y/UB-13. Environmental Monitoring Report, United States Department of Energy, Oak Ridge Facilities: Calendar Year 1979. Union Carbide Corporation, Nuclear Division, Oak Ridge, Tennessee, 1980.

Y/UB-15. Environmental Monitoring Report, United States Department of Energy, Oak Ridge Facilities: Calendar Year 1980. Union Carbide Corporation, Nuclear Division, Oak Ridge, Tennessee, 1981.

29 CFR 1910. Occupational Safety and Health Standards, Flammable and Combustible Liquids. Occupational Health and Safety Administration.

40 CFR 1500-1508. Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act. Council on Environmental Quality, Executive Office of the President.

44 FR 31514. Chlorinated Biphenyls; Criteria Modification. U.S. Environmental Protection Agency, 44 FR 31514-31563.

45 FR 2861. Radiation Protection Programs. Environmental Protection Agency Radiation Protection Standards for Nuclear Power Operations. Environmental Protection Agency, 1977.

THIS PAGE IS INTENTIONALLY BLANK

5. LIST OF PREPARERS

This chapter presents brief biographical sketches of those persons who had a major role in the preparation of this Environmental Impact Statement.

5.1 Project Management and Scoping

William T. Lawhon, Jr., Program Manager, Renewable Resources
Program Office, Battelle Columbus Division

Technical Specialties: Renewable Resources; Environmental Assessment;
Ecology, Agriculture, and Forestry

Education:

B.S.	1968	Biology, Botany	Memphis State University
M.S.	1969	Biology, Ecology	Memphis State University
Ph.D.	1973	Ecology, Forestry	University of Tennessee

Years of Experience: 13

Area of Contribution: Program Management, Ecology

Ralph E. Cooper, Principal Research Scientist, Economics, Planning, and Policy
Analysis Section, Battelle Columbus Division

Technical Specialties: Public Processes, Science and Environmental Policy
Analysis, Impact Assessment

Education:

B.S.	1969	Behavioral Sciences	Michigan State University
M.A.	1971	Psychology	Michigan State University
Ph.D.	1974	Social Psychology	Michigan State University

Years of Experience: 11

Area of Contribution: Project Management, Regulations

5.2 Purpose and Need, Regulations

Alfred G. Buoni, Research Scientist, Energy and Environmental Systems
Assessment Section, Battelle Columbus Division

Technical Specialties: Environmental Impact Assessment and Environmental and
Regulatory Policy Analysis

Education:

B.S.	1971	Biology	Fairfield University
M.P.H.	1975	Environmental Health	The University of Michigan

Years of Experience: 6

Area of Contribution: Purpose and Need, Analysis of Proposed Action and
Regulations, Editing

5.3 Process and Effluents

Wilbert O'Connell, Senior Research Scientist, Energy and Environmental Systems
Assessment Section, Battelle Columbus Division

Technical Specialties: Air Pollution Control, Emissions Assessments,
Hazardous Waste Incineration

Education:

B.S.	1955	Chemical Engineering	Drexel University

Years of Experience: 25

Area of Contribution: Process Description and Evaluation, Emissions and
Effluents Evaluation, Air Quality Impacts

Bruce Rising, Researcher, Fuels and Combustion Section, Battelle Columbus
Division

Technical Specialties: Fuel Combustion Analysis, Emissions Assessment,
Fundamental and Applied Combustion Research

Education:

B.S.	1977	Chemical Physics	San Diego State University
M.S.	1979	Fuel Science	Pennsylvania State University

Years of Experience: 3

Area of Contribution: Process Description and Evaluation

Haydee Hetrick, Researcher, Chemical Process Development Section, Battelle
Columbus Division

Technical Specialties: Fluidized Bed and Spray Drying Processes, Surfactant
Chemical Synthesis, Microwave Utilization Technology

Education:

B.S. 1975 Chemical Engineering University of Puerto Rico

Years of Experience: 6

Area of Contribution: Chemical Destruction Alternatives for PCB
Detoxification

5.4 Physical Environment

Ronald Clark, Associate Section Manager, Energy and Environmental Systems
Assessment Section, Battelle Columbus Division

Technical Specialties: Air Quality Assessment, Environmental Impact
Assessment

Education:

B.S. 1960 Chemistry Central State University

Years of Experience: 17

Area of Contribution: Physical Environment Impact Analysis

Bruce Vigon, Principal Research Scientist, Water Resources, Energy and
Environmental Systems Assessment Section, Battelle Columbus Division

Technical Specialty: Water Resources Management and Water Chemistry

Education:

B.S.	1973	Chemistry	University of Illinois
M.S.	1975	Water Resources Management	University of Wisconsin
M.S.	1976	Water Chemistry	University of Wisconsin
Ph.D.	In Progress	Environmental Chemistry	Ohio State University

Years of Experience: 5

Area of Contribution: Water Quality Impacts

Philip R. Stickse, Research Meteorologist, Energy and Environmental Systems
Assessment Section, Battelle Columbus Division

Technical Specialties: Climatology, Air Pollution Meteorology and Atmospheric
Dispersion Modeling

Education:

B.S.	1952	Physics	University of Cincinnati
M.S.	1959	Meteorology	Florida State University
Ph.D.	1966	Meteorology	Florida State University

Years of Experience: 14

Area of Contribution: Atmospheric Dispersion of Accidental Releases and
Impacts on Air Quality

Dennis P. DeNiro, Environmental Engineer, Energy and Environmental Systems
Assessment Section, Battelle Columbus Division

Technical Specialties: Solid and Hazardous Waste Management, Wastewater
Treatment

Education:

B.S.	1972	Civil Engineering	Valparaiso University

Years of Experience: 9

Area of Contribution: Solid Waste Disposal

Margenious D. Hunter, Researcher, Energy and Environmental Systems Assessment
Section, Battelle Columbus Division

Technical Specialties: Analysis and Design of Wastewater Treatment Systems,
Environmental Permitting Procedures

Education:

B.S.	1979	Civil Engineering (Sanitary/Environmental)	Tufts University
		Facilities Planning Seminar (U.S. EPA)	Wisconsin University Extension Series

Years of Experience: 3

Area of Contribution: Hydrology and Water Quality

Charles W. Rodman, Principal Research Engineer, Applied Dynamics and Acoustics
Section, Battelle Columbus Division

Technical Specialties: Environmental Acoustics, Community Noise, Noise
Control, Instrumentation and Analysis for Industrial and Environmental
Noise, Standards for Noise Measurement

Education:

B.S.	1971	Physics	The Ohio State University

Years of Experience: 30

Area of Contribution: Noise Analyses

Danny R. Jackson, Research Soil Scientist, Nuclear Materials Technology
Section, Battelle Columbus Division

Technical Specialty: Soil-Plant Chemical Processes in Natural and Disturbed
Ecosystems

Education:

B.S.	1969	Chemistry	Panhandle State University
M.S.	1971	Chemistry	West Texas State
Ph.D.	1973	Soil Chemistry	Colorado State University

Years of Experience: 8

Area of Contribution: Solid Waste Disposal

5.5 Transportation

Richard J. Burian, Principal Research Engineer, Nuclear Systems Section,
Battelle Columbus Division

Technical Specialty: Design and Licensing of Hazardous Materials Packaging

Education:

B.S.	1953	Mechanical Engineering	Iowa State University
M.S.	1955	Engineering Mechanics	Iowa State University

Years of Experience: 26

Area of Contribution: Transportation Routes, and Transportation Accident
Analysis

U. Young Park, Research Scientist, Nuclear Systems Section, Battelle Columbus Division

Technical Specialties: Decontamination, Decommissioning, Radioactive Waste Handling

Education:

B.S.	1963	Nuclear Science and Engineering	Seoul National University, Korea
M.S.	1970	Nuclear Engineering	University of Cincinnati

Years of Experience: 11

Area of Contribution: Transportation Accident Analysis

Tanfield C. Miller, Transportation Economist, Transportation Economics and Planning Group, Battelle Columbus Division

Technical Specialties: Transportation Planning and Policy, Cost-Benefit Analysis, and Quantitative Modeling

Education:

B.A.	1976	Economics	Haverford College
M.B.A.	1980	Transportation and Public Management	University of Pennsylvania
M.A.	1981	Regional Science	University of Pennsylvania

Years of Experience: 5

Area of Contribution: Transportation Route Analysis

5.6 Accident Analyses

Thomas L. Anderson, Researcher, Nuclear Materials Technology Section, Battelle Columbus Division

Technical Specialties: Environmental Impact Assessment, Site Characterization

Education:

B.S.	1973	Botany	The Ohio State University

Years of Experience: 8

Area of Contribution: Existing Environment, Accident Analysis

5.7 Occupational and Public Health

Caroline Warling, Research Scientist, Health and Environmental Sciences
Section, Battelle Columbus Division

Technical Specialties: Health Impact Analysis, Risk Assessment

Education:

B.A.	1976	Biochemistry	Ohio State University
M.S.	1977	Preventive Medicine	Ohio State University

Years of Experience: 5

Area of Contribution: Impacts on Public and Occupational Health

Gary J. Mihlan, Research Scientist, Health and Environmental Sciences Section,
Battelle Columbus Division

Technical Specialties: Occupational Health, Industrial Hygiene

Education:

B.S.	1975	Environmental Health	Colorado State University
M.S.	1979	Environmental Health	Colorado State University

Years of Experience: 6

Area of Contribution: Impacts on Public and Occupational Health

Susan Brauning, Researcher, Health and Environmental Sciences Section,
Battelle Columbus Division

Technical Specialties: Health Impact Assessment

Education:

B.A.	1978	Biology	Wittenberg University
M.S.	1980	Environmental Science-Applied Ecology	Miami University

Years of Experience: 2

Area of Contribution: Impacts on Public and Occupational Health

5.8 Socioeconomics

Robert W. Cobb, Associate Section Manager, Economics, Planning and Policy
Analysis Section, Battelle Columbus Division

Technical Specialty: Socioeconomic Assessment

Education:

B.A.	1966	Geography	Miami University
M.A.	1971	Geography	SUNY Buffalo
Ph.D.	1979	Geography	Ohio State University

Years of Experience: 12

Area of Contribution: Scoping, Socioeconomic Analysis

5.9 Miscellaneous

Ann W. Rudolph, Environmental Bibliographer, Nuclear Materials Technology
Section, Battelle Columbus Division

Technical Specialty: Information Specialist

Education:

B.S.	1957	Botany	Michigan State University
M.S.	1959	Botany	Michigan State University
Advanced courses in Library Science			

Years of Experience: 22

Area of Contribution: Bibliographic Compilation

Susan C. McMillan, Researcher, Economics, Planning and Policy Analysis
Section, Battelle Columbus Division

Technical Specialty: Energy and Environmental Policy

Education:

B.A.	1978	Biology	Smith College
M.En.	1981	Environmental Science	Miami University

Years of Experience: 3

Area of Contribution: Bibliographic Compilation, Editing

Corinne M. Buoni, Research Scientist, Energy and Environmental Systems
Assessment Section, Battelle Columbus Division

Technical Specialty: Environmental and Technology Assessments

Education:

B.A.	1972	Experimental Psychology	Connecticut College
B.S.	1983	(Expected Date) Mechanical Engineering	Ohio State University
M.S.	1977	Natural Resource Management	Ohio State University

Years of Experience: 10

Area of Contribution: Responses to Public Comment and Review, Technical Editing

THIS PAGE IS INTENTIONALLY BLANK

6.0 PERSONS, AGENCIES, AND ORGANIZATIONS TO WHOM
COPIES OF THE DRAFT WERE SENT

Mr. D. Elmo Lunn, Director
Water Quality Control Division
Tenn. Dept. of Public Health
150 Ninth Avenue North
Nashville, Tennessee 37203

Earl Leming
Tenn. Dept. of Public Health
1522 Cherokee Trail
Knoxville, Tennessee 37920

Mr. Robert Farris
Commissioner
Department of Transportation
Suite 700 Polk Building
Nashville, Tennessee 37219

Fish & Game Commissioner
Dept. of Fish & Wildlife Resources
Capitol Plaza Tower
Frankfort, Kentucky 40601

Fish and Game Director
Wildlife Resources Agency
P.O. Box 40747
Nashville, Tennessee 37204

U.S. EPA Region V
230 South Dearborn Street
Chicago, Illinois 60604

Office of Environmental Affairs
U.S. Department of Transportation
400 7th Street SW
Washington, D.C. 20540

Lt. General John W. Morris
Chief of Engineers
U.S. Army Corps of Engineers
20 Massachusetts Avenue NW
Washington, D.C. 20545

District Engineer
U.S. Army Corps of Engineers
Post Office Box 1010
Nashville, Tennessee 37202

Director of Land and
Forest Resources
Tennessee Valley Authority
Norris, Tennessee 37828

State of Ohio EPA
P.O. Box 1049
361 East Broad Street
Columbus, Ohio 43216

State of Ohio EPA
Southeast District Office
2195 Front Street
Logan, Ohio 43138

Mr. Shepard N. Moore
EIS Review Section
U.S. EPA Region IV
345 Courtland Street NE
Atlanta, Georgia 30365

Mr. J. Franmathes
New Source Permits Coordinator
U.S. EPA Region IV
345 Courtland Street NE
Atlanta, Georgia 30365

Mr. A. G. Linton
Federal Activities Coordinator
U.S. EPA Region IV
345 Courtland Street NE
Atlanta, Georgia 30365

Mr. Bill Hickling
Area Manager
U.S. Fish & Wildlife Service
Plateau Bldg., Room A-5
50 So. French Broad Avenue
Asheville, North Carolina 28801

Mr. T. Talley, Field Supervisor
Ecological Services
U.S. Fish & Wildlife Service
P.O. Box 845
Cookeville, Tennessee 38502

Mr. Walter Stieglitz
U.S. Department of Interior
Fish & Wildlife Service
75 Spring Street SW
Atlanta, Georgia 30303

Office of Environmental
& Project Review
ATTN: Bruce Blanchard
U.S. Department of Interior
C Street, NW
Washington, D.C. 20240

Office of the Regional
Representative
U.S. DOE Region IV
1655 Peachtree Street NE
Atlanta, Georgia 30309

The Hon. Marilyn Lloyd Bouquard
Federal Office Building
Oak Ridge, Tennessee 37830

The Honorable Howard H. Baker, Jr.
4123 Dirksen Building
Washington, D.C. 20510

The Honorable Randy McNally
11 Mona Lane
Oak Ridge, Tennessee 37830

The Honorable Jim Henry
Edgewater Estates
Kingston, Tennessee 37763

The Honorable J. E. Elkins
224 N. Main Street
Clinton, Tennessee 37716

The Hon. Anna Belle Clement O'Brien
Suite 9, Legislative Plaza
Nashville, Tennessee 37219

The Honorable Mayor and
Members of City Council
P.O. Box 1
Oak Ridge, Tennessee 37830

The Honorable Mayor
Administrative Building
Kingston, Tennessee 37763

Mr. Dave Bolling
County Administrator
Anderson County Court House
100 N. Main Street
Clinton, Tennessee 37716

Mr. Gerald Largen, County Executive
Roane County Court House
200 Race Street
Kingston, Tennessee 37763

Mayor John Penrod
City Hall
Paducah, Kentucky 42001

County Judge Raymond C. Schultz
County Court House
Paducah, Kentucky 42001

The Honorable Helen Garrett
700 Hilldale Road
Paducah, Kentucky 42001

Ms. Linda Byerley
Kentucky Div. of Air Pollution
1609 Kentucky Avenue
Paducah, Kentucky 42001

The Honorable Joel Ellington
Old Mayfield Road
Paducah, Kentucky 42001

The Honorable Carroll Hubbard
1119 Wilton Avenue
Mayfield, Kentucky 42066

Mr. Barry Feldman, Mayor
City Building, Second Street
Portsmouth, Ohio 45662

Mr. Earl James
Emergency Medical Coordinator
184 Columbia Drive
Waverly, Ohio 15690

The Hon. James A. Rhodes, Governor
State House
Columbus, Ohio 43215

Mr. James F. McAvoy, Director
Ohio Environmental
Protection Agency
361 East Broad Street
Columbus, Ohio 43215

Mr. Philip A. Workman, Supt.
Division of Safety and Hygiene
Industrial Commission of Ohio
246 N. High Street
Columbus, Ohio 43215

Dr. John H. Ackerman, Director
Ohio Department of Health
246 N. High Street
Columbus, Ohio 43215

Mr. Carl Mosley, Chief
Wildlife Division
Natural Resources Department
C-4 Building, Fountain Square
Columbus, Ohio 43224

Mr. David L. Weir, Director
Ohio Department of Transportation
25 S. Front Street
Columbus, Ohio 43215

Mr. James A. Duerk, Director
Community Development Division
Department of Economic and
Community Development
30 East Broad Street
Columbus, Ohio 43215

Mr. John M. Stackhouse, Director
Ohio Department of Agriculture
65 S. Front Street
Columbus, Ohio 43215

Mr. Robert S. Ryan, Director
Ohio Department of Energy
30 E. Broad Street
Columbus, Ohio 43215

The Hon. John Y. Brown, Governor
The Capitol
Frankfort, Kentucky 40601

Jackie Swigart, Secretary
Natural Resources and
Environmental Protection
Capitol Plaza Tower
Frankfort, Kentucky 40601

Mr. Merle H. Stanton, Chairman
Occupational Safety and Health
Review Commission
104 Bridge Street
Frankfort, Kentucky 40601

Mr. Michael Ragland, Director
Occupation Safety and Health
Capitol Plaza Tower
Frankfort, Kentucky 40601

Mr. Al Austin, Commissioner
Bureau for Health Services
Human Resources Department
275 East Main Street
Frankfort, Kentucky 40601

Mr. Carl E. Kays, Commissioner
Fish and Wildlife Resources
592 East Main Street
Frankfort, Kentucky 40601

Mr. Frank R. Metts, Secretary
Transportation Department
State Office Building
Frankfort, Kentucky 40601

Mr. Jack H. Segell, Commissioner
Commerce Department
Capitol Plaza Tower
Frankfort, Kentucky 40601

Mr. Ralph Coldiron, Exec. Director
Community and Regional Development
Capitol Plaza Tower
Frankfort, Kentucky 40601

Mr. Alben W. Barkley II
Commissioner of Agriculture
7th Floor, Capitol Plaza Tower
Frankfort, Kentucky 40601

Mr. Jack Wilson, Commissioner
Bureau for Environmental Protection
Capitol Plaza Tower
Frankfort, Kentucky 40601

Mr. Chester Foster, Exec. Director
Pollution Abatement Authority
Capitol Annex
Frankfort, Kentucky 40601

Mr. William Sturgill, Secretary
Department of Energy
P.O. Box 11888
Lexington, Kentucky 40578

The Hon. Lamar Alexander, Governor
State Capitol Building
Nashville, Tennessee 37219

J. B. Richesin, Commissioner
Department of Labor
501 Union Building
Nashville, Tennessee 37219

Mr. Robert Taylor, Director
Occupational Safety
Labor Department
501 Union Building
Nashville, Tennessee 37219

Dr. Eugene W. Fowinkle
Commissioner
Public Health Department
Room 344, Cordell Hull Building
Nashville, Tennessee 37219

Mr. Gary Myers, Executive Director
Wildlife Resources Agency
P.O. Box 40747
Nashville, Tennessee 37204

Mr. William B. Sansom, Commissioner
Transportation Department
807 Highway Building
Nashville, Tennessee 37219

Mr. James C. Cotham III
Commissioner
Economic and Community Devel.
1007 Andrew Jackson State Ofc. Bldg.
Nashville, Tennessee 37219

Mr. Jere Griggs, Commissioner
Department of Agriculture
P.O. Box 40627
Melrose Station
Nashville, Tennessee 37204

Ms. Ann Tuck, Commissioner
Department of Conservation
2611 West End
Nashville, Tennessee 37203

Mr. Robert H. Wolle
Commissioner for Environment
Bur. of Environmental Health Serv.
150 Ninth Avenue North
Terrace Building
Nashville, Tennessee 37203

Executive Director
Tennessee Energy Authority
Capitol Boulevard Building
Nashville, Tennessee 37219

The Honorable John Glenn
200 N. High Street
Columbus, Ohio 43215

The Honorable Howard Metzenbaum
121 East State Street
Columbus, Ohio 43215

The Honorable Walter Huddleston
Room 136C
606 Federal Place
Louisville, Kentucky 40202

The Honorable Wendell Ford
343 Walker Avenue
Lexington, Kentucky 40504

The Honorable James R. Sasser
Federal Building
716 U.S. Courthouse
Nashville, Tennessee 37203

Mr. Valdas V. Adamkus, Administrator
Environmental Protection Agency
230 S. Dearborn Street
Chicago, Illinois 60604

Mr. Charles R. Jeter, Administrator
Environmental Protection Agency
345 Courtland Street, NE
Atlanta, Georgia 30365

Mr. Ronald McCann
Regional Administrator
Occup. Health and Safety Admin.
Room 3263
230 S. Dearborn Street
Chicago, Illinois 60604

Mr. Robert A. Wendell
Regional Administrator
Occup. Safety and Health Admin.
Suite 587
1375 Peachtree Street, NE
Atlanta, Georgia 30309

Mr. Christopher Cohen
Dept. of Health and Human Serv.
300 S. Wacker Drive
Chicago, Illinois 60606

Ms. Sara Craig
Principal Regional Official
Dept. of Health and Human Serv.
101 Marietta Tower
Atlanta, Georgia 30323

Office of Envir. Project Review
Department of the Interior
175 Jackson Boulevard
Chicago, Illinois 60604

Mr. James H. Lee
Office of Envir. Project Review
Department of the Interior
75 Spring Street, SW
Atlanta, Georgia 30303

Mr. Harvey K. Nelson, Director
U.S. Fish and Wildlife Service
Department of the Interior
Federal Building, Fort Snelling
Twin Cities, Minnesota 55111

Mr. Loren A. Wittner
Nat'l. Oceanic & Atmospheric Admin.
Department of Commerce
Room 1404, CNA Building
55 East Jackson Street
Chicago, Illinois 60604

Mr. Paul Hemman
Nat'l. Oceanic & Atmospheric Admin.
Department of Commerce
Suite 300, 1365 Peachtree St., NE
Atlanta, Georgia 30309

Mr. Lawrence M. Whitfield
Forest Service
Suite 800
1720 Peachtree Road, NW
Atlanta, Georgia 30309

Mr. Robert Entzminger
Clark Building
633 W. Wisconsin Avenue
Milwaukee, Wisconsin 53203

Col. Thomas P. Nack
Louisville District
U.S. Army Corps of Engineers
P.O. Box 59
Louisville, Kentucky 40201

Col. Lee W. Tucker
Nashville District
U.S. Army Corps of Engineers
P.O. Box 1070
Nashville, Tennessee 37202

Brig. Gen. Scott B. Smith
Division Engineer
North Central Division
U.S. Army Corps of Engineers
536 S. Clark Street
Chicago, Illinois 60605

Maj. Gen. Robert C. Marshall
Division Engineer
Lower Mississippi Division
U.S. Army Corps of Engineers
P.O. Box 80
Vicksburg, Mississippi 39180

Mr. Marshall W. Taylor III, Dir.
Materials Transportation Bureau,
Central Division
U.S. Department of Transportation
911 Walnut Street
Kansas City, Missouri 64106

Mr. James C. Thomas, Director
Materials Transportation Board,
Southern Region
1568 Willingham Drive
Atlanta, Georgia 30337

Mr. Donald E. Trull, Administrator
Federal Highway Administration
U.S. Department of Transportation
18209 Dixie Highway
Homewood, Illinois 60430

Mr. E. G. Oakley
Division Administrator
Federal Highway Administration
Federal Building - U.S. Courthouse
801 Broadway, Rm. A926
Nashville, Tennessee 37203

Mr. J. Sharpe
Regional Director of Railroad Safety
Federal Railroad Administration
U.S. Department of Transportation
Room 210, 536 S. Clark Street
Chicago, Illinois 60603

Mr. Charles R. Meyrick
Regional Director of Railroad Safety
Federal Railroad Administration
U.S. Department of Transportation
Suite 440 A North Tower
1720 Peachtree Road NW
Atlanta, Georgia 30309

Mr. Edward G. Jeep, Director
Midwest Region
Economic Development Admin.
U.S. Department of Commerce
Suite 1630
175 W. Jackson Boulevard
Chicago, Illinois 60604

Mr. Robert M. Quillin, CHP
Ohio Department of Health
246 N. High Street
P.O. Box 118
Columbus, Ohio 43216

Mr. Charles E. Oxley, Director
Southeastern Region
Economic Development Admin.
U.S. Department of Commerce
1365 Peachtree Street, NE
Atlanta, Georgia 30309

Mr. Allen W. Neel
Executive Director
P.O. Box 19806
Knoxville, Tennessee 37919

Mayor Clark S. Alexander
Ohio Valley Regional
Development Commission
Griffin Hall
740 Second Street
Portsmouth, Ohio 45662

Judge Exec. James O. Guffy, Chrm.
Purchase Area Devel. District
P.O. Box 588
Mayfield, Kentucky 42066

Mr. Harold Hodges
Tennessee Dept. of Public Health
Division of Air Pollution Control
150 Ninth Avenue North
Nashville, Tennessee 37203

Mr. Ralph Jennings, Chief
Toxic Substances Section
U.S. EPA
345 Courtland St., NE
Atlanta, Georgia 30365

Mr. Charles Hunt
PALL Corporation
901 N. Washington Street
Suite 708
Alexandria, Virginia 22314

Mr. Richard Fry
Dames & Moore, Inc.
3399 Bates Creek Road
Lexington, Kentucky 40502

Mr. Norman H. Travis
Tenn. Dept. of Public Health
150 Ninth Avenue, North
Nashville, Tennessee 37203

Tennessee Valley Authority
ATTN: Mr. Larry M. Mills, Mgr.
Nuclear Regulation & Safety
400 Chestnut Tower No. 2
Chattanooga, Tennessee 37401

Mr. John Winder
5500 Friendship Boulevard
Apt. 1110, North
Chevy Chase, Maryland 20015

Mr. G. Robert Schwable, (2 copies)
Executive Director
Ohio Valley Regional
Development Commission
740 Second Street
Portsmouth, Ohio 45662

Ms. Jeanne Schmidt, Clerk
County of Scioto
140 Courthouse
Portsmouth, Ohio 45662

Ms. Winifred Hepler
111 Sherrin Avenue
Louisville, Kentucky 40207

Mr. John R. Thurman (7 copies)
Group Head, NEPA
Environmental Quality Staff
Tennessee Valley Authority
Norris, Tennessee 37828

Dr. Joel I. Klein
Envirosphere Co.
Two World Trade Center
New York, NY 10048

Mr. Paul C. Swartz, Chief
Planning Services Division,
Southeast Region
National Park Service
U.S. Department of Interior
75 Spring Street, SW
Atlanta, GA 30303

Mr. Joseph Pidkowicz
135 North Seneca Road
Oak Ridge, Tennessee 37830

Mr. Gene H. Irrgang
Product Manager
Trane Thermal Company
Brook Road
Conshohocken, Pennsylvania 19428

Mr. Wm. N. Hedeman, Director
Federal Activities Office
U.S. EPA
401 M Street, SW
Washington, D.C. 20460

Mr. William R. Rhyne
140 Wingham Road
Oak Ridge, Tennessee 37830

City of Oak Ridge
ATTN: Mr. James D. Harless
Environmental Health Supervisor
P.O. Box 1
Oak Ridge, Tennessee 37830

Mr. Vernon A. Taylor
Field Office Chief
National Transportation Safety Bd.
Federal Building
John F. Kennedy Airport
Jamaica, New York 11430

Mr. Bruce G. Hoch
Field Office Chief
National Transportation Safety Bd.
601 E. 12th Street
Kansas City, Missouri 64106

Mr. Jay Golden
Field Office Chief
National Transportation Safety Bd.
Suite 921
1720 Peachtree Road, NW
Atlanta, Georgia 30309

Rick Sonnenberg (6 copies)
Assistant to the City Manager
Municipal Building
Oak Ridge, TN 37830

Ms. Ruth Neff
Tennessee Environmental Council
P.O. Box 1422
Nashville, TN 37202

Sarah Lynn Cunningham
Louisville Paddlewheel Alliance
1325 Bardstown Rd., #1
Louisville, KY 40204

Mr. Tom Eblin
Associated Press
c/o The Knoxville Journal
210 West Church Avenue
Knoxville, TN 37902

Mr. W. M. Good
113 Taylor Road
Oak Ridge, TN 37830

The Oak Ridger
Oak Ridge, TN 37830

Rhoda Granat, Librarian
WAPORA, Inc.
6900 Wisconsin Avenue
Chevy Chase, MD 20815

Ms. Rosemarie Carr, EIS Officer (4 copies)
Kentucky Department of Natural Resources
and Environmental Protection
Office of Special Projects, 4th Floor
Capitol Plaza Towers
Frankfort, KY 40601

Mr. John Leonard
Division of Solid Waste
Tennessee Department of Public Health
1522 Cherokee Trail
Knoxville, TN 37920

Mr. Dwight Hinch
Division of Solid Waste
Tennessee Department of Public Health
150 Ninth Avenue North
Nashville, TN 37203

Mr. Oscar Webster (3 copies)
U.S. E.P.A., Region IV
345 Courtland Street NE
Atlanta, GA 30365

Shirley Harkins
P.O. Box 837
Lake City, TN 37769

Sybil Davis, Librarian (2 copies)
IT Envirosiences
9041 Executive Park Drive
Knoxville, TN 37923

Mr. Thomas W. Webb, Manager (10 copies)
TN Planning/Environmental Services
1800 James K. Polk Building
505 Deaderick Street
Nashville, TN 37219

Tom Charlier
Lake City Town Crier
P.O. Box 495
Lake City, TN 37769

Lyle Cheever (3 copies)
Environmental Coordinator
Administration & Technical Support
Division
U.S. Department of Energy
9700 South Cass Avenue
Argonne, IL 60439

Mr. Harold Rouff
1320 SE 17th Street
Cape Coral, FL 33904

Mr. Ken E. Mathias
U.S. Department of Energy
Western Area Power Administration
P.O. Box 3402
Golden, CO 80401

Mr. Gordon Hallum
U.S. Department of Energy
Alaska Power Administration
P.O. Box 50
Juneau, AL 99802

Mr. Peter Gillson
GSC - NCR - WPBA
7th and D Streets, SW
Washington, D.C. 20407

Mr. Doye B. Cox
Tennessee Valley Administration
248 401 Building
Chattanooga, TN 37401

Dr. C. R. Richmond
Building 4500 N, Room I-206
Oak Ridge National Laboratory
Oak Ridge, TN 37830

Mr. Paul Zehnder
WOHI Radio
P.O. Box 90
East Liverpool, OH 43920

Ms. Barbara Starr
McGraw Hill World News
400 National Press Building
Washington, D.C. 20045

Tillie Rickert (2 copies)
Third Floor, Building 1505
Oak Ridge National Laboratory
Oak Ridge, TN 37830

Mr. Bruce Blanchard, Director (2 copies)
Office of Environmental Project Review
U.S. Department of Interior
Washington, D.C. 20240

Mr. Paul A. Dols
U.S. Department of Energy
Southwestern Power Administration
P.O. Box 1619
Tulsa, OK 74101

Dr. A. W. Lawrence
4299 Old New England Road
Allison Park, PA 15101

Ms. Frances Pleasanton
Group Against Synfuels Pollution
111 Pleasant Road
Oak Ridge, TN

B. C. Pal (2 copies)
MS 001, Room 200, B. 2001
Oak Ridge National Laboratory
Oak Ridge, TN 37830

Mr. Erich Helbig
2520 Holbrook Drive
Knoxville, TN 37918

Mr. Adam Finkel, Editor
Hazardous Materials Intelligence Report
P.O. Box 535
Cambridge, MA 02238

Mr. Greg Miner
Morrison - Knudsen Corp.
P.O. Box 7808
Boise, ID 83729

Mr. Mark Schleifstein
The Clarion - Ledger
P.O. Box 40
Jackson, MS 39205

Mr. Jim Bailey (2 copies)
Building 9720-6, MS-001
UCCND
Y-12 Plant

Ms. Jeannine Honicker
362 Binkley Drive
Nashville, TN 37211

Honorable A. K. Bissell
Mayor, City of Oak Ridge
P.O. Box 1
Oak Ridge, TN 37830

Cheryl Wodley
Library, B90P
Lawrence Berkeley Lab
Berkeley, CA 94720

John McEwen
M.M. Dillon Co. Ltd.
50 Holly Street
Box 219, Station K
Toronto, Canada M4P265

Jack Fitch
Fluor Corporation
Oak Ridge, TN 37830

Mr. Charles Howell
Commissioner
Department of Conservation
2611 W. End
Nashville, TN 37203

Mr. Robert Farris
Commissioner
Department of Transportation
Suite 700 Polk Building
Nashville, TN 37219

Jennifer Worley
Rt. 16 Box 28
Knoxville, TN 37920

Erich M. Helbig
5508 #2 Fifth Street
Knoxville, TN 37918

A. L. Sandpiper Corporation
2917 North Star Road
Columbus, OH 43221

Ms. Frances Pleasanton
Group Against Synfuels Pollution
111 Pleasant Road
Oak Ridge, TN 37830

B. C. Pal
MS 001, Room 200, B 2001
Oak Ridge National Laboratories
Oak Ridge, TN 37830

Mr. Erich Helbig
2520 Holbrook Drive
Knoxville, TN 37918

Mr. Adam Finkel, Editor
Hazardous Materials Intelligence Report
P.O. Box 535
Cambridge, MA 02238

Mr. Greg Miner
Morrison - Knudsen Corp.
P.O. Box 7808
Boise, ID 83729

Mr. Mark Schleifstein
The Clarion - Ledger
P.O. Box 40
Jackson, MS 39205

Mr. Paul Zehnder
WOHI Radio
P.O. Box 90
East Liverpool, OH 43920

Ms. Barbara Starr
McGraw Hill World News
400 National Press Building
Washington, D.C. 20045

Tillie Rickert
Third Floor, Building 1505
Oak Ridge National Labs
Oak Ridge, TN 37830

Mr. Bruce Blanchard, Dr.
Office of Environmental Project Review
U. S. Department of Interior
Washington, D.C. 20240

Mr. Paul A. Dols
U. S. Department of Energy
Southwestern Power Administration
P.O. Box 1619
Tulsa, OK 74101

Dr. A. W. Lawrence
4299 Old New England Road
Allison Park, PA 15101

Mr. Ken A. Mathias
U.S. Department of Energy
Western Area Power Administration
P.O. Box 340Z
Golden, CO 80401

Mr. Gordon Hallum
U. S. Department of Energy
Alaska Power Administration
P.O. Box 50
Juneau, AL 99802

Mr. Peter Gillson
GSC - NCR - WPBA
7th and D Streets, SW
Washington, D.C. 20407

Mr. Doye B. Cox
Tennessee Valley Administration
248 401 Building
Chattanooga, TN 37401

Mr. C. R. Richmond
Building 4500 N, Room I-206
Oak Ridge National Laboratory
Oak Ridge, TN 37830

Shirley Harkins
P.O. Box 837
Lake City, TN 37769

Sybil Davis, Librarian [2]
IT Envirosiences
9041 Executive Park Drive
Knoxville, TN 37923

Mr. Thomas W. Webb, Mgr. [10]
TN Planning/Environmental Services
1800 James K. Polk Building
505 Deaderick Street
Nashville, TN 37219

Tom Charlier
Lake City Town Crier
P.O. Box 495
Lake City, TN 37769

Lyle Cheever, Environmental Coordinator [3]
Administration & Technical Support (Building 4)
Argonne National Laboratory
9700 S. Cass Avenue
Argonne, IL 60439

Mr. Harold Rouff
1320 SE 17th Street
Cape Coral, FL 33904

Rhoda Granat, Librarian
WAPORA, Inc.
6900 Wisconsin Ave.
Chevy Chase, MD 20815

Ms. Rosemarie Carr, EIS Officer [4]
Kentucky Department of Natural Resources
and Environmental Protection
Office of Special Projects, 4th Floor
Capital Plaza Towers
Frankfort, KY 40601

Mr. John Leonard
Division of Solid Waste
Tennessee Department of Public Health
1522 Cherokee Trail
Knoxville, TN 37920

Mr. Dwight Hinch
Division of Solid Waste
Tennessee Department of Public Health
150 Ninth Avenue North
Nashville, TN 37203

Mr. Oscar Webster [3]
U. S. EPA, Region IV
345 Courtland Street, NE
Atlanta, GA 30365

Jim Bailey [2]
Building 9720-6, MS-001
UCCND
Y-12 Plant
Oak Ridge, TN 37830

Ms. Jeannine Honicker
362 Binkley Drive
Nashville, TN 37211

Hon. A. K. Bissell
Mayor, City of Oak Ridge
P.O. Box 1
Oak Ridge, TN 37830

Cheryl Wodley
Library, B90P
Lawrence Berkeley Lab
Berkeley, CA 94720

John McEwen
M. M. Dillon Co. Ltd.
50 Holly Street
Box 219, Station K
Toronto, Canada M4P2G5

Jack Fitch
Fluor Corporation
Oak Ridge, TN 37830

Lida Whitaker
U. S. Department of Energy
NE - 610
GTN/OUEA
Germantown, MD 20545

Rick Sonnenberg [6]
Assistant to the City Manager
Municipal Building
Oak Ridge, TN 37830

Ms. Ruth Neff
Tennessee Environmental Council
P.O. Box 1422
Nashville, TN 37202

Sara Lynn Cunningham
Louisville Paddlewheel Alliance
1325 Bardstorm Rd., #1
Louisville, KY 40204

Mr. Tom Eblin
Associated Press
c/o The Knoxville Journal
210 West Church Ave.
Knoxville, TN 37902

Mr. W. M. Good
113 Taylor Road
Oak Ridge, TN 37830

The Oak Ridger
Oak Ridge, TN 37830

Mr. Erich Wischhusen
Knox Valve Fitting Co.
6310 Deane Hill Drive
Knoxville, TN 37919

Mr. Bernard Lerner
BECO Engineering
P.O. Box 39
Glenshaw, PA 15116

P. Lovgren
CHEMCONTROL A/S
Dagmarhus
DK - 1553 Copenhagen V
Denmark

Mr. K. B. Hinerman, Manager
Government Operations
NUS Corporation
4 Research Place
Rockville, MD 20850

Mr. Patrick Hughes
Brown & Root Development Co., Inc.
P.O. Box 2002
Houston, TX 77001

Ms. Joan Berkowitz, Vice President
Chemical Systems
Arthur D. Little, Inc.
Acorn Park
Cambridge, MA 02140

COPIES OF THE ENVIRONMENTAL IMPACT STATEMENT
ARE AVAILABLE FOR PUBLIC REVIEW AT THE
FOLLOWING LOCATIONS:

Oak Ridge Public Library
Civic Center Building
Oak Ridge Turnpike
Oak Ridge, Tennessee 37830

Paducah Public Library
555 Washington Street
Paducah, Kentucky 42001

Portsmouth Public Library
1220 Gallia Street
Portsmouth, Ohio 45662

U.S. Department of Energy
Public Reading Room
6A 152
1000 Independence Avenue
S.W. Washington, D.C. 20585

Chicago Operations, Regional Office
9800 South Cass Avenue
Argonne, Illinois 60439

U.S. Department of Energy
Public Document Room
Betty G. Camp, Librarian
1655 Peachtree Street, NE
Atlanta, Georgia 30309

THIS PAGE IS INTENTIONALLY BLANK

APPENDIX A

DATA TO SUPPORT WASTE MATERIALS INVENTORY,
INCINERATOR DISPOSAL RATE ESTIMATES,
AND INCINERATOR FUEL REQUIREMENTS

THIS PAGE IS INTENTIONALLY BLANK

APPENDIX A

DATA TO SUPPORT WASTE MATERIALS INVENTORY, INCINERATOR DISPOSAL RATE ESTIMATES, AND INCINERATOR FUEL REQUIREMENTS

A.1 Waste Materials Inventory

The majority of the proposed incinerator feedstocks may be classified as liquid and solid organic waste materials. Some inorganics, such as acid/base solutions and contaminated topsoil from a chemical land farm, are also designated for disposal in the proposed incinerator. Many of these wastes are contaminated to varying degrees with PCBs. Table A-1 lists the estimated PCB concentrations in the various waste materials and the estimated total quantity of PCBs removed and stored.

From Table A-1, an estimate of the PCB concentrations in the feedstock can be made. The quantities of PCBs in the annual waste materials are:

Annual Waste Materials (1987)

Total PCBs:	14,000 kg/yr
Total Wastes:	854,000 kg/yr
Percent PCBs:	1.6 percent.

The quantities of PCBs in the stored waste materials are:

Stored Waste Materials (by 1987):

Total PCBs:	206,000 kg/yr
Total Wastes:	8,800,000 kg/yr
Percent PCBs:	2.34 percent.

The quantities of PCBs in storage (as liquids) will be approximately 75,000 kg while the total liquids will be approximately 2,200,000 kg. This would produce a PCB concentration in a blended waste stream of 3.4 percent. This figure is the highest likely concentration of PCBs fed to the incinerator, due to the conservative assumptions made in estimating the amount of PCBs.

TABLE A-1. WASTE MATERIALS INVENTORY

Waste Type	Assumed PCB Concentration	Annual Wastes		Stored Wastes	
		Total Waste (kg/yr)	Total PCB (kg/yr)	Wastes in Storage (1987) (kg)	PCBs in Storage (1987) (kg)
Concentrated PCB	60%	17,700	10,620	108,000	65,280
PCB oils	5%	16,592	829	121,500	6,100
PCB Contaminated Oil	500 ppm	13,000	6.5	690,400	345
PCB Contaminated Oil	50 ppm	6,400	0.3	54,600	2.7
Hydrocarbons with PCB	2%	20,500	411	137,000	2,741
Fullers Earth	50 ppm	10,900		81,600	4.1
Solid Waste	10%	24,000	2,400	48,000	4,800
Dirt	2%	0	0	6,350,000	127,000
Total PCB containing wastes ^a		119,000	14,000	7,591,900	206,000
All other wastes		735,000		1,208,000	
Total wastes ^a		854,000		8,800,000	
Percent PCBs in Waste		1.6		2.34	

Source: K/D-5222

a Entries may not sum to total due to rounding.

A.2 Incinerator Disposal Rate Estimates

An estimate of the time required to dispose of the stored wastes can be made by comparing the maximum solids/liquids disposal rate with the materials removed annually and those stockpiled.

The average design feedrate of the incinerator will be approximately 1,300,000 kg/yr for liquids and 1,400,000 kg/yr for solids. The incinerator will be capable of operating up to 25 percent above the average design heat input of 6 million Btu/hr. Since much of this additional heat input will result from higher inputs of liquid feedstocks, the maximum annual liquids disposal rate can be estimated by multiplying the average liquids disposal rate by a factor of 1.25. The incinerator disposal rates are as follows:

Average annual liquids disposal rate:	1,300,000 kg/yr
Average annual solids disposal rate:	1,400,000 kg/yr
Maximum annual liquids disposal rate:	1,600,000 kg/yr.

It has been estimated that the annual liquids/solids rates for 1987 will be:

liquids:	819,000 kg/yr
solids:	34,900 kg/yr.

The quantities of liquids/solids that will be in storage by 1987 will be approximately:

liquids:	2,300,000 kg
solids:	6,500,000 kg.

The incinerator operating at its maximum capacity will have a capacity in excess of that required to dispose of annual materials and this excess capacity will be used to eliminate stored materials. The excess capacity of the incinerator (i.e., capacity above the annual materials removal rate) will be:

liquids:	780,000 kg/yr
solids:	1,360,000 kg/yr.

Based upon these capacities, the stored materials could be disposed of in the following periods:

Period to eliminate all stored liquids:	35 months (approx.)
Period to eliminate all stored solids:	58 months (approx.).

A.3 Incinerator Fuel Requirements

A supplemental fuel, such as No. 2 fuel oil, will be used to provide additional heat input into the incinerator in the event that heat of combustion of the feedstock is insufficient to maintain incinerator temperatures. The maximum quantity of fuel that might be used in the incinerator can be made using the following assumptions:

- The incinerator will be operating at its design heat and mass flow ratings.
- The feedstock to the incinerator will contain the minimum heating value for the incinerator to operate.
- The additional heat input will come from the fossil fuel (No.2 fuel oil).

The calculations proceed as shown in Table A-2.

This computation neglects the heat released from solids and the heat absorbed by aqueous solutions. It also assumes a heating value of 41.9×10^6 Joules/kg (18,000 Btu/lb) for No. 2 fuel oil. The requirements for the air feed would not be changed since the original calculations assumed a 6×10^9 Joules/hr (5.6 million Btu/hr) flow rate which would remain constant as long as the heat release rate is constant.

This value computed in Table A-2 is the maximum quantity of fuel oil that might be used to support the incinerator. If the heating value of the liquids to be fed to the incinerator is greater than the minimum levels specified, which is probable, then less fuel oil will be required than indicated.

The maximum quantity of fuel oil that would be required for the incinerator to operate at its average design rating would be approximately 60.5 kg/hr (133 lb/hr). Because of the high heating value of the wastes, the actual fuel requirements will be somewhat less.

TABLE A-2. INCINERATOR FUEL REQUIREMENTS COMPUTATION

<u>Incinerator design firing rate (average):</u>	6×10^9 Joule/hr (5.6×10^6 Btu/hr)
<u>Kiln</u>	
Liquids feed rate (average):	85.4 kg/hr (188 lb/hr)
Minimum heating value:	16×10^6 J/kg (7,000 Btu/kg)
Minimum heat input from liquids into the kiln (average):	1.4×10^9 Joule/hr (1.3×10^6 Btu/hr)
<u>Afterburner</u>	
Liquids feed rate (average):	84.5 kg/hr (186 lb/hr)
Minimum heating value:	23×10^6 Joules/kg (10,000 Btu/hr)
Minimum heat input from liquids into the afterburner (average):	1.9×10^9 Joules/hr (1.9×10^6 Btu/hr)
<u>Total</u>	
Total heat released in incinerator from organic liquid wastes:	3.3×10^9 Joules/hr (3.2×10^6 Btu/hr)
Difference between heat released from organic wastes and the average design rating:	2.7×10^9 Joules/hr (2.4×10^6 Btu/hr)
Amount of No. 2 fuel required to raise the heat release rate to the average design rating:	60.5 kg/hr (133 lb/hr)

Source: Calculations based on data derived from K/D-5222.

A.4 References

K/D-5222. Conceptual Design Report for Compliance With the Toxic Substance Control Act (TSCA) Project No. 83-OR-14. Goodyear Atomic Corporation, Nuclear Division of Union Carbide Corporation, Engineering Divisions, March 28, 1981.

APPENDIX B

TRANSPORTATION ANALYSES

THIS PAGE IS INTENTIONALLY BLANK

APPENDIX B

TRANSPORTATION ANALYSES

This appendix presents a discussion of alternative routes for transporting waste materials to the proposed incinerator site at ORGDP. The major focus of the analysis is the proposed routing, since each alternative shares a significant portion of the proposed route.

B.1 Routes from Portsmouth Gaseous Diffusion Plant to ORGDP

Preliminary analysis of the possible routes from the Portsmouth Gaseous Diffusion Plant in Piketon, Ohio to the Oak Ridge Gaseous Diffusion Plant shows that the major artery is Interstate 75. The following discussion presents the proposed and alternative routes from Piketon to ORGDP.

B.1.1 The Proposed Route from Piketon to ORGDP

The proposed route from Piketon to Oak Ridge (see Figure B-1) covers approximately 656 km (408 mi). About 75 percent of the route consists of interstate highways, and 88 percent of the route is either a four or six lane divided road. This route has a minimal direct contact with major population centers.

The distance from the Piketon plant gate to US 23 is 2.1 km (1.3 mi); this four lane road represents the only alternative. US 23 Northbound to US 35 is a four lane road. The distance to the US 35 intersection is 42 km (26 mi) of which about 34 km (21 mi) are a divided highway. This section of the route crosses ten creeks and two rivers, and it also traverses alongside creeks/rivers for about 11 km (7 mi).

US 35 from US 23 to Interstate 71 is 68 km (42 mi) long, 36 km (22 mi) of which are four lane divided freeways, while the other 32 km (20 mi) are two lane highways. This section crosses ten creeks, two rivers, and three rail lines. It has significant truck traffic despite the fact that the two lane portion of this section is narrow and has a narrow shoulder.

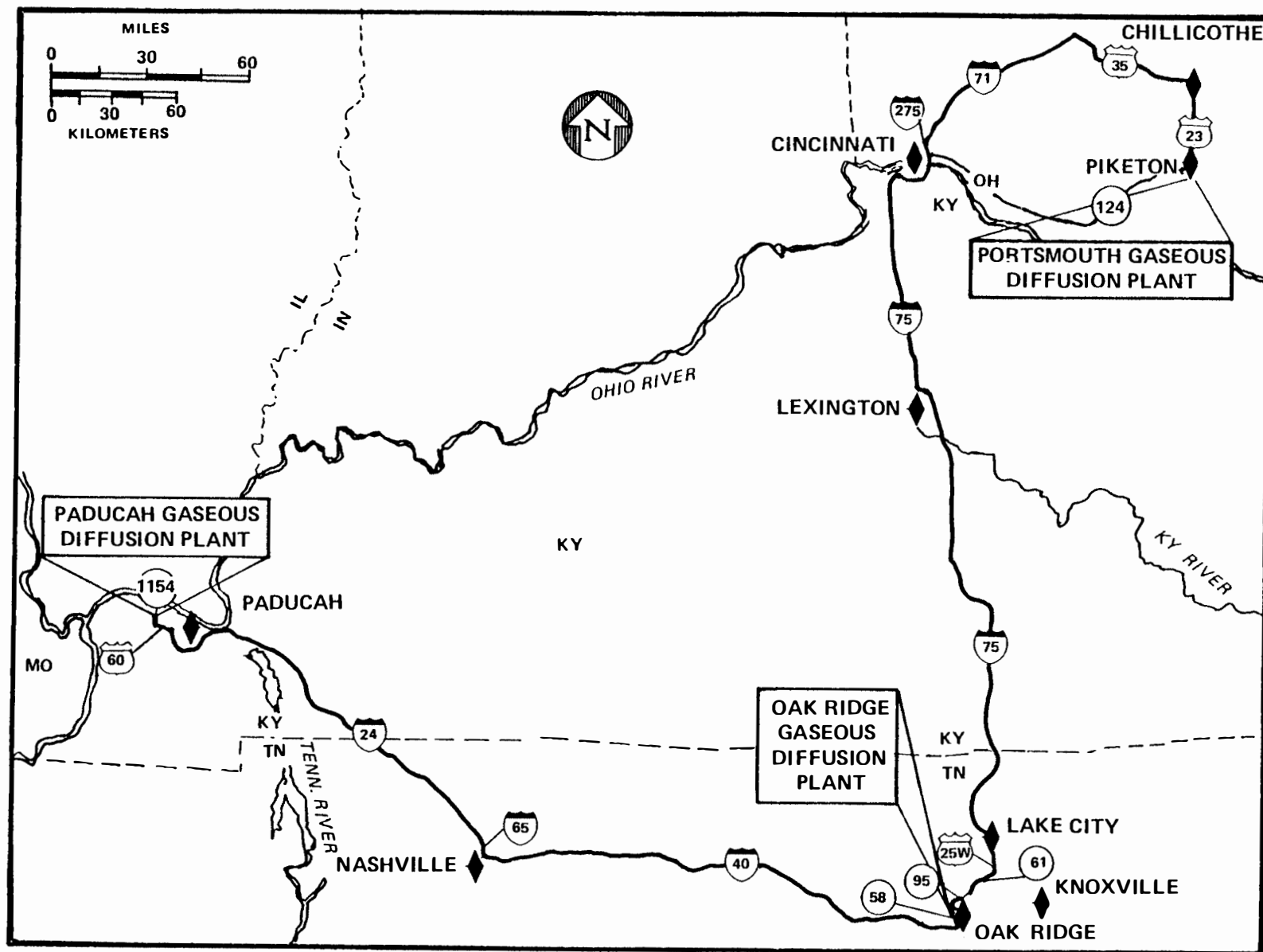


FIGURE B-1. PROPOSED ROUTES: PIKETON, OHIO, AND PADUCAH, KENTUCKY ORGDP

The approximately 79 km (49 mi) of Interstate 71 South from US 35 to Interstate 275 East crosses over six creeks and rivers and one railroad line. It exhibits standard interstate travel conditions, as do the 56 km (35 mi) on the next section on Interstate 275 East to Interstate 75. Interstate 275 East is a six lane highway for 32 km (20 mi) of the 56 km (35 mi) section, and does not pass through any densely populated business or residential areas of metropolitan Cincinnati (population 383,600). The road is isolated and relatively uncongested in non-rush hour periods, which would be an important factor to consider in the actual scheduling of shipments. It crosses over five creeks and rivers, and one rail line.

An alternative route from Piketon to Interstate 275 is Ohio 124, a limited access, four lane highway currently under construction. Waste will be transported on this route to Interstate 275 once this route is completed (within the next 5 to 6 years).

The next section of this route consists of 357 km (222 mi) of Interstate 75 to the Lake City exit outside of Knoxville. Interstate 75 does not pass directly through any very densely populated areas. However, it does come close to the outskirts of Lexington, although this should not represent a major problem. Just south of the Tennessee/Kentucky border, the road ascends and descends through the Cumberland Mountains. In the approximately 40 km (25 mi) stretch, fog can occasionally present a serious hazard. However, a viable alternative to this section does not exist. In total, along the 357 km (222 mi) Interstate 75 crosses thirteen creeks and eight rivers and lakes, while it passes under two railroad bridges.

The distance along US 25W from Interstate 75 (Lake City exit) to TN 61 is about 17 km (10.4 mi). Although Lake City is a small town (population 2,000), there is some congestion during the first few kilometers through Lake City. The remainder of this 17 km (10.4 mi) section to TN 61 is primarily a two lane road. There is a significant amount of truck traffic on this road, however. There is one 4.12 meter (13'8") clearance under a railroad bridge, as well as one bridge over a creek. The distance on TN 61 from US 25W to Oak Ridge (population 27,600) is 8.9 km (5.5 mi). This road is four lanes for the approximately one-half kilometer (0.3 mi) through Clinton. Six kilometers (3.7 mi) south of Clinton, TN 61 borders the Clinch River for about 0.5 km (0.3 mi).

TN 61 leads to TN 95 Southbound which passes through Oak Ridge. A four lane road constitutes 17 km (10.6 mi) of this 21 km (13.2 mi) section. About 3 km (2 mi) through Oak Ridge are congested, but a center curb divides the traffic in this area. TN 95 Southbound becomes TN 58 Southbound for the 1.8 km (1.1 mi) stretch which leads to Blair Road and the ORGDP plant entrance. TN 58 South is a four lane undivided road, while the 1.5 km (0.9 mi) section of Blair Road to the proposed site is only two lanes. Blair Road represents the only reasonable entrance to the ORGDP incinerator site, regardless of the route followed from Piketon to Oak Ridge.

A principal advantage of this entire 656 km (408 mi) route emanates from the fact that it minimizes close contact with any large population centers. Secondly, four lane roads and interstate highways constitute a large portion of the total length.

B.1.2 Alternative Routes: Piketon to Interstate 75

There are three alternative routes to Interstate 75 from Piketon (see Table B-1 and Figure B-2). Alternative 3 (US 68 Southbound across Ohio) ranks below the other two; although it is the shortest route of the three, a substantial percentage of this route consists of two lane highway (about 37 percent). This route also closely traverses along the Ohio River for a greater distance than do the other two alternatives.

Alternative 2, which crosses Kentucky via Interstate 64, compares favorably with Alternative 1 (the Interstate 71 route) in two criteria. This route is about 61 km (38 mi) shorter than Alternative 1, and has about a 5 percent greater amount of four lane road. However, use of US 23 Southbound and then US 52 Eastbound results in passing through the northern outskirts of Portsmouth, through its downtown district and then through the eastern fringes of the city. In all, this constitutes almost sixteen kilometers (ten miles) of travel through heavily congested business and residential areas. The total distance of travel through Portsmouth can be reduced by crossing the Ohio River at the bridge in Portsmouth. US 23 Southbound leads directly into this bridge and it eventually intersects with Interstate 64 in Kentucky. However, this option still requires travel over about six kilometers (four miles) of

TABLE B-1. DESCRIPTION OF PIKETON TO OAK RIDGE ROUTE ALTERNATIVES

Alternative	Route Segment	Kilometers ^a (Miles)	Number of Creeks/Streams Crossed	Number of Rivers and Lakes Crossed	Major Urban Areas ^b		Minor ^c Urban Areas Passed Through
					Passed Through	By Passed	
(1)	Plant Gate - US 23	2(1)	0	0	0	0	0
	US 23 North - US 35	42(26)	10	2	0	0	2
	US 35 West - I-71	68(42)	10	2	0	0	1
	I-71 South - I-275	79(49)	4	2	0	0	0
	I-275 East - I-75	56(35)	2	3	0	1	0
	I-75 South - US 25W (Lake City)	357(222)	13	8	0	1	0
	Total	604(375)	39	17	0	2	3
(2)	Plant Gate - US 23	2(1)	0	0	0	0	0
	US 23 South - US 52	32(20)	2	0	0	0	0
	US 52 East - I-64	72(45)	2	0	1	1	0
	I-64 West - I-75	191(119)	6	6	1	0	0
	I-75 South - US 25W (Lake City)	245(152)	10	6	0	1	0
	Total	542(337)	20	12	2	2	0
(3)	Plant Gate - US 23	2(1)	0	0	0	0	0
	US 23 South - US 52	32(20)	2	0	1	0	0
	US 52 West - US 68	90(56)	13	3	0	0	0
	US 68 South - I-75	97(60)	5	6	0	0	2
	I-75 South - US 25W (Lake City)	249(155)	10	6	0	1	0
	Total	470(292)	30	15	1	1	2

Source: Direct Measurement

a Distances are rounded to nearest whole number

b Major urban areas are defined for this study as areas which had a population of over 25,000 in 1975. Population data was obtained from: U.S. Department of Commerce, Bureau of the Census, County and City Data Book 1977 (A Statistical Abstract Supplement), U.S. Government Printing Office, Washington, D.C., 1978.

c Minor urban areas are defined for this study as areas which had a population of between 2,500 and 25,000 in 1975

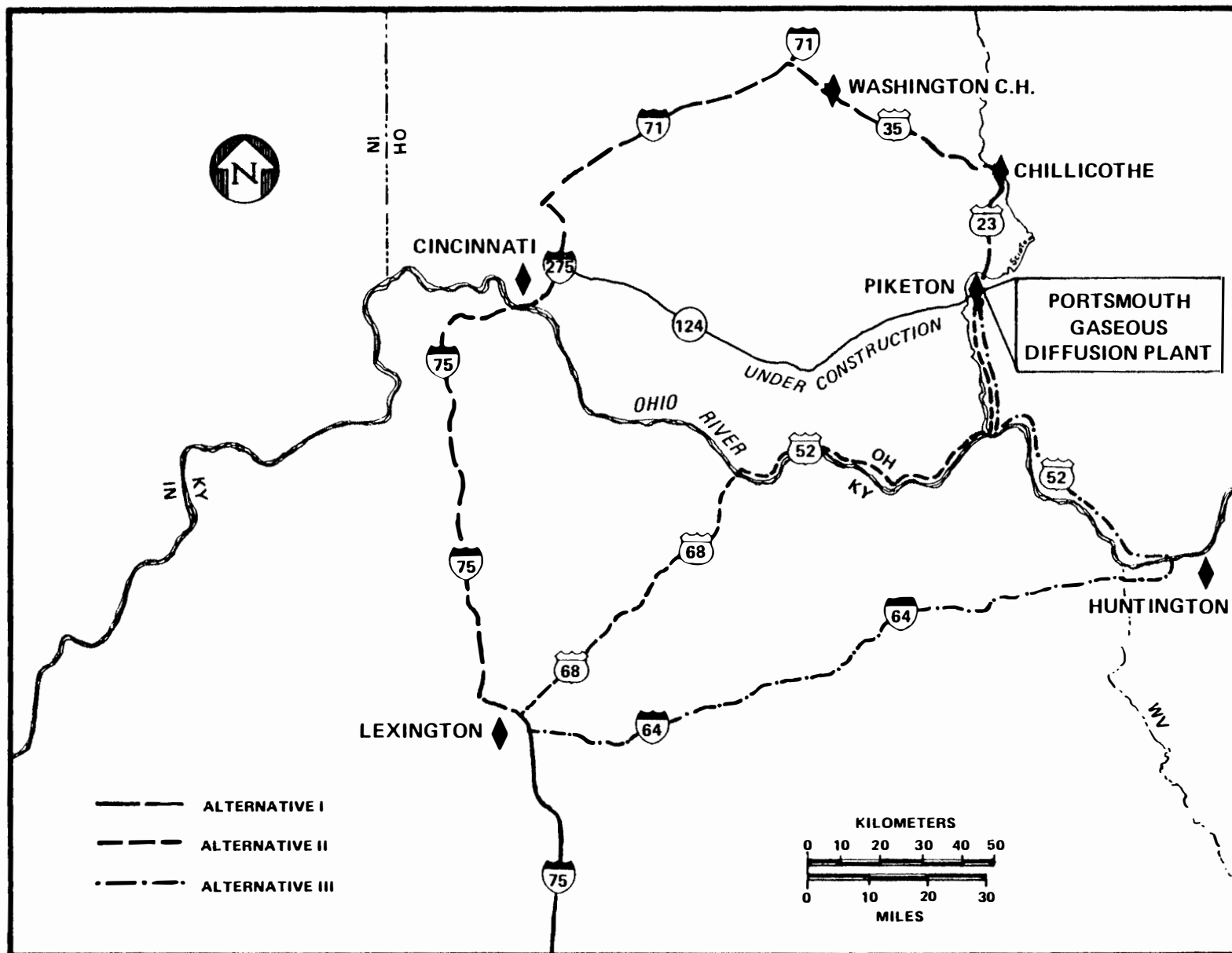


FIGURE B-2. ALTERNATIVE ROUTES: PIKETON TO INTERSTATE 75

heavily congested travel through Portsmouth before reaching the bridge. Furthermore, US 23 passes through a heavily congested area in Ashland, KY before it intersects with I-64. Thus, this option does not improve Alternative 2.

On the basis of the above evaluation, Alternative 1 represents the safest route over which to ship contaminated PCB waste from Piketon to the proposed incinerator at ORGDP. Although this route is longer than the other two, it minimizes congested travel through densely populated areas. Furthermore, 95 percent of the distance of this route is over four lane roads. Finally, proximity to major bodies of water along this route is relatively small.

B.1.3 Alternative Routes: Interstate 75 to ORGDP

There are three alternative routes from Interstate 75, near Lake City, to the Oak Ridge Gaseous Diffusion Plant (Table B-2, Figure B-3). Alternative 2 has some advantage in that it minimizes the total miles of two lane highway after leaving I-75 and by-passes the City of Oak Ridge. Alternative Approaches 1 and 3 have about 32 km (20 mi) of two lane road. Alternative 2 includes about 19 km (12 mi) of two lane highway. However, Merchants Road and Clinton Highway are very congested roads with numerous retail shopping malls on both sides of the road. Furthermore, a truck which exits at Merchants Road must negotiate metropolitan Knoxville traffic, both on the last 16 km (10 mi) of I-75 and then on Merchants Road and Clinton Highway.

Alternatives 1 and 3 completely avoid the Knoxville area, and therefore, are better approaches to Oak Ridge. Alternative 1 (Lake City exit) is considered safer than Alternative 3 (TN 61 exit at Bethel). US 25W, which is about 16 km (10 mi) long between Lake City and Clinton, is a wide two-lane road with three lane upgrades on hills, and about 3 km (2 mi) of four-lane highway. In contrast, the approximately 9.6 km (6 mi) of TN 61, between I-75 exit at Bethel to Clinton, is a newly rebuilt two lane road; it is not specifically constructed as a truck route and does not have three lane and four lane upgrades as does US 25W. TN 61 also has one narrow, curving section which passes by an industrial area and fish hatchery.

TABLE B-2. DESCRIPTION OF ALTERNATIVE APPROACHES TO THE ORGDP FROM LAKE CITY

Alternative	Route Segment	Kilometers ^a (Miles)	Number of Creeks/Streams Crossed	Number of Rivers and Lakes Crossed	Major Urban Areas ^b		Minor ^c Urban Areas Passed Through
					Passed Through	By Passed	
(1)	US 25W (Lake City) South - TN 61	16(10)	1	0	0	0	0
	TN 61 South - TN 95	10(6)	0	0	0	0	1
	TN 95 South - TN 58	21(13)	1	0	1	0	0
	TN 58 South - Blair Rd.	2(1)	0	0	0	0	0
	Blair Rd. - ORGDP entrance	3(2)	0	0	0	0	0
	Total	52(32)	2	0	1	0	1
(2)	I-75 (Lake City) South - Merchants Rd. Exit	32(20)	2	1	0	1	0
	Merchants Rd. - Clinton Highway	2(1)	0	0	1	0	0
	Clinton Highway - New Edgemore Rd.	14(9)	2	0	1	0	0
	New Edgemore Rd. - Bethel Valley Rd.	10(6)	0	3	0	0	0
	Bethel Valley Rd. - TN 95	16(10)	0	0	0	0	0
	TN 95 North - TN 58	5(3)	0	0	0	0	0
	TN 58 South - Blair Rd.	2(1)	0	0	0	0	0
	Blair Rd. - ORGDP entrance	3(2)	0	0	0	0	0
	Total	84(52)	4	4	1 ^d	1	0
(3)	I-75 (Lake City) South - TN 61 exit	10(6)	1	1	0	0	0
	TN 61 South - TN 95	20(12)	1	1	0	0	1
	TN 95 South - TN 58	21(13)	1	0	1	0	0
	TN 58 South - Blair Rd.	2(1)	0	0	0	0	0
	Blair Rd. - ORGDP entrance	3(2)	0	0	0	0	0
	Total	56(35)	3	2	1	0	1

Source: Direct Measurement

a Distances are rounded to nearest whole number

b Major urban areas are defined for this study as areas which had a population of over 25,000 in 1975. Population data was obtained from: U.S. Department of Commerce, Bureau of the Census, County and City Data Book 1977 (A Statistical Abstract Supplement), U.S. Government Printing Office, Washington, D.C., 1978.

c Minor urban areas are defined for this study as areas which had a population of between 2,500 and 25,000 in 1975

d Total is 1 instead of 2 because Merchants Rd. and Clinton Highway both pass through Knoxville.

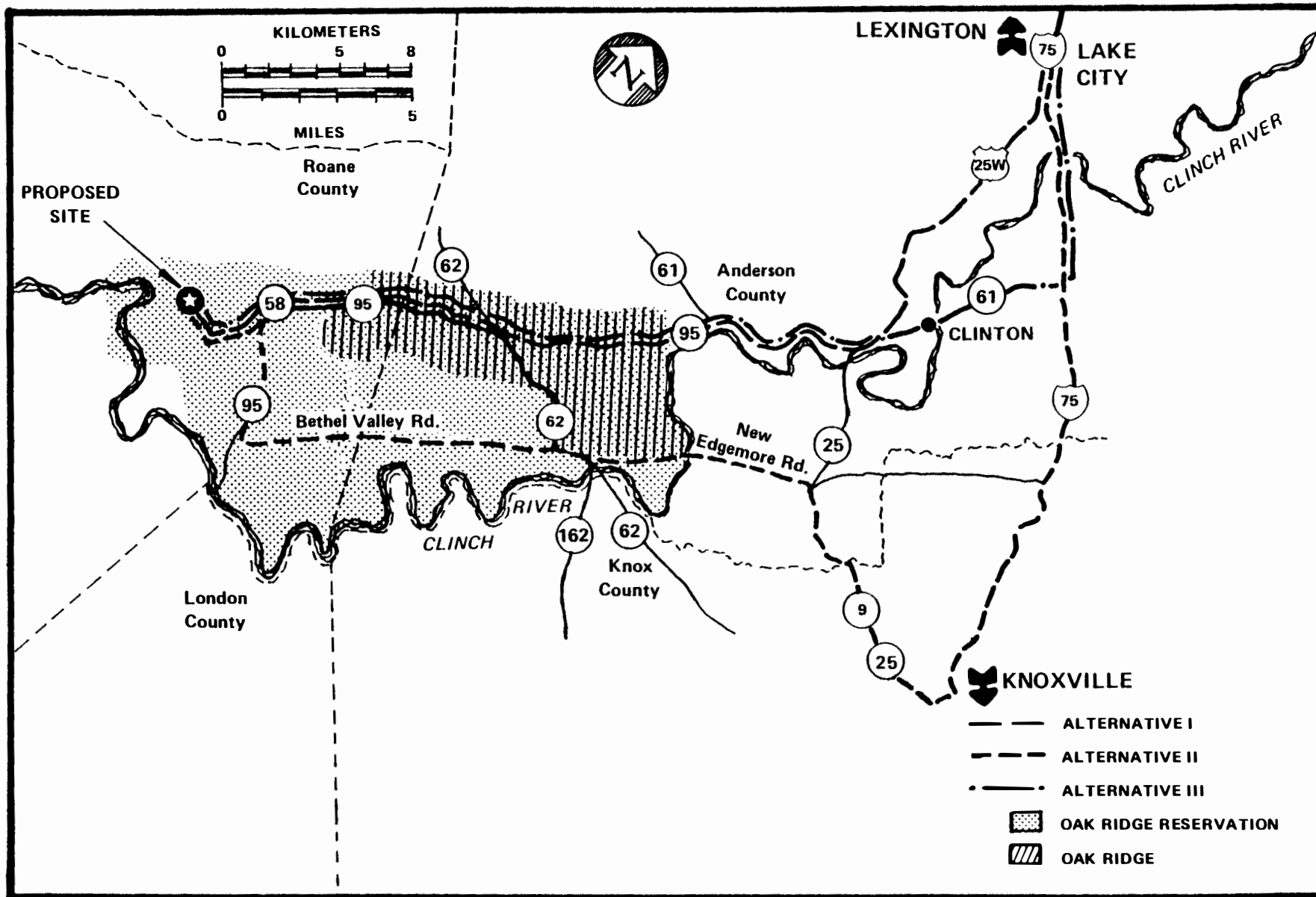


FIGURE B-3. ALTERNATIVE ROUTES: INTERSTATE 75 to ORGP

The only significant drawback to Alternative 1 is that US 25 passes through Lake City. However, previous experience (with shipments of such materials as spent fuels) does not indicate that this presents a problem. Thus, because US 25W is designed as a truck route, it is considered the best approach route to the incinerator at ORGDP.

Interstate 95 ("Oak Ridge Turnpike") which passes through downtown Oak Ridge, is a heavily traveled road. However, it is also a good four lane road which has some divided sections, as well as special turning lanes and lights. Furthermore, a truck which uses TN 95 can travel to Blair Road (the plant entrance road) without having to make any turns. A route which followed back roads around Oak Ridge, such as Alternative 2, would be longer and would involve numerous turns. In particular, the junction of TN 95 and TN 58 has had a relatively high frequency of truck accidents in recent years (The intersection, however, will be upgraded in the near future). A back road route around Oak Ridge would require trucks to turn at that intersection. For these reasons TN 95 is considered to offer the best final approach to the Oak Ridge incinerator.

B.1.4 Hazardous Sections of the Proposed Route from Piketon

As a part of the analysis of the proposed routes, accident data were obtained for each segment of the route. Table B-3 presents the relative probabilities of a vehicle being involved in an accident on each segment of the proposed route. This analysis is based on the total number of accidents on each segment, including those occurring at night, during peak traffic flows, and during inclement weather. It is important to note that the proposed action includes the scheduling of shipments to avoid periods of severe weather (e.g., snow and ice) as well as peak traffic flow periods.

The analysis in Table B-3 is based upon the concept of accidents per million vehicle-kilometers per day (AMVKD). This is the estimated historical number of accidents for a segment weighted by the volume of traffic and the length of the segment, and is presented in the last column of the table. From this analysis, it may be seen that the most dangerous sections of the proposed route from Piketon to ORGDP are:

TABLE B-3. SUMMARY OF TRAFFIC AND ACCIDENTS ON THE PROPOSED
ROUTE FROM PIKETON TO ORGDP

Route Section	Distance, km (Miles) ^a	Traffic Density Vehicle per 24 Hour Day ^b	No. of Traffic Accidents in 1980 ^c	Accident Rate No. per 10 ⁶ Vehicle km per Day ^d
<u>On US 23 in Ohio</u>				
Piketon to Waverly	9 (6)	11,910	18	0.46
Waverly to Jct Ohio 104 S. Chillicothe	20 (12)	11,740	52	0.62
Jct 104 S. Chillicothe to Jct Ohio 35	4 (3)	11,900	13	0.74
<u>On US 35 in Ohio</u>				
Jct US 23 E. Chillicothe to Jct Ohio 104 N. Chillicothe	7 (4)	12,860	40 ^e	1.28
Jct Ohio 104 N. Chillicothe to Jct Ohio 138	24 (15)	2,980	17	0.66
Jct Ohio 138 to Jct Ohio 753 (two lane)	19 (12)	2,328	47	2.94
Jct Ohio 753 to end of 4-lane W. of Washington Court House (Washington Court House Bypass)	9 (6)	2,633	11	1.27
End of 4-lane W. Washington Court House to Jct I-71 (two lane)	13 (8)	3,100	28	1.84
<u>On I-71 in Ohio</u>				
Jct US 35 to Port William	13 (8)	12,550	20	0.35
Port William to Jct US 68	11 (7)	12,700	14	0.28
Jct US 68 to Warren County 7 Exit	23 (14)	12,760	79	0.75
Warren County 7 Exit to Jct Warren County 31 (Kings Mills Exit)	18 (11)	14,550	90	0.92
Jct Warren County 31 to Jct I-275	13 (8)	22,310	62	0.61

TABLE B-3. (Continued)

Route Section	Distance, km (Miles) ^a		Traffic Density Vehicle per 24 Hour Day ^b	No. of Traffic Accidents in 1980 ^c	Accident Rate No. per 10 ⁶ Vehicle km per Day ^d
<u>On I-275 in Ohio</u>					
Jct I-71 to Loveland Exit	6	(4)	39,120	45 ^f	0.53
Loveland Exit to Jct Ohio 28	7	(4)	30,910	62	0.80
Jct Ohio 28 to Jct Ohio 32	10	(6)	22,750	60 ^g	0.73
Jct Ohio 32 to Jct Ohio 125	6	(3)	13,080	41 ^h	1.53
Jct Ohio 125 to Kentucky Line	11	(7)	5,830	18	0.80
<u>On I-275 in Kentucky</u>					
Ohio Line to I-471	3	(2)	14,350	15	0.89
I-471 to Ky 9	3	(2)	20,426	6	0.25
Ky 9 to Ky 17	5	(3)	25,499	14	0.31
Ky 17 to Dixie Highway	5	(3)	31,552	33	0.59
Dixie Highway to I-75	2	(1)	35,331	22	1.06
<u>On I-75 in Kentucky</u>					
I-275 to US 42	8	(5)	69,681	169	0.83
US 42 to I-71	11	(7)	49,558	107	0.53
I-71 to Crittenden	8	(5)	31,736	33	0.35
Crittenden to Williamstown	19	(12)	28,493 ⁱ	53	0.26
Williamstown to KY 32	29	(18)	21,873	95	0.41
KY 32 to US 460	19	(12)	21,027	37	0.25
US 460 to I-64	13	(8)	36,940 ^j	36	0.21
I-64 to KY 922	5	(3)	39,000 ^j	29	0.42
KY 922 to US 27/28	3	(2)	39,000 ^j	44	0.96
US 27/28 to I-64	3	(2)	39,000 ^j	45	0.98
I-64 to US 60	2	(1)	29,860 ^j	31	1.77
US 60 to KY 418	10	(6)	25,642	16	0.18
KY 418 to KY 627	14	(9)	27,533	50	0.34
KY 627 to KY 876	13	(8)	33,065	32	0.21
KY 876 to Berea	24	(15)	25,428 ⁱ	51	0.23
Berea to Mt. Vernon	23	(14)	20,869 ⁱ	85	0.50
Mt. Vernon to KY 80	35	(22)	19,408	74	0.30
KY 80 to Corbin	19	(12)	22,324	46	0.29
Corbin to Williamsburg	21	(13)	21,428	50	0.31
Williamsburg to Tennessee Line	27	(17)	19,849	32	1.16

TABLE B-3. (Continued)

<u>Route Section</u>	<u>Distance, km (Miles)^a</u>		<u>Traffic Density Vehicle per 24 Hour Day^b</u>	<u>No. of Traffic Accidents in 1980^c</u>	<u>Accident Rate No. per 10⁶ Vehicle km per Day^d</u>
<u>On I-75 in Tennessee</u>					
Kentucky Line to Caryville	43	(27)	15,390	76	0.32
Caryville to Lake City (US 25W)	9	(6)	25,000 ^j	28	0.34
<u>On US 25W in Tennessee</u>					
Lake City to Clinton (Tenn 61)	16	(10)	16,900 ^j	40	0.40
<u>On Tenn 61 in Tennessee</u>					
Clinton to Tenn 95	8	(5)	10,500 ^j	75	2.51
<u>On Tenn 95 in Tennessee</u>					
Tenn 61 to Tenn 58	21	(13)	16,000 ^j	197	1.61
<u>On Tenn 58 in Tennessee</u>					
Tenn 95 to Blair Road	2	(1)	9,700 ^j	2	0.32

Sources as follows:

a Direct Measurement

b,c State of Ohio, 1978; State of Ohio Department of Safety, 1981; Norman, 1981; Ethington, 1981; Brothers, 1981; Edens, 1981

d Calculation from Columns 1, 2, and 3

e 18 of the 40 accidents in this section occurred at intersection of Ohio 159 with US 35 in Chillicothe

f 17 of these occurred at interchange with US 22 and 18 occurred at Loveland Exit

g 14 of these occurred at interchange with Ohio 32

h 27 of these occurred at interchange with Ohio 125

i 1979 data

j Estimate

- US 35 in Chillicothe (1.23 AMVKD), with special concern at the intersection with OH 159;
- US 35 where it is a two-lane road (two segments, 2.94 and 1.84 AMVKD);
- US 35 By-pass around Washington Court House (1.27 AMVKD);
- Sections of the I-275 By-pass around Cincinnati (1.06 and 1.53 AMVKD);
- I-75 as it by-passes Lexington (1.77 AMVKD);
- TN61 (2.51 AMVKD); and
- TN 95 (Oak Ridge Turnpike) through Oak Ridge (1.61 AMVKD).

It should be noted that these segments are also the most congested segments along the proposed route, which reflects in the accident statistics; careful scheduling to avoid peak traffic flow periods in these areas will reduce the likelihood of an accident.

B.2 Routes from Paducah Gaseous Diffusion Plant to ORGDP

Preliminary analysis of the possible routes from the Paducah Gaseous Diffusion Plant to the proposed incinerator site at the Oak Ridge Gaseous Diffusion Plant shows that the major artery is the Interstate Route consisting of I-24 and I-40. The following section describes the proposed route and possible alternative approaches to the ORGDP.

B.2.1 The Proposed Route from Paducah to ORGDP

The proposed route from Paducah (population 29,200) to Oak Ridge (Table B-4) provides a direct link between the two plants, with 473 km (293 mi) of the approximately 506 km (314 mi) distance consisting of interstate highway. The only significant congestion problem occurs in the Nashville area. With this one exception, the route is isolated.

KY 1154, which leads from the Paducah Gaseous Diffusion Plant to US 60, is 5.3 km (3.3 mi) long. It is a wide, three lane, high quality access road which crosses two sets of railroad tracks.

TABLE B-4. DESCRIPTION OF PADUCAH TO OAK RIDGE ROUTE

Route Segment	Kilometers ^a (Miles)	Number of Creeks/Streams Crossed	Number of Rivers and Lakes Crossed	Major Urban Areas ^b		Minor ^c Urban Areas Passed Through
				Passed Through	By Passed	
Plant Exit Rd. (KY 1154) To US 60	5(3)	0	0	0	0	0
US 60 East to I-24	14(9)	3	0	0	0	0
I-24 East to I-65	219(136)	8	8	0	0	0
I-24 and I-65 South to I-40	19(12)	0	0	0	1	0
I-40 East to TN 58	<u>235(146)</u>	<u>6</u>	<u>9</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total	491(305)	17	17	0	1	0

B-15

Source: Direct Measurement

a Distances are rounded to nearest whole number

b Major urban areas are defined for this study as areas which had a population of over 25,000 in 1975. Population data was obtained from: U.S. Department of Commerce, Bureau of the Census, County and City Data Book 1977 (A Statistical Abstract Supplement), U.S. Government Printing Office, Washington, D.C., 1978.

c Minor urban areas are defined for this study as areas which had a population of between 2,500 and 25,000 in 1975

US 60 Eastbound from KY 1154 to Interstate 24 is a two-lane road which is 14.5 km (9 mi) long. It passes through a very small town (Future City) and crosses over two creeks and one set of railroad tracks; there is one narrow bridge. A small ditch/creek also runs alongside the road intermittently. Although US 60 is not an ideal road, it represents the only feasible route.

The distance on Interstate 24 from Paducah to Interstate 65 in the Nashville area is approximately 219 km (136 mi). Standard interstate travel conditions prevail (four lane divided highway) with no noteworthy hazards. This section has bridges over eight rivers and lakes, eight creeks, and four railroad tracks.

In the Nashville area, Interstate 24 joins Interstate 65 Southbound, and has sections of both four lane and six lane divided highway. The approximately 19 km (12 mi) section to Interstate 40 poses significant congestion problems. It has numerous entrances and exits, as well as frequent merging conditions. Although the residential and business areas are set back from the road itself, this route passes through much of Nashville.

Interstate 40 East from Nashville to the TN 58 North Oak Ridge exit is 235 km (146 mi) long. It crosses nine rivers and lakes, six creeks, and also runs alongside water for a total of about 0.8 km (0.5 mi). The final 30 km (19 mi) before the Oak Ridge exit may be hazardous. In particular, around Harriman, there is an approximately 16 km (10 mi) section in which hazardous fog conditions frequently develop. In this same area, there is also a steep drop of approximately 305 meters (1000 feet). These conditions have contributed to numerous serious accidents on I-40 in the past. Despite this problem, I-40 seems to be a better route than any other alternative. However, these potentially dangerous road conditions illustrate the significance of careful scheduling of shipments.

The portion of TN 58 North, between I-40 and Blair Road, is a wide high quality, two lane road, with one brief stretch of four lane highway. In the 10 km (6.4 mi) between I-40 and Blair Road, TN 58 North crosses over Clinch River and it also runs alongside a body of water for about 0.1 km (0.1 mi). In general, it is a good approach to the ORGDP incinerator site because it avoids the central part of Oak Ridge.

Overall, this Paducah to Oak Ridge route is satisfactory for the shipment of the waste materials. However, the congested conditions around Nashville, as well as the sharp descent and fog potential around Harriman, represent two major areas requiring special attention.

B.2.2 Alternative Approaches to ORGDP

The only feasible route from Paducah to Interstate 40 near ORGDP is presented in the preceeding section. However, the final approach to ORGDP from Paducah involves a choice among a set of alternatives (see Table B-5 and Figure B-4). There are three alternative Oak Ridge exits off Interstate 40. Based on the evaluation, Alternative 1 (the TN 58 North exit) is the better route. Of the three alternatives, TN 58 North (Alternative 1) is the westernmost exit and results in the lowest total distance. Alternative 2 is eliminated as a useful route because of the distance factor.

The critical factor which distinguishes Alternative 1 from Alternative 3 (TN 95 North) is the quality of the two roads. TN 58 North is a relatively straight, wide, two lane road. However, TN 95 North is a hilly and curvy road which crosses over two bridges. Furthermore, the 95 North route would require that the truck make a left turn at the hazardous intersection of 58 and 95. The TN 58 North exit at Oak Ridge is considered to be the best approach to ORGDP from Paducah.

B.2.3 Hazardous Sections of the Proposed Route from Paducah

As described in Section B.1.4, accident data have been used to assess the hazardous sections of the proposed routes in terms of the likelihood of accidents. Table B-6 presents this analysis for the Paducah to ORGDP route. From the table, it may be seen that the most dangerous sections of this route are those in the Nashville area, where six of the eight segments have more than one accident per million vehicle-kilometers per day. These segments are the most congested on the route and careful scheduling could significantly reduce the hazard involved. In addition, the Civil Defense organization in the Nashville area has offered to escort shipments and to assist in scheduling; acceptance of this offer could further reduce the potential hazard associated with this portion of the proposed route.

TABLE B-5. DESCRIPTION OF ALTERNATIVE APPROACHES TO THE ORGDP FROM INTERSTATE 40 AT TN 58

Alternative	Route Segment	Kilometers ^a (Miles)	Number of Creeks/Streams Crossed	Number of Rivers and Lakes Crossed	Major Urban Areas ^b		Minor ^c Urban Areas Passed Through
					Passed Through	By Passed	
(1)	TN 58 North - Blair Rd.	10(6)	0	1	0	0	0
	Blair Rd. - ORGDP entrance	3(2)	0	0	0	0	0
	Total	13(8)	0	1	0	0	0
(2)	I-40 (TN 58) East - TN 162 exit	30(19)	5	0	0	0	0
	TN 162 North - TN 62	10(6)	1	0	0	0	0
	TN 62 North - Bethel Valley Rd.	3(2)	0	1	1	0	0
	Bethel Valley Rd. - TN 95	13(8)	0	0	0	0	0
	TN 95 North - TN 58	5(3)	0	0	0	0	0
	TN 58 South - Blair Rd.	2(1)	0	0	0	0	0
	Blair Rd. - ORGDP entrance	3(2)	0	0	0	0	0
	Total	66(41)	6	1	1	0	0
(3)	I-40 (TN 58) East - TN 95 TN 61 exit	18(11)	4	0	0	0	0
	TN 95 North - TN 58	16(10)	1	2	0	0	0
	TN 58 South - Blair Rd.	2(1)	0	0	0	0	0
	Blair Rd. - ORGDP entrance	3(2)	0	0	0	0	0
	Total	39(42)	5	2	0	0	0

Source: Direct Measurement

a Distances are rounded to nearest whole number.

b Major urban areas are defined for this study as areas which had a population of over 25,000 in 1975. Population data was obtained from: U.S. Department of Commerce, Bureau of the Census, County and City Data Book 1977 (A Statistical Abstract Supplement), U.S. Government Printing Office, Washington, D.C., 1978.

c Minor urban areas are defined for this study as areas which had a population of between 2,500 and 25,000 in 1975.

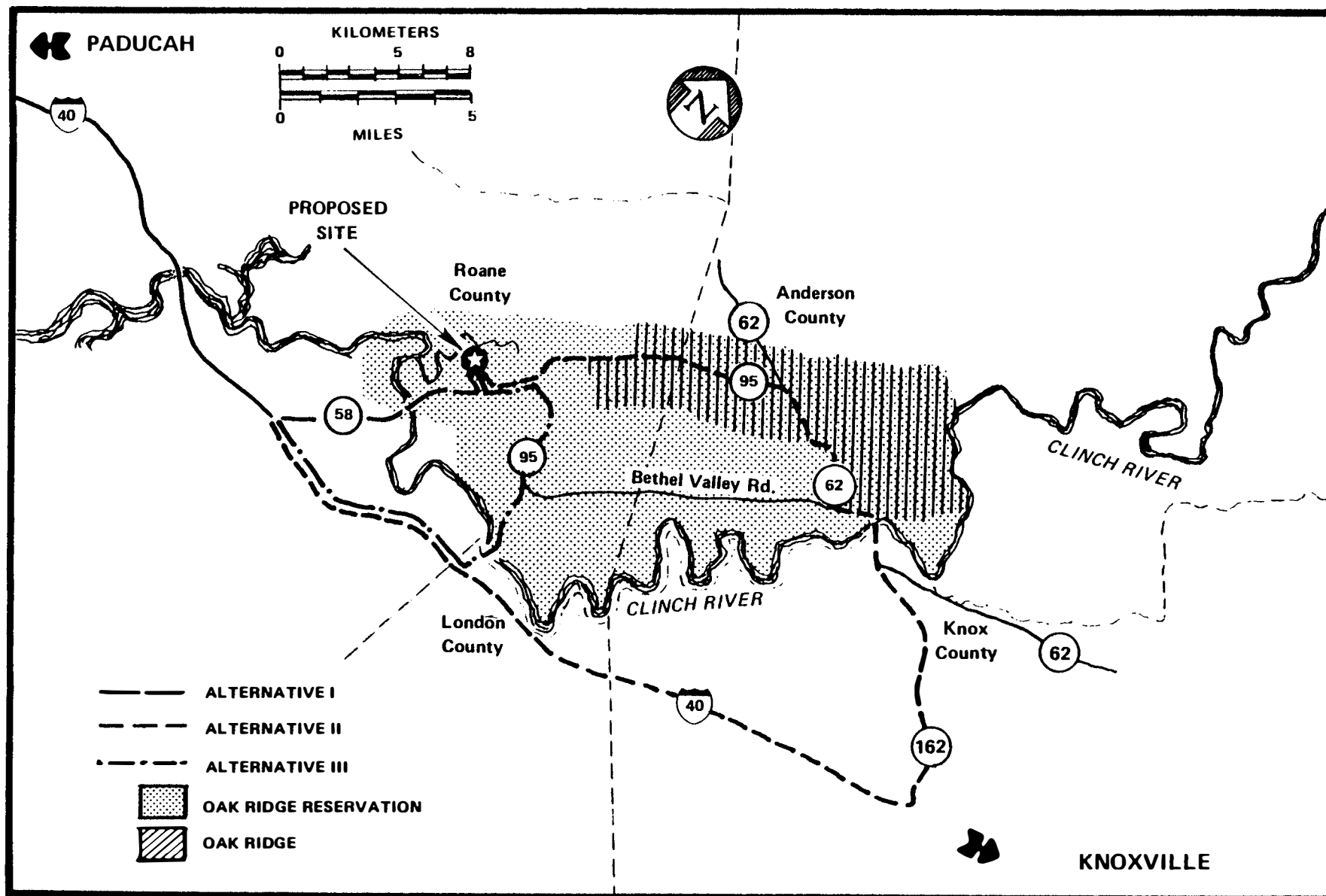


FIGURE B-4. ALTERNATIVE ROUTES: INTERSTATE 40 TO ORGDP

TABLE B-6 SUMMARY OF TRAFFIC AND ACCIDENTS ON THE PROPOSED
ROUTE FROM PADUCAH TO ORGDP

Route Section	Distance km (Miles) ^a	Traffic Density Vehicle per 24 Hour Day ^b	No. of Traffic Accidents in 1980 ^c	Accident Rate No. per 10 ⁶ Vehicle km per Day ^d
<u>On KY 1154 in Kentucky</u>				
Plant Gate to US 60	5 (3)	e	3	--
<u>On US 60 in Kentucky</u>				
KY 1154 to I-24	15 (9)	11,352 ^f	39	0.65
<u>On I-24 in Kentucky</u>				
US 60 to US 45	3 (2)	6,812	5	0.62
US 45 to US 68	16 (10)	4,390 ^{f,g}	17	0.66
US 68 to US 62 near Gilbertsville	16 (10)	5,220 ^{f,g}	11	0.36
US 62 near Gilbertsville to US 62 near Kuttawa	23 (14)	5,220 ^{f,g}	11	0.26
US 62 near Kuttawa to KY 139	26 (16)	5,220 ^{f,g}	8	0.16
KY 139 to US 68	16 (10)	3,949	7	0.30
US 68 to US 41A	35 (22)	4,310	10	0.18
US 41A to Tennessee Line	10 (6)	10,642	4	0.11
<u>On I-24 in Tennessee</u>				
Kentucky Line to US 79	7 (4)	8,000 ^g	7	0.34
US 79 to Tenn 49	33 (20)	14,400 ^g	35	0.20
Tenn 49 to US 431	17 (11)	17,300 ^g	28	0.26
US 431 to Exit No. 40	9 (6)	18,900 ^g	12	0.19
Exit No. 40 to I-65	7 (4)	20,000 ^g	31	0.61
<u>On I-65 in Tennessee</u>				
I-24 to Exit No 87	3 (2)	100,000 ^g	93	1.02
Exit No. 87 to I-265	2 (1)	100,000 ^g	73	0.96
I-265 to Main St. Exit	2 (1)	100,000 ^g	74	1.10
Main St. to Shelby Ave. Exit	1 (1)	100,000 ^g	53	1.29
Shelby Ave. Exit to I-40	1 (1)	100,000 ^g	39	0.80

TABLE B-6. (Continued)

Route Section	Distance km (Miles) ^a	Traffic Density Vehicle per 24 Hour Day ^b	No. of Traffic Accidents in 1980 ^c	Accident Rate No. per 10 ⁶ Vehicle km per Day ^d
<u>On I-40 in Tennessee</u>				
I-65 to I-24	3 (2)	100,000g	176	1.42
I-24 to Exit No. 215	3 (2)	20,000g	56	2.46
Exit No. 215 to Exit No. 216	3 (2)	20,000g	46	2.22
Exit No. 216 to Exit No. 226	15 (9)	20,000g	76	0.70
Exit No. 226 to US 231	19 (12)	20,000g	24	0.17
US 231 to US 70	3 (2)	20,000g	3	0.15
US 70 to Exit No. 258	31 (19)	20,000g	48	0.21
Exit No. 258 to Exit No. 273	24 (15)	20,000g	33	0.19
Exit No. 273 to Tenn. 111	26 (16)	20,000g	48	0.26
Tenn. 111 to Exit No. 290	3 (2)	20,000g	8	0.42
Exit No. 290 to Exit No. 301	18 (11)	20,000g	18	0.13
Exit No. 301 to US 127	26 (16)	20,000g	30	0.16
US 127 to Crab Orchard	19 (12)	20,000g	34	0.25
Crab Orchard to Exit No. 338	15 (9)	20,000g	35	0.32
Exit No. 338 to Exit No. 347	15 (9)	20,000g	21	0.19
Exit No. 347 to Tenn. 58	15 (9)	20,000g	37	0.33
<u>On Tenn. 58 in Tennessee</u>				
I-40 to Blair Road	10 (6)	8,500g	10	0.32

Sources as follows:

- a Direct Measurement
 b,c Norman, 1981; Brothers, 1981; Ethington, 1981; Edens, 1981
 d Calculations derived from columns 1, 2, and 3
 e No data
 f 1979 Data
 g Estimate

B.3 Routes from ORNL and Y-12 to ORGDP

There exists only one feasible route for the transport of wastes from each of the Oak Ridge area plants to the proposed incinerator site. These are presented below (See Figure B-5).

B.3.1 ORNL to ORGDP

The approximately 11 km (7 mi) trip between ORNL and ORGDP is on four roads, two of which are public and two of which are private. Bethel Valley Road from the ORNL plant towards TN 95 is a good two lane road. About 1.6 km (1 mi) from ORNL, Bethel Valley Road intersects TN 95. From this intersection north on TN 95 to the junction with TN 58 is 5.2 (3.2 mi). TN 95 is a curvy, hilly two lane road which crosses over two ridges during this stretch. Although it is not an ideal road, it is the best available option. The intersection of TN 58 and TN 95 has been the site of numerous truck accidents in the past. (This intersection will be improved sometime in the future, according to the DOE Oak Ridge traffic department.) From the intersection of TN 58 and TN 95, this route follows southbound on TN 58 to Blair Road, and then on Blair Road to the ORGDP entrance road. The brevity of this route and the fact that the infrequent shipments can be selectively scheduled should facilitate safe trips between ORNL and ORGDP.

B.3.2 Y-12 Plant to ORGDP

It is approximately 10 km (6 mi) from the Y-12 Plant west on Bear Creek Road to TN 95. In the immediate vicinity of the Y-12 Plant entrance road, Bear Creek Road has four lanes. However, it becomes a two lane improved road shortly thereafter. This route then follows northbound on TN 95 for about 2.4 km (1.5 mi); during this stretch TN 95 crosses over one ridge. It then intersects with TN 58, which leads to Blair Road and the ORGDP entrance road.

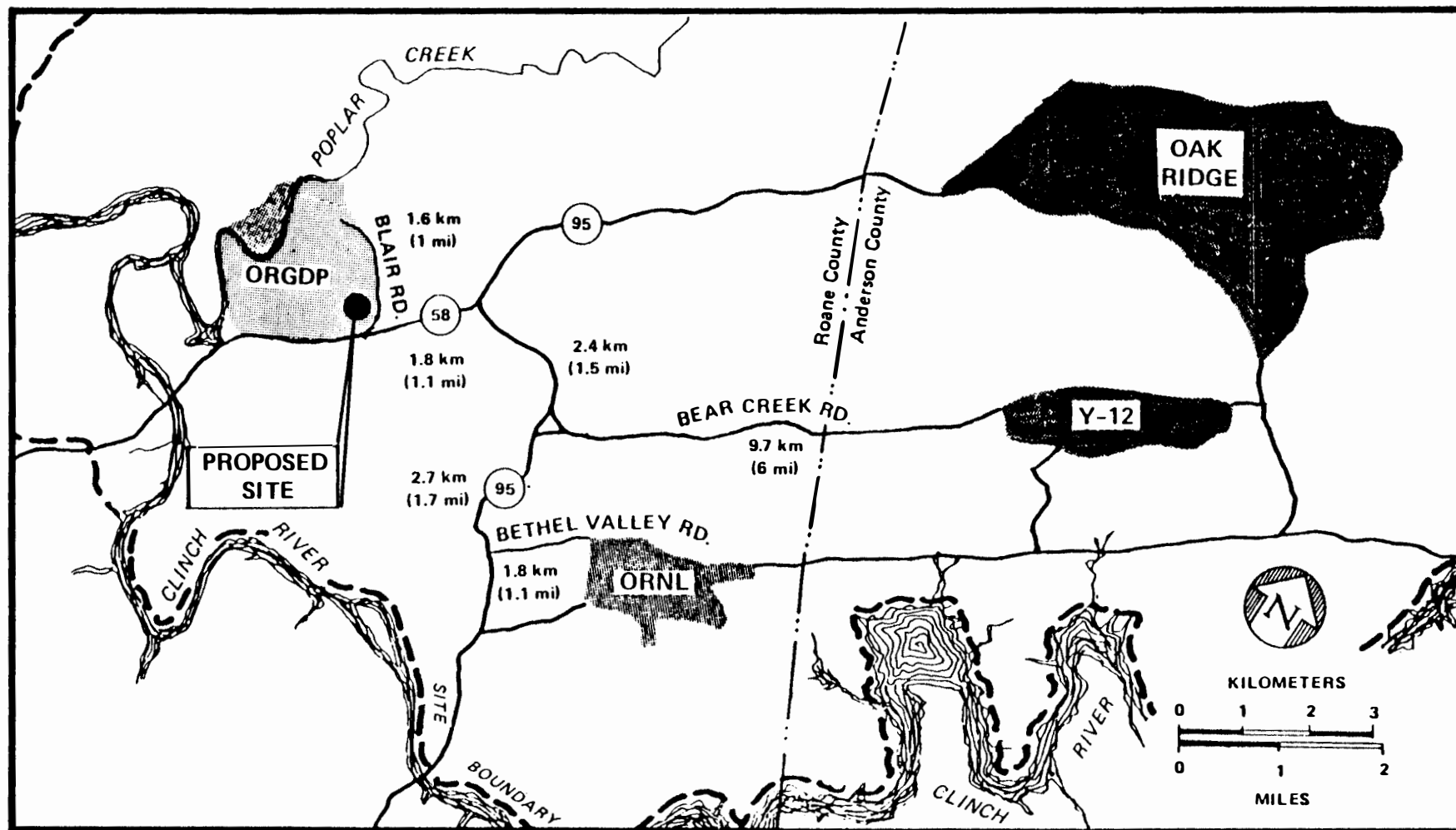


FIGURE B-5. PROPOSED ROUTES: Y-12 PLANT AND ORNL TO PROPOSED SITE

B.4 References

Brothers, B., Office of Research and Planning, State of Tennessee, Department of Transportation. Letter to R. Burian (Battelle), May 8, 1981

Edens, Paul, Director, Office of Research and Planning, State of Tennessee, Department of Transportation. (Letter dated June 4, 1981).

Ethington, G. C., Acting Director, Division of Traffic, Commonwealth of Kentucky Department of Transportation. (Letter dated June 9, 1981).

Norman, P. Van, Division of Traffic, Commonwealth of Kentucky, Department of Transportation. Letter to R. Burian (Battelle), May 6, 1981.

State of Ohio Department of Highway Safety, Traffic Accident List for 1980.

State of Ohio, Department of Transportation, Traffic Survey Report of the State Highway System in Western Half of the States including Districts 1, 2, 6, 7, 8, and 9, 1978.

APPENDIX C

CHEMICAL DESTRUCTION ALTERNATIVES

THIS PAGE IS INTENTIONALLY BLANK

APPENDIX C

CHEMICAL DESTRUCTION ALTERNATIVES

This appendix reviews the methods of chemical destruction which have been proposed for PCB contaminated materials. The review presents, for each of three methods, a description of the process, an analysis of its technical capability to destroy the waste materials inventory of concern, and an assessment of the likely impacts on the environment should the alternative be implemented. In general, these methods do not represent technically feasible alternatives to the proposed action.

It must be noted that the analysis presented in this appendix is based upon limited information on the processes. Detailed information is not available due to the proprietary nature of the processes, and the available literature does not address all of the features of the process necessary for evaluation. Where reasonable assumptions would permit a more complete analysis, these have been made. It is believed that the processes have been fairly presented and that the technical problems and environmental impacts described herein are reasonable estimates or approximations to those which would be encountered if they were implemented for the purpose of disposal of the waste materials described in Chapter 2.

C.1 Technical Issues

There are a variety of chemical processes that are available to treat different types of waste, however there are very few chemical processes presently identified as being capable of disposing of PCBs. It is uncertain if any chemical process can be used to degrade PCBs in the presence of other chlorinated substances, such as carbon tetrachloride, which exist in the waste material inventory. In addition, the waste materials which require disposal include solids and sludges, such as contaminated soil, and a significant volume of water; none of the available methods has yet demonstrated the capability to degrade PCBs in solids or in the presence of significant amounts of water. Finally, there is a concern that the method of disposal not result in

dispersal of the uranium content of the waste material in the environment or in a substantial increase in the volume of uranium contaminated material requiring extended management and disposal. The process for PCB and other waste disposal will be required to be commercially available in 1985 in order for a facility to be constructed at ORGDP by 1987, the expected operational date of the proposed incinerator. On this basis, development, permitting, construction, and testing prior to commercial development must be performed in three years. To meet this scheduling, the PCB disposal process should have three attributes. These are:

- The process is developed now to a pilot scale.
- The process will dispose of the wastes currently identified, which cannot be disposed of by commercial facilities.
- The process operation and effluents will be environmentally acceptable.

Only three chemical processes are known to have the potential for meeting the general requirements for the proposed disposal operation. These processes are:

- PCBX process; developed by SunOhio
- Sodium naphthalide process; developed by Goodyear
- Wet air oxidation; similar to the process developed by Zimpro.

C.2 The PCBX Process

The PCBX process has been developed by SunOhio, a partnership formed by subsidiaries of the Ohio Transformer Corporation and Sun Company. The process was developed to remove PCBs from transformer oil so that the oil can be reused, following addition of a new dielectric material to replace the PCB. SunOhio is seeking EPA permits to operate a truck mounted unit and has received a permit for limited applications. SunOhio divulges little information about this process and the potential effluents from it.

C.2.1 PCBX Process Description

The PCBX process (see Figure C-1) has several steps identified as: chemical reactions, filtration, dehydration and degassing stages. The PCB contaminated oil from the transformer is heated to 180 F, reacted with chemicals (1)^a and pumped through a bed of Fuller's Earth (2) which removes unidentified harmful contaminants and clarifies the color. The oil is processed through vacuum chambers (3) where moisture and unidentified gases are removed. The cleaned, dry oil is then returned to the transformer (4).

No information on the reactants and quantities utilized for the chemical reactions is available. However, SunOhio claims that the chemicals to strip the chlorine from PCB are not exotic, but commercially available and reasonably priced (Chemical Engineering, 1980). PCBX is a continuous process, operating at a rate of 57 liters (15 gallons) of fluid per minute. It operates at very low temperatures and pressures (Chemical Week, 1980).

C.2.2 PCBX Technical Performance

The PCBX process has reduced PCB levels in transformer oil from 1,000 ppm to 1 ppm and from 1,000-10,000 ppm to 50 ppm in a single treatment. In a test for the EPA, the process reduced the PCB level in oil from 255 ppm to 1 ppm. At a rate of 150 milliliters per minute, it reduced pure PCB solutions to solutions containing 7 ppm PCBs (Sorenson, 1981). There has been no demonstration of its effectiveness on materials containing water, solids, or other chlorinated materials.

C.2.3 Technical Barriers

The technical barriers to the PCBX process are hard to determine and analyze due to the lack of information on the process. However, several statements can be made on its applicability to the waste inventory.

^a The parenthetical numbers in text are keyed to the numbers displayed in Figure C-1 which shows the PCBX process.

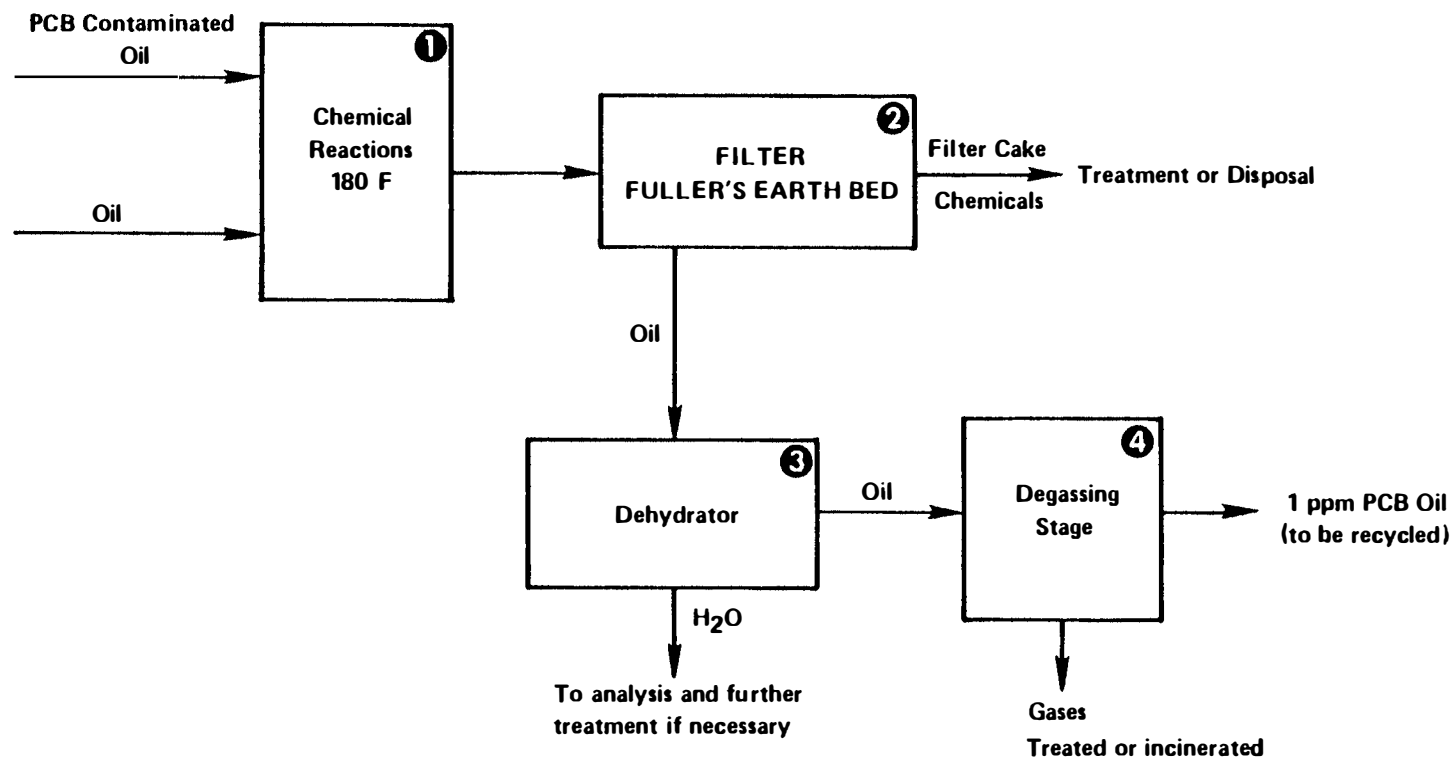


FIGURE C-1. PCBX PROCESS

- The PCBX process was designed to destroy PCB without the destruction of mineral oils which contain it. DOE has the need to dispose of other organic materials in addition to PCBs. These will need further treatment by either another chemical process or by incineration.
- No information is available on the applicability of the PCBX process to either solid or aqueous waste. The impact of radioactive waste on the process has not been determined.
- Since the reactants are not mentioned, the handling requirements for the reactants and products (and associated costs) cannot be determined.
- The filter refuse would require disposal. However, the disposal method required cannot be determined without the knowledge of the filter cake composition.
- SunOhio claims that this process is environmentally safer than incineration because it is a totally enclosed liquid system at low temperatures and pressures (Chemical Engineering, 1980). This claim cannot be disputed, and if valid, is a chief advantage of the process for those materials for which it is effective.
- SunOhio also claims that this process uses a simple technique, but "it must be precise" (Chemical Week, 1980). Therefore, specific conditions must be met to prevent process malfunction; the process can yield a low conversion, resulting in high PCB concentrations in the wastes from the process.

C.2.4 Probable Impacts from the PCBX Process

Because so little information on the process is available, it is difficult to assess the probable impacts should the PCBX process be implemented on a waste material inventory similar to that described in Chapter 2. However, several general statements can be made regarding the process and its impacts:

- Because the PCBX process has not been demonstrated for waste materials other than pure PCBs and PCBs in oil, it must be assumed that it is not effective for these and some additional disposal process would be required, with associated environmental impacts.
- The PCBX process results in a filter cake of unidentified composition and in some air emissions of unidentified gases. These represent potential adverse impacts on the environment, including risks to occupational and public health.

- The rate at which the process operates is sufficiently slow that several units would be required to treat the wastes which are generated at the Oak Ridge Operations plants.
- The fate of the uranium contamination in any waste material fed to the PCBX unit is unknown.
- The specific reagents are unknown. Potential occupational and public health and safety risks cannot be evaluated. These would involve system recharge events and potential accident events due to chemical reactions beyond control.

C.3 The Sodium Naphthalide Process

The sodium naphthalide process was developed by Goodyear for the destruction of PCB-contaminated waste oils. The process dechlorinates the PCBs which allows the separation of the oil or transformer fluid from the remaining materials.

C.3.1 Process Description

The sodium naphthalide process operates on a batch basis (see Figure C-2)^a. The sodium naphthalide is prepared prior to the dechlorination step in a batch operation (1) by adding sodium metal to a dispersing oil at approximately 25 C in an autoclave. The oil may or may not be contaminated with PCBs. The mixture is heated by steam to 150-170 C for 5 to 10 minutes and then cooled by water to ambient temperature. After cooling to 25 C, naphthalene and THF are added to the mixture in a mixing tank (2) and stirred for 1 to 4 hours at room temperature to complete the preparation of the reagent. A nitrogen purge is used to transport the reagent and to control the rate of reaction (Goodyear Tire and Rubber, 1980).

After its preparation, the reagent is added to the PCB-contaminated waste in a large batch reaction tank (3) at temperatures that can vary from 0 to 50 C and in proportions up to 50 to 100 moles of reagent per mole of PCBs.

^a The parenthetical numbers in text are keyed to the numbers displayed in Figure C-2 which shows the Goodyear process.

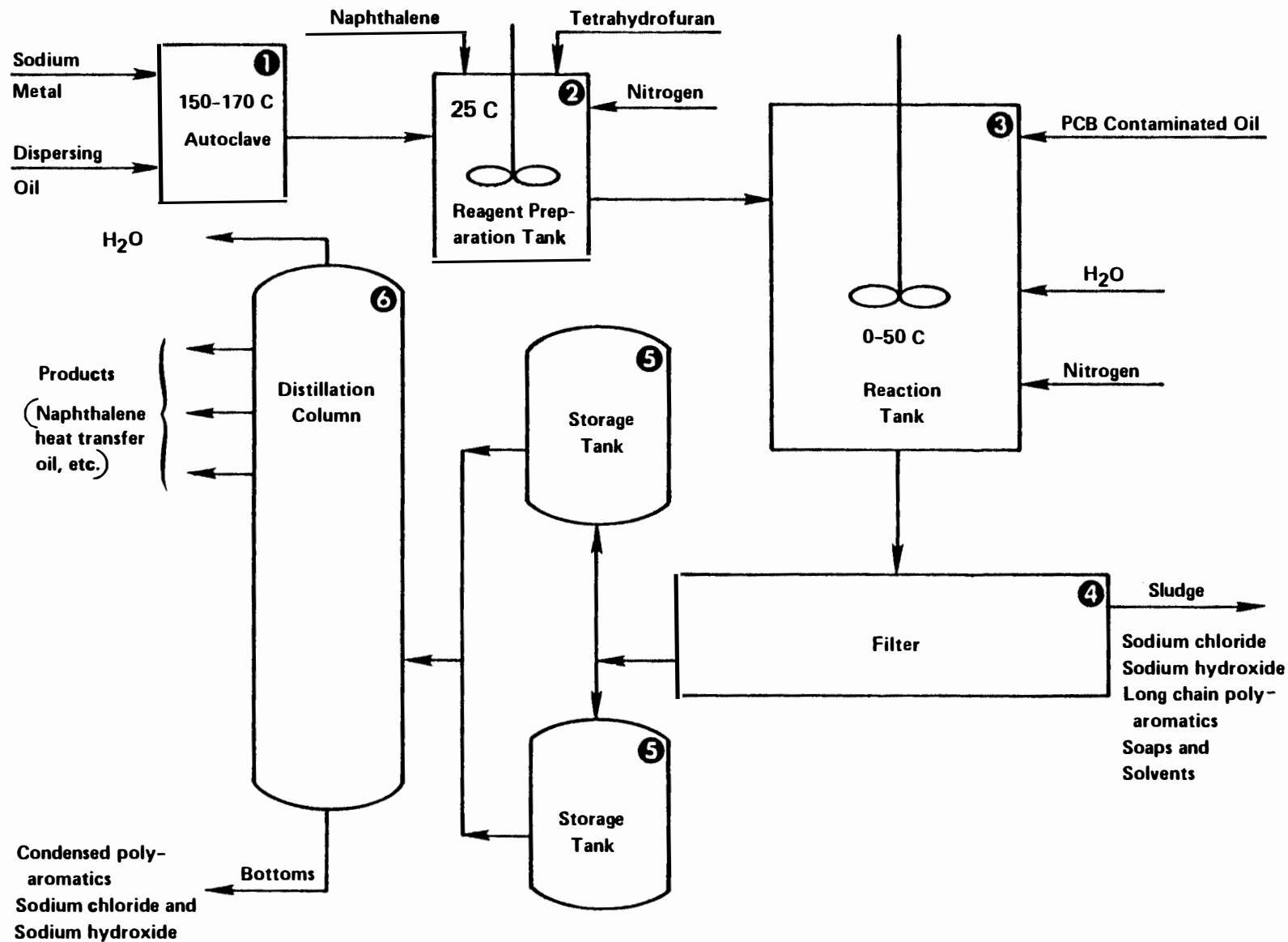


FIGURE C-2. SODIUM NAPHTHALIDE: GOODYEAR PROCESS

The resulting mixture is stirred for a period of time at room temperature, quenched with stoichiometric amounts of water, and, after four hours of mixing, is pumped through a filter (4) into the storage tanks (5). The tanks have an inert nitrogen atmosphere to aid in keeping the mixture stable. The filter removes a sludge containing long chain aromatics, and sodium compounds.

The stored mixture is pumped to a distillation column (6) where several products are recovered, namely: THF, naphthalene, and oil or heat transfer fluid free of PCBs. The bottom residue contains condensed polyaromatics, sodium chloride, and sodium hydroxide.

C.3.2 Technical Performance and Barriers

This process has been demonstrated to reduce PCB levels in oils from 18,000 ppm to 7 ppm and from 37 to 39 percent PCB to 600 ppm on a laboratory scale. A pilot plant has been operated to reduce PCBs from 750 ppm to 1 ppm. There are several concerns about the applicability of this process to the PCB waste inventory proposed for destruction by the incinerator. They include:

- The process was designed for the dechlorination of liquid waste containing chlorinated organic compounds including PCBs. It is not known to be functional for the destruction of other organic liquid materials.
- The process cannot handle solid waste. Goodyear researchers have indicated that solids could potentially be treated if the PCBs are extracted first. They have also indicated that, with modifications, the process could handle PCB-contaminated solids. Neither modification for solids handling nor extraction of PCB from solid waste is proven technology. No studies have been completed on dechlorination of solids or sludges to date.
- The process depends on an active reagent - sodium naphthalide. Aqueous feed streams would deactivate the reagent, yielding a higher content of PCB in the final products or requiring a larger amount of reagent for equivalent PCB removal. Water, alcohols, and similar compounds will react with the reagent at room temperature to form hydrogen. This reaction is very exothermic (Kirk-Othmer, 1963a, 1963b), liberating sufficient energy to reach the autoignition temperature of sodium (120 C). If air or oxygen is present, the sodium will burn and ignite the hydrogen evolved from the reaction. Therefore, this reaction represents a potential fire and explosion hazard requiring special attention.

Goodyear uses nitrogen blankets and purges to provide an inert atmosphere. The equipment and facilities need to be designed considering the potential fire and explosion hazards.

- Goodyear indicates that large quantities of PCBs would generate large quantities of energy due to the exothermic reaction. Control of run-away temperature rise in the reaction would require cooling facilities to dispose of the excess energy. The temperatures are not considered high enough to make energy recovery attractive, however.
- The process as designed requires up to 50 moles of reagent per mole of chlorine to obtain the desired PCB removal efficiency. The reagent requires large quantities of sodium metal for its preparation. The reaction produces sodium chloride and sodium hydroxide after the reaction is quenched. Recovery of the metal out of the reactor effluent stream may be difficult or uneconomical. In addition, the metal is extremely difficult and dangerous to handle; the handling difficulties are directly proportional to the quantity used.
- Goodyear estimated a raw material cost of 1-2 cents (Electrical Week, 1981) per pound of PCB processed. However, this cost depends on the price of specialty chemicals (sodium, THF, naphthalene) which change constantly. A rough estimate of raw material costs assuming that the solvents are reused, and based on equivalent amounts of sodium metal, lies in the cost range from \$0.25 to \$8.16 per pound of PCB containing 42 percent chlorine^a. This cost will change depending on chemical prices, the amount of chlorine in the PCBs, and the presence of other chlorinated or aqueous materials, and the amount of sodium metal required to take the reaction to completion. Capital costs of the process facilities have not yet been released by Goodyear.
- The economics of the system depend on solvent recovery. The solvents (THF and naphthalene) are recovered in a distillation column, a process which is both capital cost and energy intensive.
- The composition of the waste product streams has not yet been determined. Reaction mechanisms are also unknown. Because of the high reactivity of the chemicals used to dechlorinate PCBs, there is a potential for the reaction to yield different products depending on the temperature and reactants present.
- The waste products are likely to be hazardous materials. Provisions for protection of human safety need to be made in case of accidental spillage or process upset that may cause human contact in the operating plant or during final disposal.

^a April, 1981 prices.

C.3.3 Probable Impacts

Although more is known about the sodium naphthalide process than the PCBX process, the reactions, the composition of intermediate process streams, and the characteristics of emissions and effluents are unknown at present. However, several general statements can be made regarding the probable environmental impacts associated with the use of the sodium naphthalide process on a waste materials inventory such as that described in Chapter 2.

- The process uses several highly reactive and potentially hazardous substances (tetrahydrofuran, naphthalene, metallic sodium). The handling of these materials presents a potential occupational risk as well as a risk to the environment and to public health.
- The process itself is a series of complex and potentially difficult to control chemical reactions which increases the risk of accident release of the materials involved.
- The process results in a variety of toxic, hazardous, and environmentally undesirable emissions and effluents requiring subsequent treatment. These include long chain, aromatic, and polyaromatic hydrocarbons, solvents, sodium chloride, and sodium hydroxide. Per volume of PCB destroyed, a larger amount of dissolved solids (salts) and hydrocarbon effluents is likely, compared to that which would be produced by the proposed incinerator.
- The process requires a significant amount of energy and generates a large amount of waste heat.
- The process would probably result in a significant increase in the volume of radioactively contaminated materials, given the waste inventory characteristics. This would likely result in increased release of radioactivity to the environment.
- Another disposal method would be required for the solid waste materials in the inventory, with associated environmental impacts.

C.4 Wet Air Oxidation

Wet air oxidation processes have been developed for the purpose of destroying organic wastes through oxidation at moderate temperatures. Although there are a variety of wet air oxidation processes, most share the characteristics described in this section.

C.4.1 Process Description

Wet air oxidation processes oxidize organic matter in a water-organic emulsion at elevated temperatures and pressure with compressed air (see Figure C-3). The aqueous waste is mixed by sparging compressed air into the material, which is preheated (1), and fed into the reactor by a high-pressure pump. If additional heat is required, steam is injected into the reactor. The oxidation reaction (2) is exothermic and will further raise the temperature of the mixture to design conditions. These conditions vary from 350 psig at 175 C to 3000 psig at 320 C. The degree of oxidation depends on the temperature and the residence time. After the oxidation is finished, the mixture from the reactor passes through a heat exchanger (1) which preheats the incoming reactants. The mixture then is discharged into a separator (3). Here, spent air, carbon dioxide, and steam are disengaged from the mixture which then is discharged and sent for disposal.

C.4.2 Technical Performance and Barriers

The wet air oxidation process has been used to destroy organic chemicals including some chlorinated aromatic compounds on a commercial scale. However, this process has not been demonstrated to destroy or dechlorinate PCBs.

There are several potential problems associated with applying this process to the waste material inventory:

- The principal barrier is the presumed inability of the process to oxidize PCBs. This process does not meet DOE needs unless used in conjunction with the sodium naphthalide, the PCBX, or an incineration process.
- The waste inventory contains solid materials and radioactive materials. Applicability of this process to these types of waste is unknown; pumping of solids at high pressure is difficult and requires frequent maintenance.
- The process flow rate is unknown. Several reactors could be required to dispose of the waste inventory of the Oak Ridge Operations facilities.

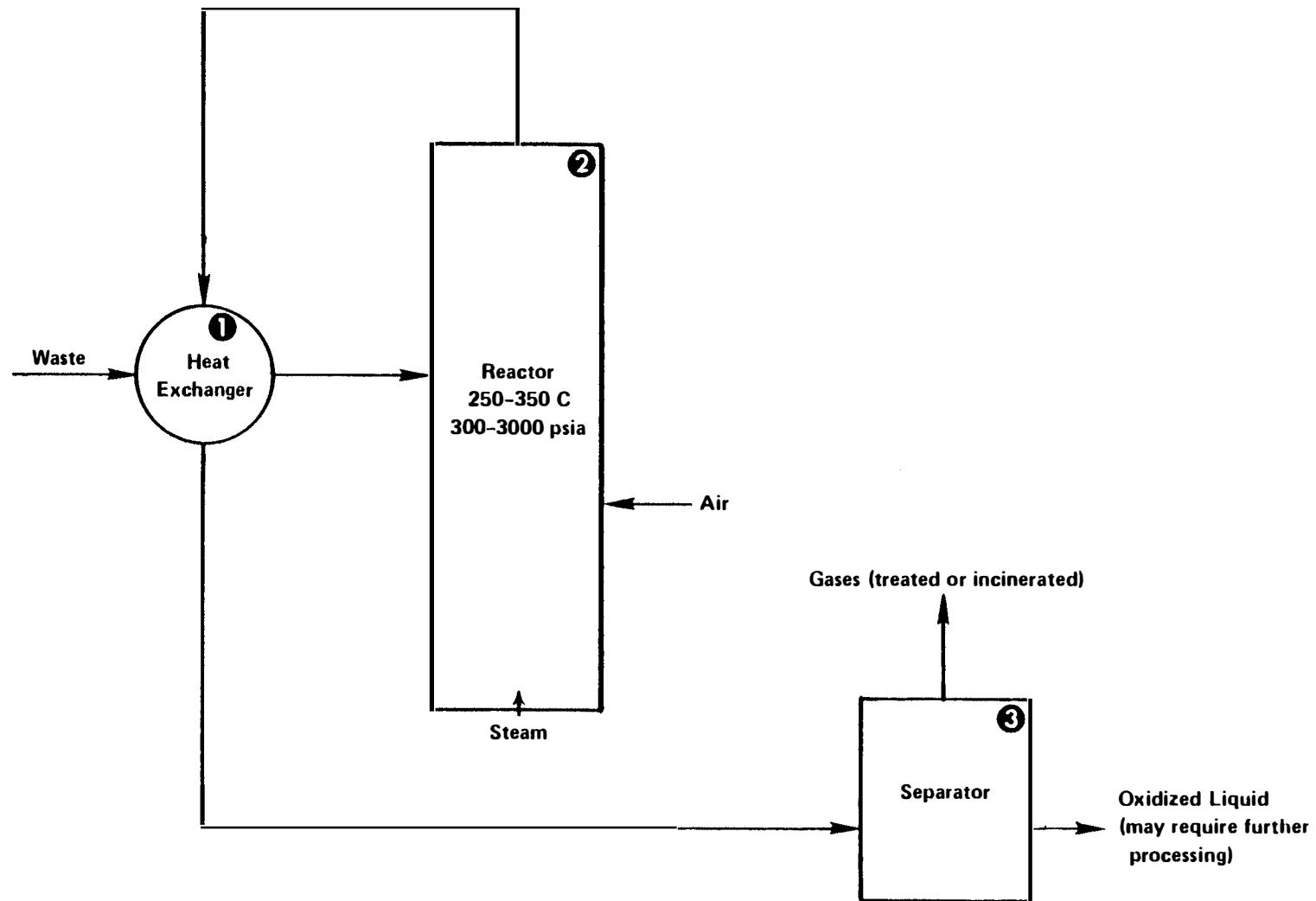


FIGURE C-3. WET AIR OXIDATION PROCESS

- The process will readily oxidize high molecular weight compounds to biodegradable low molecular weight intermediates such as acetic acid, methanol, and formaldehyde. Smaller toxic radicals are completely oxidized to carbon dioxide. Sulfur compounds convert to sulfates and nitrogen compounds to ammonium carbonate, sulfate, or nitrates. These effluents will require either biological or physical/chemical treatment before final disposal or may be recovered.
- The gaseous emissions may require scrubbing or incineration treatment for volatile hydrocarbons, nitrides, and cyanides.
- Process costs are not identified, but high capital cost is expected because the process requires prior and/or post-treatment for PCB, aqueous effluents, and gases, and must be chloride resistant at high temperatures.

C.4.3 Probable Environmental Impacts

The major effluents of the system would be PCBs (if not treated prior to the process), low molecular weight organics and potential toxic gases. All these effluents will require further treatment before final disposal. The disposal method will depend on which process is utilized to finally decompose the materials.

Since the wet air oxidation method will not destroy PCBs, a secondary or final disposal method would be required to completely process all the wastes. The impacts of the combined processes can only be estimated at this point, but because at least two processes must be used, the environmental impacts could be greater than for a single stage process. If for example, the final processing were achieved by incineration, the impacts already assessed for the proposed incinerator would have to be added to the impacts created by the inclusion of the wet air oxidation process. Therefore, the possible impact on the environment could be significant for this process.

C.5 Summary

None of the chemical destruction methods has been demonstrated for the disposal of the entire waste inventory described in Chapter 2. Thus, while each is effective for some portion of the waste inventory, each would

require an additional method, such as an incinerator, for the disposal of the remaining wastes. In addition, each produces effluents and emissions which contain (or may contain) organic chemicals requiring further treatment or incineration.

Each of the chemical destruction methods would impose environmental impacts in addition to those associated with the auxiliary treatment of remaining waste materials. These include:

- Occupational health and safety risks due to accident, exposure to reagents, and exposure to hazardous or toxic effluents and emissions;
- Public health risks due to exposure to reagents and hazardous or toxic effluents and emissions;
- Increases in volume of waste materials contaminated with uranium, with increased waste management and disposal;
- Increases in waterborne effluents, particularly dissolved solids and possibly hydrocarbons (especially true of the sodium naphthalide process);
- Increases in air emissions, primarily emissions of volatile organic compounds.

In addition, one or more of the processes would require:

- Large quantities of expensive and hazardous reagents;
- Significant energy resources; and/or
- Significant cooling, through the use of cooling water.

Finally, since each of these alternatives operates at low or unknown rates each could require more than one unit to dispose of the waste material to which it is applicable.

In summary, none of the chemical destruction alternatives can dispose of the entire waste materials inventory now at the DOE Oak Ridge Operations plants. In addition, none is clearly environmentally preferable to the proposed incinerator for those wastes to which it is applicable.

C.6 References

Chemical Engineering. Another Route to Detoxify PCB-Contaminated Fluids Has Been Announced, September 22, 1980, p. 35.

Chemical Week. SunOhio Zeros in on PCB Disposal, September 17, 1980, p. 56.

Electrical Week. EPA to Require Inspections for PCB Looks; OK of Destruction Process Near, January 22, 1981.

Goodyear Tire and Rubber Company. A Safe Efficient Chemical Disposal Method for Polychlorinated Biphenyls - "PCBs". September 12, 1980.

Kirk-Othmer. Hydrogen Reactions. Encyclopedia of Chemical Technology (2nd ed.). John-Wiley Sons, New York, 1963a, 11, p. 343.

Kirk-Othmer. Sodium. Encyclopedia of Chemical Technology (2nd ed.) John-Wiley Sons, New York, 1963b, 18, p. 432.

Sorenson, C. SunOhio. Letter to H. Hetrick (Battelle), April 17, 1981.

C-16

THIS PAGE IS INTENTIONALLY BLANK

APPENDIX D

TABLES OF BACKGROUND CHEMICAL AND
RADIOLOGICAL DATA ON THE ORGDP AREA

THIS PAGE IS INTENTIONALLY BLANK

TABLE D-1. ORGDP PERIMETER AND REMOTE SITE RADIONUCLIDE CONTENT
IN SOIL AS COMPARED TO NATURALLY OCCURRING LEVELS
(pCi/g dry weight)

Nuclide	1978 ^a		1979 ^b		1980 ^c		Naturally ^d Occurring
	Perimeter	Remote	Perimeter	Remote	Perimeter	Remote	
⁹⁰ SR	0.45	0.40	0.25	0.29		0.40	
¹³⁷ Cs	2.50	2.00	1.9	1.7	1.85	1.7	
²²⁶ Ra	0.80	1.20	1.05	1.3	--	--	0.81
²³⁴ U	0.46	0.50	0.4	0.52	0.45	0.46	0.7
²³⁵ U	0.02	0.03	0.25	0.02	0.02	0.02	
²³⁸ U	0.33	0.43	0.29	0.43	0.32	0.38	0.65
²³⁸ Pu	0.002	0.0017	0.001	0.001	0.002	0.001	
²³⁹ Pu	0.04	0.03	0.025	0.03	0.02	0.02	

Sources as follows:

- a Y/UB-10
- b Y/UB-13
- c Y/UB-15
- d Bowen, 1979

TABLE D-2. ELEMENTAL CONTENT OF SEDIMENTS IN POPLAR CREEK
AND THE CLINCH RIVER IN THE VICINITY OF THE ORGDP

Element	1978 ^a Mean (Range) (ppm)	1979 ^b Mean (Range) (ppm)	1980 ^c Mean (Range) (ppm)	Naturally Occurring ^d Mean (ppm)
Uranium	18 (4-95)	21 (1-184)	9 (1-31)	3.1
Mercury	7 (0.2-21)	8 (0.2-35)	8 (1-19)	0.19
Lead	47 (30-54)	51 (33-68)	35 (12-57)	19
Nickel	92 (30-388)	145 (30-790)	72 (14-198)	52
Copper	61 (20-165)	77 (15-412)	58 (11-120)	33
Zinc	105 (60-169)	110 (47-237)	101 (32-168)	150
Chromium	77 (43-237)	107 (25-244)	83 (14-175)	72
Manganese	814 (511-1875)	518 (360-985)	769 (391-2409)	770
Cadmium	<5	<5	2	0.17

Sources as follows:

^a Y/UB-10. (14 sampling sites in East Fork, Poplar Creek,
and the Clinch River.)

^b Y/UB-13. (Same as note a.)

^c Y/UB-15. (Same as note a.)

^d Bowen, H.J.M., 1979

TABLE D-3. CHEMICAL ANALYSIS OF GROUNDWATER
FROM ORGDP WELL NUMBER 5

Parameter	Concentration mg/l
Cadmium	0.002 ^a
Chromium	0.014
Copper	0.004 ^a
Fluoride	1.89
Nickel	<0.01
Uranium	0.002
Zinc	0.06
Total Organic Carbon	15.6
Mercury	0.001
Lead	0.01
Manganese	0.01
pH	8.6

Source: Long, June 1981.

^a Detection limit

References

Bowen, H.J.M., Environmental Chemistry of the Elements. New York, Academic Press, 1979.

Long, L.W., Environmental Management Group, Union Carbide, Nuclear Division, Oak Ridge Gaseous Diffusion Plant. Letter to Battelle, June 29, 1981.

Y/UB-10. Environmental Monitoring Report. U.S. Department of Energy. Oak Ridge Facilities: Calendar Year 1978. Union Carbide Corporation, Nuclear Division, Oak Ridge, Tennessee, June 1978.

Y/UB-13. Environmental Monitoring Report. U.S. Department of Energy. Oak Ridge Facilities: Calendar Year 1979. Union Carbide Corporation, Nuclear Division, Oak Ridge, Tennessee, June 1979.

Y/UB-15. Environmental Monitoring Report. U.S. Department of Energy. Oak Ridge Facilities: Calendar Year 1980. Union Carbide Corporation, Nuclear Division, Oak Ridge, Tennessee, June 1980.

APPENDIX E

REGULATED AIR POLLUTANTS

THIS PAGE IS INTENTIONALLY BLANK

APPENDIX E

REGULATED AIR POLLUTANTS

The following is a list of regulated air pollutants. Those marked with an asterisk are the criteria pollutants.

- Carbon Monoxide*
- Nitrogen Oxides*
- Sulfur Dioxide*
- Particulate Matter*
- Ozone* (regulated as Hydrocarbons)
- Lead*
- Asbestos
- Beryllium
- Mercury
- Vinyl Chloride
- Fluorides
- Sulphuric Acid Mist
- Hydrogen Sulfide
- Total Reduced Sulfur
- Reduced Sulfur Compounds

Source: 45 FR 52732.

References

45 FR 52732. Approval and Promulgation of State Implementation Plans. U.S. Environmental Protection Agency, August 7, 1980.

E-2

THIS PAGE IS INTENTIONALLY BLANK

APPENDIX F

ESTIMATION OF EMISSIONS OF VOLATILE ORGANICS

THIS PAGE IS INTENTIONALLY BLANK

APPENDIX F

ESTIMATION OF EMISSIONS OF VOLATILE ORGANICS

The emissions of volatile organics from the storage tanks were estimated using the procedures recommended in AP-42 with modifications as recommended by EPA (Burr and Moody, 1981) to bring the results into agreement with the most recent information in the field. The volatile solvents are expected to be received in drums and unloaded through drum unloading hoods. They will then be pumped to receiving and storage tanks where they will be diluted in much larger volumes of nonvolatile oil. In all, four transfers are expected before the material is burned.

The equation for calculating working losses from fixed roof tanks presented in AP-42 (p. 4.3-10) is:

$$L_w = 2.40 \times 10^{-2} M P K_n K_c$$

where

L_w = working loss (lb/10³ gal throughput)
 M = molecular weight of vapor
 P = true vapor pressure at bulk liquid temperature (psia)
 K_n = turnover factor (AP-42, Figure 4.3-11, 1.0 in this case)
 K_c = crude oil factor (1.0 in this case).

The values used in the calculations are presented in Table F-1.

The equation for calculating breathing losses from fixed roof tanks presented in AP-42 (p. 4.3-6) is:

$$L_B = 2.21 \times 10^{-4} M \frac{P}{14.7-P}^{0.68} D^{1.73} H^{0.51} dT^{0.50} F_p C K_c$$

where

L_B = breathing loss (lb/day)
 D = tank diameter (ft)
 H = average vapor space height (ft)
 dT = average diurnal ambient temperature change
 F_p = paint factor (AP-42, Table 4.3-2)
 C = diameter adjustment factor (AP-42, Figure 4.3-10)

TABLE F-1. VALUES FOR CALCULATING WORKING LOSSES FROM FIXED ROOF TANKS

Compound	gal/yr ^a	Vapor Pressure psia	Molecular Weight	Working Loss-lb/yr ^b
Trichloroethylene	13,072	1.1	132	182
Trichloroethane	12,590	1.9	134	308
Unidentified mix	11,600	1.0	100	100
Varsol	8,807	0.33	100	28
Perchloroethylene	7,020	0.31	166	35
Freon 11	2,420	0.13	137	4
Methanol	1,500	1.9	32	9
Isopropanol	1,500	0.6	60	5
Acetone	1,500	3.5	58	29
Chloroform	750	2.9	119	25
Methylene chloride	740	6.6	85	40
Freon 113	580	1.5	187	16
Hexane	329	2.4	86	6
Freon TA	320	1.5	187	9
Oil	331,000	.002	190	2.8

Sources as follows:

a K/D-5222.

b See text.

The results of recent studies have established that emissions are actually about 28 percent of the amount calculated by this formula. The next revision of AP-42 will contain a change to this formula substituting a coefficient of 6.19×10^{-5} for the 2.21×10^{-4} , producing the following formula which was used in this case:

$$L_B = 6.19 \times 10^{-5} M \left[\frac{P}{14.7-P} \right]^{0.68} D^{1.73} H^{0.51} T^{0.50} F_p C K_c$$

Since the volatile solvents comprise about 0.56 percent of the total liquid feed to the incinerator, an average vapor pressure of the mixed feed was estimated using conservative values for the components to be 0.014 psi. The

calculations were made using the reported size and number of tanks assuming that they were painted white and averaged 75 percent full, and that the average diurnal temperature change was 20 F. On this basis, breathing losses for all of the tanks were calculated to be 120 lbs per year.

The emissions from the drum unloading hood were estimated by hypothesizing that the unit would be designed for 1000 cubic feet per minute, that the maximum organic concentration in the air in the hood would be 25 percent of the lower flammability limit for hexane (the most flammable material in drums), that it would take 5 minutes to empty a drum, and that the emissions of other solvents would be proportional to the vapor pressure relative to hexane. The emissions were calculated for all drums by the following formula:

$$D = \sum (QLMFTVD_a)$$

where

D = Annual emissions from all drums (kg/yr)

Q = Flowrate of hexane (ft³/min) (estimates based on 1000 ft³/min)

L = Fraction of lower flammability limit for hexane (estimates based on 25 percent of the lower limit for hexane, 1.10 % in air)

M = Molecular weight of hexane = 86.2 lb/lb mole

F = Conversion factor = 387 ft³/lb mole

T = Time period (min) (estimates based on 5 min)

V = Ratio of vapor pressure of compound to that of hexane (psia)

$$\left(\frac{P_a}{P_h} = \frac{P_a}{2.4} \right)$$

D_a = Drums unloaded per year containing compound 'a' having vapor pressure P_a

References

AP-42. Compilation of Air Pollution Emission Factors. (3rd ed.) U.S. Environmental Protection Agency, Washington, D.C., February 1980.

Burr, R., and W. Moody, U.S. Environmental Protection Agency and TRW, Inc. (respectively). Personal communication with W. O'Connell, May 10, 1981.

K/D-5222. Conceptual Design Report for Compliance with the Toxic Substance Control Act (TSCA) Project No. 83-ORO-14. Goodyear Atomic Corporation, Nuclear Division of Union Carbide Corporation, Engineering Divisions, March 28, 1981.

APPENDIX G

CALCULATION OF PRIMARY NOISE EMISSION FROM
STACK OF THE PROPOSED PCB INCINERATOR

THIS PAGE IS INTENTIONALLY BLANK

APPENDIX G

CALCULATION OF PRIMARY NOISE EMISSION FROM STACK OF THE PROPOSED PCB INCINERATOR

The calculation starts with an estimate of the sound power in each of nine contiguous octave-bands covering the range of concern. Factors related to propagation angle are applied and the propagation losses are calculated for the acoustical path between the stack and the nearest critical noise receivers.

G.1 Sound Power of the Source^a

$$L_w = 42 + 10 \log_{10} Q + 20 \log_{10} SP \text{ (dB)} \quad (1)$$

where

L_w = overall sound power in decibel (dB) re 10^{-12} Watt (W)

SP = static pressure drop across fan in inches of water

Q = volume of gas in feet³/min (CFM)

Values for pressure and volume have been assumed to be as follows:

Q = 3700 CFM

SP = 37 inches water column

thus

$$\begin{aligned} L_w &= 42 + 10 \log 3700 + 20 \log 37 \text{ (dB)} \\ &= 42 + 36 + 31 = 109 \text{ dB} \end{aligned}$$

G.2 Correction for Propagation Angle

The sound energy propagates from the stack opening in a non-uniform way. For the majority of noise sensitive sites, the propagation angle is horizontal or 90 degrees (relative to 0 degrees for the stack centerline).

Table G-1 shows the correction factors, by octave band, to be applied to the data for horizontal propagation. Table G-2 shows the result of applying these factors.

^a Edison Electric Institute, 1977.

TABLE G-1. CORRECTION FACTORS, BY OCTAVE
BAND, FOR HORIZONTAL PROPAGATION

O-B Center Frequency, Hz	31	64	125	250	500	1K	2K	4K	8K
Correction, dB	-2	-3	-4	-6	-8	-10	-12	-14	-16

Source: Edison Electric Institute, 1977.

TABLE G-2. SOUND POWER DATA CORRECTED FOR HORIZONTAL PROPAGATION

O-B Center Frequency, Hz	31	64	125	250	500	1K	2K	4K	8K
Sound Power Level, dB	96	97	98	95	92	90	84	78	69

Source: Edison Electric Institute, 1977.

G.3 Computation for Length of the Propagation Path

As the sound propagates from the stack opening, it is attenuated by interaction with air and water vapor molecules, and by geometrical spreading so that the sound pressure level at the receiver is given by:

$$\begin{aligned} \bar{L}_p &= L_w - [10 \log 2 d^2 + a_m(f) d/100 + a_a(f) d/100] \quad (2) \\ &= L_w - 20 \log d + (d/100) [a_m(f) + a_a(f)] - 8 \end{aligned}$$

where

$\bar{L}_p$ = time-averaged sound pressure level (in dB, re 2×10^5 Pa) at distance d (in meters) from the acoustic center of a point source, radiated in the direction of interest,

L_w = sound power level of the source (in dB, re 10^{-12} W),

$a_m(f)$ = molecular absorption rate (in dB per 100 m), as a function of frequency, and

$a_a(f)$ = anomalous excess attenuation rate (in dB per 100 m) as a function of frequency.

The term $\bar{L}_p$ designates the long-term time-averaged sound pressure levels which include the effects of average molecular absorption rates and anomalous excess attenuation rates. For a source projecting different sound pressure level values in different directions from the source, directivity corrections must be applied to the average level.

The quantity inside the parentheses of the equation is known as the Distance Term, DT. In effect then

$$\bar{L}_p = L_w - DT. \quad (3)$$

G.4 Prediction of Sound Level

The time averaged sound level at a specific receiver will be the result of combining the acoustic energy of the existing sounds with the acoustic energy reaching that location from the new source. The combined sound energy is obtained by calculating the logarithmic sums of ambient sound level and the sound level contribution of the new source.

Since all of the measurement locations have essentially identical background sound levels, and the contribution of the stack radiated sound decreases with an increase in path length, the closest receiver location was examined first since it would show the greatest increase in sound level. Table G-3 shows the computation of octave-band sound pressure levels (row 3) by applying the distance terms (row 2) for a 600 m path length to the corrected sound power levels (row 1) of the stack. It also shows the existing octave-band sound levels (row 4) and the result of taking the log sum of rows 3 and 4 to obtain the resultant level (row 5).

As Table G-3 indicates (row 5), there would be no change in the time-average level resulting from noise radiated from the incinerator stack.

TABLE G-3. COMPUTATION OF RESULTANT SOUND
PRESSURE LEVEL AT CLOSEST RECEIVER

Octave Band Center Frequency, Hz	31	64	125	250	500	1K	2K	4K	8K
(1) Stack Sound Power, dB	96	97	98	95	92	90	84	78	69
(2) Distance Factor ^a	-65	-65	-65	-66	-68	-70	-75	-86	-101
(3) Contribution, dB	31	32	33	29	24	20	9	-	-
(4) Existing Level, dB	60	56	55	49	43	38	30	20	13
(5) Resultant Level, dB	60	56	55	49	43	38	30	20	13
(6) Change	----- 0 -----								

Source: Computation described in text.

^a Edison Electric Institute, 1977.

G.5 Variable Factors

Wind velocities in excess of 18 km/hr could produce an additional increase in the noise contribution, in the downwind direction, of up to 6 dB. However, this increase would not greatly influence the overall time-average sound level, and the increase in background sound caused by the wind in the trees would be sufficient to mask the sound.

In the event of operation of the ID fan at less than full capacity, there will be a pure tone generated at the blade passage frequency. The level of the tone can be as much as 10 dB greater than the level calculated for the octave band containing the tone. If the tone were in the 1 KHz octave band and the wind were blowing from the stack to the receiver, there would be a 2 dB increase in the time-average level for that octave-band. The overall A-weighted level would not change significantly.

G.6 Other Locations

The remainder of the locations chosen for the study are all more distant from the incinerator stack. As a consequence, the contribution of the ID fan to the sound level at these locations would be smaller than the contribution calculated above. Therefore, no increase in sound level is expected at these locations.

G.7 References

Edison Electric Institute (EEI). Electric Power Plant Environmental Noise Guide. Prepared for EEI by Bolt, Beranek and Newman, 1977, 1, No. 3221.

G-6

THIS PAGE IS INTENTIONALLY BLANK

APPENDIX H

AIR QUALITY IMPACT ANALYSES

THIS PAGE IS INTENTIONALLY BLANK

APPENDIX H

AIR QUALITY IMPACT ANALYSES

The selection of critical receptors for air quality modeling was influenced by the special attributes of the proposed incinerator site within the large Oak Ridge Reservation. The purpose of establishing the Reservation was and still is to isolate the special activities taking place there from the general public. In this case, the effect is to restrict public access to the areas of expected maximum plume impact on the tops of the surrounding ridges. Public access to the off-road areas of the Reservation is restricted, and so far as can be determined, irregular visits by foresters and power line right-of-way maintenance personnel constitute the only human presence on the ridge. It was not considered necessary, therefore, to calculate the concentration of the emissions on the nearby hilltops. Other areas of potential human exposure were identified as the roads and fields surrounding the ORGDP, and the three nearest residences located as described in the text up the valley, down the valley, and in the next valley from the incinerator.

Because of the complexity of the terrain surrounding the proposed incinerator site, no dispersion model can be expected to provide an accurate prediction of ambient concentrations. However, in each case, it was our judgment that a model could be selected that would provide an admittedly high upper limit, with the actual concentrations expected to be considerably lower than predicted by the model.

In predicting concentrations in the relatively flat area around the ORGDP, a flat terrain model was used, since it was estimated that the additional atmospheric turbulence induced by the hills, the trees, the buildings, and the heat island effect of the plant would overcome the downwash effects caused by air flow over McKinney Ridge. EPA's short-term gaussian dispersion model PTMAX was used to identify the point of maximum concentration and the maximum concentration to be expected under a variety of meteorological conditions. The highest ground level concentration was identified as occurring under "A" stability (clear, sunny day) with light winds (0.8 m/sec) at about 350 meters (1150 feet) from the incinerator (see Figure H-1).

OAK RIDGE PCB INCINERATOR

ANALYSIS OF CONCENTRATION AS A FUNCTION OF STABILITY AND WIND SP
 VERSION 75128, D. B. TURNER.

EMISSION RATE (G/SEC) = 0.09 0.087 NOx
 PHYSICAL STACK HEIGHT (M) = 30.50 100'
 STACK GAS TEMP (DEG K) = 453.00 170°C
 AMBIENT AIR TEMPERATURE (DEG K) = 293.
 VOLUME FLOW (CU M/SEC) = 1.75 3700 acfm

STABILITY	WIND SPEED (M/SEC)	MAX CONC (G/CU M)	DIST OF MAX (KM)	PLUME HEIGHT (M)
1	0.5	3.1909E-06	0.433	100.6
1	0.8	3.2294E-06	0.347	74.3
1	1.0	3.1724E-06	0.314	65.6
1	1.5	2.9390E-06	0.265	53.9
1	2.0	2.6851E-06	0.239	48.0
1	2.5	2.4634E-06	0.223	44.5
1	3.0	2.2629E-06	0.212	42.2
2	0.5	2.6491E-06	0.706	100.6
2	0.8	2.8716E-06	0.536	74.3
2	1.0	2.8922E-06	0.474	65.6
2	1.5	2.7710E-06	0.388	53.9
2	2.0	2.5770E-06	0.346	48.0
2	2.5	2.3845E-06	0.320	44.5
2	3.0	2.2039E-06	0.303	42.2
2	4.0	1.8971E-06	0.281	39.3
2	5.0	1.6568E-06	0.269	37.5
3	2.0	2.6152E-06	0.525	48.0
3	2.5	2.4350E-06	0.484	44.5
3	3.0	2.2605E-06	0.456	42.2
3	4.0	1.9574E-06	0.421	39.3
3	5.0	1.7159E-06	0.401	37.5
3	7.0	1.3680E-06	0.378	35.5
3	10.0	1.0442E-06	0.360	34.0
3	12.0	9.0089E-07	0.353	33.4
3	15.0	7.4662E-07	0.347	32.8
4	0.5	1.3941E-06	2.985	100.6
4	0.8	1.8071E-06	1.861	74.3
4	1.0	1.9560E-06	1.531	65.6
4	1.5	2.0944E-06	1.128	53.9
4	2.0	2.0509E-06	0.961	48.0
4	2.5	1.9306E-06	0.885	44.5
4	3.0	1.8063E-06	0.835	42.2
4	4.0	1.5804E-06	0.773	39.3
4	5.0	1.3946E-06	0.735	37.5
4	7.0	1.1207E-06	0.693	35.5
4	10.0	8.6080E-07	0.661	34.0
4	12.0	7.4453E-07	0.649	33.4
4	15.0	6.1861E-07	0.636	32.8
4	20.0	4.8219E-07	0.624	32.3
5	2.0	9.9114E-07	2.330	57.6
5	2.5	8.6565E-07	2.207	55.7
5	3.0	7.7299E-07	2.115	54.2
5	4.0	6.4349E-07	1.983	52.0
5	5.0	5.5599E-07	1.891	50.5
6	2.0	8.6051E-07	3.989	53.0
6	2.5	7.5381E-07	3.748	51.4
6	3.0	6.7456E-07	3.568	50.2
6	4.0	5.5798E-07	3.374	48.4
6	5.0	4.7935E-07	3.242	47.1

FIGURE H-1. COMPUTER OUTPUT FROM POLLUTANT DISPERSION COMPUTATION

The maximum concentrations of the other major air pollutants were derived from the concentration of nitrogen oxides by multiplying the NO_x concentration by the ratio of the emission rates for the two pollutants. It is possible to use this procedure, rather than running the model for each pollutant, because the mathematical equation used by the model to predict the concentration establishes a linear relationship between the emission rate and the ambient concentration for the pollutant (Turner, 1970).

The concentration predicted by the model is generally construed to represent a one-hour average concentration. However, Turner (1970) states that the dispersion coefficients are for a ten-minute average, and that a one-hour average would be about 73% of the ten-minute average. However, in conformity with general practice, this reduction has not been made and, in this report, the model output has been assumed to represent a one-hour average.

The predicted point of maximum impact will occur near Blair Road or within the boundaries of the ORDGP depending upon the wind direction. Since the estimated concentrations were very low and no continuous human exposure was involved, an annual average concentration was not calculated for this point.

Since the residences to the southwest are separated from the incinerator by relatively level ground, it was considered appropriate to use flat terrain models to calculate concentration at that point also. The output from PTMAX was inspected to locate the point of maximum concentration closest to the residences. This was found to occur at 4.0 km with an "F" stability and 2.0 m/s windspeed. These conditions were used to calculate the expected short-term concentration of NO_x at the residences. Using the procedures in Turner's Workbook (1970), a concentration of 0.96 ug/m^3 was calculated, representing approximately 30 percent of the maximum concentrations. The short-term concentrations of the other pollutants were determined by their ratio to NO_x emissions, in the same manner described for the maximum concentrations.

As discussed in the text, there are no mathematical models which would allow the prediction of the ground level concentrations of pollutants at the residences which are located in the valleys on the other side of the

ridges from the incinerator. However, the general mechanics of atmospheric dispersion allow a qualitative prediction that interposing a ridge between the source and the receptor will significantly reduce the concentration observed at the receptor, below that which would occur in the absence of the ridge. This is due to a longer plume travel distance and increased turbulence in the wake of the ridge. Therefore, a flat terrain model may be assumed to predict concentrations which would be higher than would actually occur. Using the same procedure described above for the residences to the southwest, the maximum short-term concentration of pollutants was calculated for the nearest residences (3.2 km NNW); these concentrations were essentially identical to those identified for the residence to the southwest.

Annual average concentrations of pollutants due to the proposed incinerator were estimated using EPA's flat terrain, gaussian dispersion model CDM. The results of these calculations are expected to be conservative (overestimation) because of the terrain effects previously described and because the incinerator was assumed to operate continuously for a full year rather than 7300 hours per year.

The dispersion model was run by the Oak Ridge National Laboratory using the best available local data and the particulate emission rate estimated for the incinerator. The National Weather Service's meteorological data on windspeed, wind direction, and atmospheric stability are from McGee Tyson Airport for 1968-1973. This data represents the best data available that approximates the meteorological conditions at the proposed site. The results supplied by ORNL (Figure H-2) give the average concentrations for each of the four seasons for receptors located on lines radiating from the proposed incinerator in each of the sixteen common compass directions. The annual average concentration was derived by averaging the seasonal averages. Concentrations of other pollutants were derived by multiplying the particulate concentration by the ratio of the emissions of the two pollutants as described above. Because of the predominance of upvalley and downvalley winds, the annual average concentration at the nearest residences, which are in the next valley, were not the highest; rather the highest concentrations were at the houses to the southwest. The estimated concentrations at the most exposed residence, which were derived from these calculations, are higher than those which should actually occur, due to the conservative assumptions made in estimating emissions and in calculating the dispersion of those emissions.

H-5

OUTPUT OF CDM FOR BARD
 KNOXVILLE, TN, STAR DATA 1968-73, SEASONAL
 DISTANCES FROM 0.5 TO 5.0 KM
 SOURCE TERM OF 0.0503 GM/SEC
 CONCENTRATIONS IN MICROGRAMS/M**3

DIRECTION IS E

DISTANCE	DJF	MAM	JJA	SON	
0.5	0.033	<u>0.054</u>	<u>0.051</u>	0.033	10427
1.0	0.035	0.043	0.038	0.031	
1.5	0.025	0.029	0.025	0.022	
2.0	0.018	0.021	0.018	0.016	
2.5	0.014	0.015	0.013	0.012	
3.0	0.010	0.012	0.010	0.009	
3.5	0.008	0.009	0.008	0.007	
4.0	0.007	0.008	0.007	0.006	
4.5	0.006	0.006	0.005	0.005	
5.0	0.005	0.005	0.005	0.004	

DIRECTION IS ENE

DISTANCE	DJF	MAM	JJA	SON
0.5	0.038	0.040	0.049	0.031
1.0	0.038	0.035	0.039	0.031
1.5	0.026	0.025	0.026	0.023
2.0	0.019	0.017	0.019	0.016
2.5	0.014	0.013	0.014	0.012
3.0	0.011	0.010	0.011	0.010
3.5	0.009	0.008	0.009	0.008
4.0	0.007	0.007	0.007	0.006
4.5	0.006	0.005	0.006	0.005
5.0	0.005	0.005	0.005	0.004

DIRECTION IS NE

DISTANCE	DJF	MAM	JJA	SON
0.5	0.022	0.031	0.035	0.021
1.0	0.022	0.029	0.032	0.020
1.5	0.016	0.020	0.023	0.015
2.0	0.011	0.015	0.016	0.010
2.5	0.008	0.011	0.012	0.008
3.0	0.007	0.008	0.010	0.006
3.5	0.005	0.007	0.008	0.005
4.0	0.004	0.006	0.006	0.004
4.5	0.004	0.005	0.005	0.003
5.0	0.003	0.004	0.004	0.003

FIGURE H-2. OUTPUT FROM CDM COMPUTER SIMULATION

DIRECTION IS NNE

DISTANCE	DJF	MAM	JJA	SON
0.5	0.008	0.017	0.019	0.012
1.0	0.009	0.016	0.017	0.013
1.5	0.007	0.011	0.012	0.009
2.0	0.005	0.008	0.009	0.007
2.5	0.004	0.006	0.007	0.005
3.0	0.003	0.004	0.005	0.004
3.5	0.002	0.004	0.004	0.003
4.0	0.002	0.003	0.003	0.003
4.5	0.002	0.002	0.003	0.002
5.0	0.001	0.002	0.002	0.002

DIRECTION IS N

DISTANCE	DJF	MAM	JJA	SON
0.5	0.010	0.017	0.019	0.015
1.0	0.013	0.018	0.016	0.015
1.5	0.010	0.013	0.012	0.011
2.0	0.008	0.010	0.008	0.008
2.5	0.006	0.007	0.006	0.006
3.0	0.004	0.006	0.005	0.005
3.5	0.004	0.005	0.004	0.004
4.0	0.003	0.004	0.003	0.003
4.5	0.003	0.003	0.003	0.003
5.0	0.002	0.003	0.002	0.002

DIRECTION IS NNW

DISTANCE	DJF	MAM	JJA	SON
0.5	0.003	0.008	0.009	0.006
1.0	0.004	0.007	0.009	0.006
1.5	0.003	0.005	0.006	0.004
2.0	0.003	0.004	0.004	0.003
2.5	0.002	0.003	0.003	0.003
3.0	0.002	0.002	0.003	0.002
3.5	0.001	0.002	0.002	0.001
4.0	0.001	0.001	0.002	0.001
4.5	0.001	0.001	0.001	0.001
5.0	0.001	0.001	0.001	0.001

FIGURE H-2. (CONTINUED)

DIRECTION IS NW

DISTANCE	DJF	MAM	JJA	SON
0.5	0.005	0.007	0.016	0.010
1.0	0.006	0.008	0.015	0.011
1.5	0.004	0.006	0.011	0.008
2.0	0.003	0.004	0.008	0.006
2.5	0.003	0.003	0.006	0.005
3.0	0.002	0.003	0.005	0.004
3.5	0.002	0.002	0.004	0.003
4.0	0.001	0.002	0.003	0.002
4.5	0.001	0.001	0.003	0.002
5.0	0.001	0.001	0.002	0.002

DIRECTION IS WNW

DISTANCE	DJF	MAM	JJA	SON
0.5	0.007	0.009	0.014	0.014
1.0	0.010	0.010	0.013	0.016
1.5	0.008	0.008	0.010	0.012
2.0	0.006	0.006	0.007	0.009
2.5	0.005	0.004	0.005	0.007
3.0	0.004	0.003	0.004	0.005
3.5	0.003	0.003	0.003	0.004
4.0	0.002	0.002	0.003	0.003
4.5	0.002	0.002	0.002	0.003
5.0	0.002	0.002	0.002	0.002

DIRECTION IS W

DISTANCE	DJF	MAM	JJA	SON
0.5	0.013	0.016	0.021	0.020
1.0	0.014	0.014	0.016	0.022
1.5	0.010	0.010	0.011	0.017
2.0	0.008	0.007	0.008	0.012
2.5	0.006	0.005	0.006	0.009
3.0	0.004	0.004	0.005	0.007
3.5	0.004	0.003	0.004	0.006
4.0	0.003	0.003	0.003	0.005
4.5	0.003	0.002	0.003	0.004
5.0	0.002	0.002	0.002	0.003

FIGURE H-2. (CONTINUED)

DIRECTION IS WSW

DISTANCE	DJF	MAM	JJA	SON
0.5	0.025	0.022	0.035	0.033
1.0	0.026	0.020	0.026	0.035
1.5	0.019	0.014	0.018	0.026
2.0	0.014	0.010	0.013	0.019
2.5	0.010	0.008	0.010	0.014
3.0	0.008	0.006	0.007	0.011
3.5	0.007	0.005	0.006	0.009
4.0	0.005	0.004	0.005	0.007
4.5	0.004	0.003	0.004	0.006
5.0	0.004	0.003	0.003	0.005

DIRECTION IS SW

DISTANCE	DJF	MAM	JJA	SON	
0.5	0.041	0.041	0.036	<u>0.051</u>	.0422
1.0	0.046	0.034	0.029	0.051	
1.5	0.034	0.024	0.020	0.037	
2.0	0.025	0.017	0.015	0.027	
2.5	0.018	0.012	0.011	0.020	
3.0	0.014	0.010	0.008	0.015	
3.5	0.012	0.008	0.007	0.012	
4.0	0.009	0.006	0.005	0.010	
4.5	0.008	0.005	0.004	0.008	
5.0	0.007	0.004	0.004	0.007	

DIRECTION IS SSW

DISTANCE	DJF	MAM	JJA	SON	
0.5	0.032	0.028	0.028	0.039	
1.0	0.036	0.025	0.024	0.037	
1.5	0.026	0.017	0.017	0.027	
2.0	0.019	0.012	0.012	0.019	
2.5	0.014	0.009	0.009	0.014	
3.0	0.011	0.007	0.007	0.011	
3.5	0.009	0.006	0.006	0.009	
— 4.0	0.007	0.005	0.004	0.007	.0058
4.5	0.006	0.004	0.004	0.006	
5.0	0.005	0.003	0.003	0.005	

FIGURE H-2. (CONTINUED)

DIRECTION IS S

DISTANCE	DJF	MAM	JJA	SON	
0.5	0.041	0.036	0.054	0.041	.0430
1.0	0.044	0.030	0.039	0.038	
1.5	0.032	0.021	0.026	0.027	
2.0	0.023	0.015	0.019	0.019	
2.5	0.017	0.011	0.014	0.014	
3.0	0.013	0.009	0.011	0.011	
3.5	0.011	0.007	0.008	0.009	
4.0	0.009	0.006	0.007	0.007	
4.5	0.007	0.005	0.006	0.006	
5.0	0.006	0.004	0.005	0.005	

DIRECTION IS SSE

DISTANCE	DJF	MAM	JJA	SON
0.5	0.012	0.014	0.021	0.016
1.0	0.012	0.012	0.014	0.016
1.5	0.009	0.008	0.009	0.012
2.0	0.007	0.006	0.006	0.008
2.5	0.005	0.004	0.005	0.006
3.0	0.004	0.003	0.004	0.005
3.5	0.003	0.003	0.003	0.004
4.0	0.003	0.002	0.002	0.003
4.5	0.002	0.002	0.002	0.003
5.0	0.002	0.002	0.002	0.002

DIRECTION IS SE

DISTANCE	DJF	MAM	JJA	SON
0.5	0.012	0.017	0.024	0.012
1.0	0.012	0.013	0.014	0.010
1.5	0.009	0.009	0.009	0.007
2.0	0.007	0.006	0.006	0.005
2.5	0.005	0.005	0.004	0.004
3.0	0.004	0.004	0.003	0.003
3.5	0.003	0.003	0.003	0.002
4.0	0.003	0.002	0.002	0.002
4.5	0.002	0.002	0.002	0.002
5.0	0.002	0.002	0.001	0.001

FIGURE H-2. (CONTINUED)

DIRECTION IS ESE

DISTANCE	DJF	MAM	JJA	SON
0.5	0.020	0.020	0.022	0.018
1.0	0.021	0.015	0.017	0.016
1.5	0.015	0.010	0.011	0.012
2.0	0.011	0.007	0.008	0.008
2.5	0.008	0.005	0.006	0.006
3.0	0.006	0.004	0.005	0.005
3.5	0.005	0.003	0.004	0.004
4.0	0.004	0.003	0.003	0.003
4.5	0.003	0.002	0.003	0.003
5.0	0.003	0.002	0.002	0.002

FIGURE H-2. (CONTINUED)

APPENDIX I

CALCULATIONS OF THE WATER QUALITY EFFECTS OF
THE PROPOSED ALTERNATIVE (INCINERATION)

THIS PAGE IS INTENTIONALLY BLANK

APPENDIX I

CALCULATIONS OF THE WATER QUALITY EFFECTS OF THE PROPOSED ALTERNATIVE (INCINERATION)

The procedures used to determine the potential water quality impacts of the proposed disposal alternative were relatively straightforward, but required some assumptions. These assumptions involved certain processes in the transport sequence from source to ultimate sink. The generalized flow chart is illustrated in Figure I-1. Items indicated by an asterisk are those for which the assumptions are described below.

Calculations were performed separately for the direct aqueous discharge to Poplar Creek from the K-1700 facility and for the indirect discharges to the Creek via the storm water drainage ditches or overland flow.

I.1 Direct Discharges

The concentrations in Poplar Creek were arrived at by starting with the raw waste concentrations and volumes from the ash tank and the scrubber purge tank. To calculate the extent of dilution and removal of individual contaminants in the treatment facility it was necessary to make some assumptions regarding chemical behavior. Each contaminant in the incinerator waste was categorized as to the extent to which it would be expected to precipitate or adsorb during lime treatment. For those constituents where such behavior would not be anticipated (i.e., chloride, sulfate, sodium, and beryllium) a simple dilution calculation was made:

$$\left[\begin{array}{c} \text{Future} \\ \text{Concentration} \\ \text{in K-1700 Outfall} \end{array} \right] = \left[\begin{array}{c} \left[\begin{array}{c} \text{Flow from} \\ \text{Incinerator} \end{array} \right] \left[\begin{array}{c} \text{Concentration in} \\ \text{Incinerator Waste} \end{array} \right] \\ + \left[\begin{array}{c} \text{Present Inflow} \\ \text{Rate} \end{array} \right] \left[\begin{array}{c} \text{Present Concentration} \\ \text{in K-1700 Outfall} \end{array} \right] \end{array} \right] \bigg/ \left[\begin{array}{c} \text{Total} \\ \text{Flow} \end{array} \right]$$

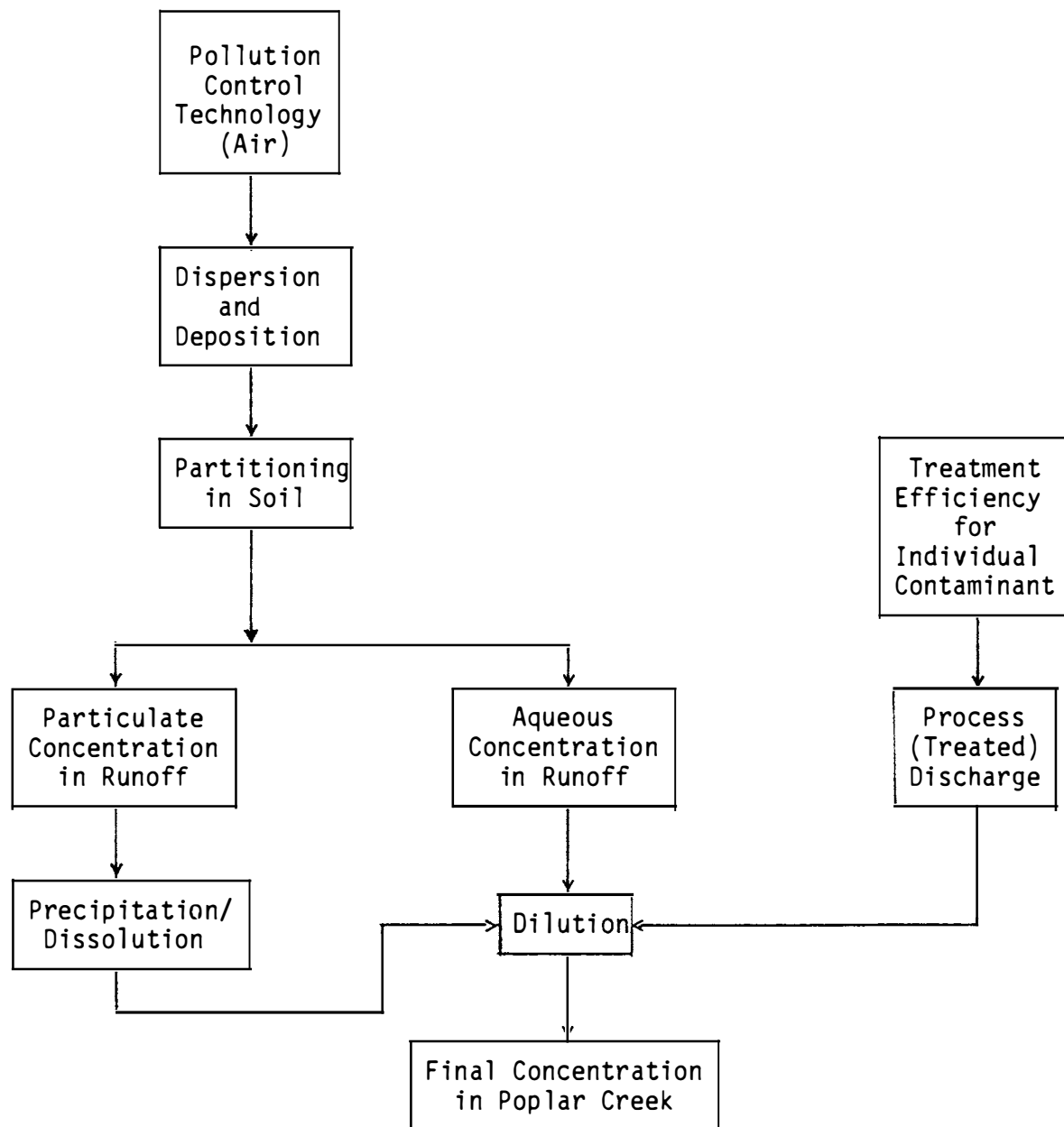


FIGURE I-1. CONCEPTUAL SCHEME OF WATER QUALITY CALCULATIONS

The existing concentrations in the K-1700 discharge were obtained from monitoring data provided by UCC-ND. Sulfate is monitored on a routine basis so 1980 data were used. Chloride, sodium, and beryllium are not currently analyzed for, but were included in a comprehensive program undertaken in 1970-74. Since essentially no changes have occurred in the treatment system since that time, the 1974 data are considered representative. The calculations for chloride are illustrated; the other parameters were estimated in a similar fashion.

$$[Cl^-]_{\text{future}} = \frac{(20 \text{ gal/min}) (5700 \text{ mg/l}) + (750 \text{ gal/min}) (37 \text{ mg/l})}{770 \text{ gal/min}} = 184 \text{ mg/l.}$$

This methodology, of course, assumes that the present treatment system achieves no removals of those contaminants so that their influent concentrations are not needed. For those contaminants affected by absorption or precipitation treatment behavior was assumed to be dominated by the behavior of the particulate fraction. Therefore, additional removals proportional to the 57 percent particulate removal achieved in the K-1407B system were incorporated, followed by the appropriate dilution between incinerator-derived flow and the remaining total waste flow. Present K-1700 concentrations were obtained from 1980 data except phosphate, which is from 1974. The exception to this general rule was fluoride. In the case of fluoride, whose solubility is considerably higher than that of the heavy metals, only a portion of the influent fluoride was assumed to be associated with the particulates. Calculation of K-1700 concentrations for lead and fluoride are illustrated in Table I-1.

Determination of present downstream concentrations in Poplar Creek were made from UCC-ND monitoring data. As with the K-1700 concentrations, 1974 data were used for chloride, phosphate, sodium and beryllium. Future

TABLE I-1. CALCULATION OF LEAD AND FLUORIDE CONCENTRATIONS IN K-1700 OUTFALL

$$\text{FORMULA: } C_f = \frac{[E] [Q_1] [C_1] + [Q_2] [C_2]}{Q}$$

where
 C_f = Future K-1700 contaminant concentration (mg/l)
 C_1 = Contaminant concentration in incinerator flow (mg/l)
 C_2 = Contaminant concentration in other flow (mg/l)
 Q = Total flow rate (gal/min)
 Q_1 = Flow rate from incinerator (gal/min)
 Q_2 = Other flow rate (gal/min)
 E = Removal factor, expressed as a fraction

$$\text{LEAD}^a: C_f = \frac{[0.47] [20] [2.4] + [750] [0.01]}{770} = 0.039 \text{ mg/l}$$

$$\text{FLUORIDE}^b: C_f = \frac{[0.735] [280] [20] + [750] [0.86]}{770} = 6.18 \text{ mg/l}$$

Source: See text.

^aFor lead, the removal factor (E) used was based on a particulate removal efficiency of 53 percent, $E = (1-0.53)$.

^bFor fluoride, the removal factor (E) of 0.735 was calculated as follows:

$$\begin{array}{lcl} \text{TOTAL MASS OF FLUORIDE IN} & \begin{array}{l} \nearrow 50 \% \text{ ADSORBED} \\ \searrow 50 \% \text{ SOLUBLE} \end{array} & \begin{array}{l} \nearrow 47 \% \text{ NOT REMOVED} \\ \searrow 53 \% \text{ REMOVED} \end{array} \end{array} \left. \vphantom{\begin{array}{l} \nearrow 50 \% \text{ ADSORBED} \\ \searrow 50 \% \text{ SOLUBLE} \end{array}} \right\} 0.5 + (0.47) (0.5) = 0.735 = E$$

downstream concentrations were determined by calculating the percentage of the present and future mass loads in Poplar Creek contributed by K-1700:

$$\frac{\text{Present and Future Mass Load Contributions of K-1700}}{C_k Q_k} = \frac{C_k Q_k}{\sum C_i Q_i},$$

where C_k is the present or future concentration of some contaminant in the K-1700 discharge and Q_k is the annual flow from K-1700 to Poplar Creek. The summation term $\sum C_i Q_i$ represents each of the mass contributions from upstream sources to yield the downstream mass load. This term was determined directly from monitoring data for the existing situation. Once this information was known, the calculation of the downstream concentrations was straightforward:

$$\text{Future Concentration in Poplar Creek} = C_d = \frac{\sum C_i Q_i}{\sum Q_i},$$

where the numerator is obtained from the mass calculations and the denominator is the sum of the present and incremental flows in Poplar Creek. The calculation procedure is illustrated for phosphate:

$$\text{Present Load Distribution: } \frac{(0.85 \text{ mg/l}) (1.496 \times 10^9 \text{ l/yr})}{(0.25 \text{ mg/l}) (1.790 \times 10^{11} \text{ l/yr})} = 2.84 \% \text{ of } \text{PO}_4 \text{ (P) from K-1700}$$

$$\begin{aligned} \text{Future Load Distribution: } & \frac{(1.46 \text{ mg/l}) (1.54 \times 10^9 \text{ l/yr})}{(0.25 \text{ mg/l}) (1.79 \times 10^{11} \text{ l/yr}) + (9.97 \times 10^8 \text{ mg/yr})} = \frac{2.248 \times 10^9}{4.57 \times 10^{10}} \\ & = 4.91 \% \text{ of } \text{PO}_4 \text{ (P) from K-1700} \end{aligned}$$

$$\text{Future Poplar Creek Concentration: } \frac{4.57 \times 10^{10} \text{ mg/yr}}{1.79 \times 10^{11} \text{ l/yr}} = 0.26 \text{ mg/l } \text{PO}_4 \text{ (P).}$$

I.2 Indirect Discharges

The transport of contaminants to Poplar Creek via atmospheric deposition and overland transport was evaluated in three steps. The first step was to take the stack emissions inventory and disperse it within the watershed(s). Discussions with project personnel suggested that a 20 square mile depositional area would be appropriate. This corresponds to a particulate deposition velocity of 1 cm/sec and an effective stack height of 150 ft with a 2 mph average prevailing wind. The resulting radius is approximately 2.5 miles.

Most of this area is topographically within the Poplar Creek watershed (about 85 percent). Given the prevailing wind patterns at the site, nearly all of the pollutant deposition will occur in the Poplar Creek basin.

Effects of facility releases were assumed to occur over a 25 year lifetime. During this period deposition, erosion and transport would occur simultaneously. Background concentration data indicated that soil buildup and transport to Poplar Creek would be potentially measurable only for lead and uranium.

To determine the magnitude of the erosion and transport, it was necessary to calculate reasonable soil losses. These were obtained by making a rough estimate from the Universal Soil Loss Equation:

$$A \text{ (tons/ac-yr)} = RKLSCP$$

where R is related to rainfall erosion potential, K and LS are soil type and topographic factors, respectively. C and P taken together determine the protective influence of natural vegetative cover and man-made management practices. An initial estimate based on these factors produced a value between 3 and 15 tons/ac-yr. A 20 square mile area delivers about 15 percent of this amount to a water body. This value was refined by comparing it to amounts of suspended solids in Poplar Creek and the percentage of drainage basin in which the incinerator deposition is to occur. This resulted in an estimated value of 5 tons per year considering that the vegetation characteristics are not uniform and that the flow and suspended solids measurements are averages, not cumulative or continuous distributions.

Lead and uranium are both present as oxides or mixed oxide-hydroxide-carbonates in the soil. Their downward transport was thought to be confined to the top 5 cm of soil. This volume is 4.5×10^6 cu ft; based on a value of 100 lb/cu ft bulk density the mass is 2.1×10^8 kg. Five tons per acre per year corresponds to a net transport (to the creek) of 0.0175 cm of soil. Considering the 5 cm slice in two parts yielded an approach to calculate the incremented concentrations in the soil over time.

At time = 0, the concentration in the 5 cm slice is uniform and $C_{\text{excess}} = 0$. After the first year, the 4.9825 cm remaining has been enriched by one year's accumulation distributed throughout 5 cm. The top 0.0175 cm has been eroded, with, $C_{\text{excess}} = (C_1 + 0)/2$, an average of the concentration at the beginning and end of the year.

Continuing this process for 25 years gives a value for $C_{\text{excess}} = 0.039$ mg/kg of lead and 0.102 mg/kg of uranium (Figure I-2). Current measurements of lead concentrations around ORGDP are in the range of 20-159 mg/kg with an average of 59. Incremented lead concentrations are therefore about 0.06 percent of background. If anything, this estimate is conservative since in acid soils downward transport may be more likely.

For uranium the incremental concentrations in the eroded soil after 25 years were converted to activities and compared to background:

$$(0.1 \text{ mg/kg}) (7.81 \times 10^{-10} \text{ Ci/mg}) (1 \times 10^{12} \text{ pCi/Ci}) = 0.0781 \text{ pCi/g};$$

$$(0.0781 \text{ pCi/kg}) \div [0.97 \text{ pCi/kg (background)}] = 8.1\%.$$

Soil related contributions to Poplar Creek were calculated as follows:

$$(5 \text{ t/ac-yr})(12,800 \text{ ac})(0.15 \text{ trans. factor})(1.05 \text{ pCi/g})(2000 \text{ lb/t})(453 \text{ g/lb})$$

$$= 9.1 \times 10^9 \text{ pCi/yr};$$

$$\text{or } 9.1 \times 10^9 \text{ pCi/yr} = 5 \times 10^{-5} \text{ pCi/ml (or } 1.79 \times 10^{14} \text{ ml/yr)}$$

compared to a baseline level of 4.69×10^{-5} pCi/ml.

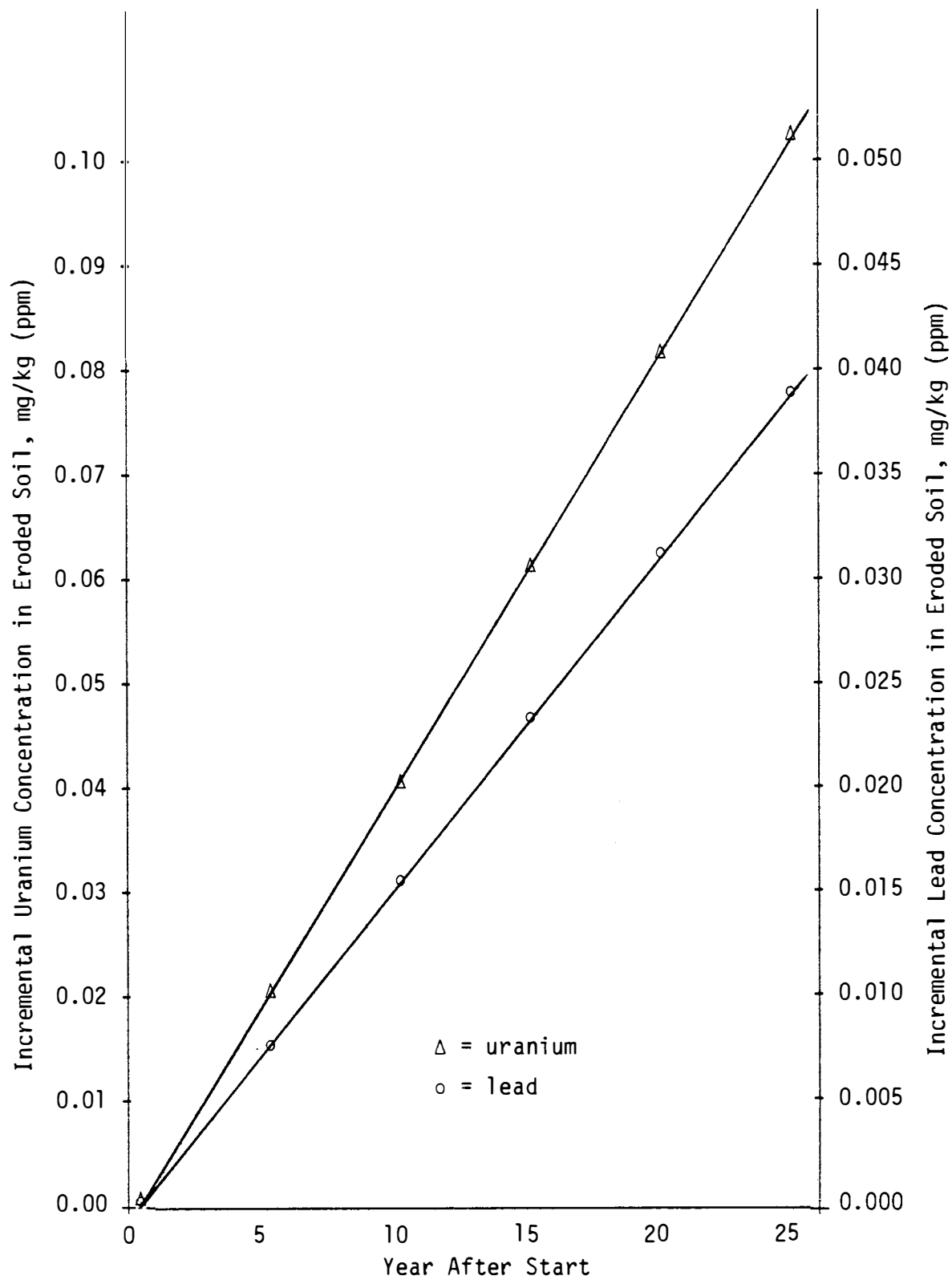


FIGURE I-1. INCREMENTAL URANIUM AND LEAD CONCENTRATIONS IN ERODED SOIL PARTICLES

Total incremental uranium was calculated as the sum of the direct and indirect contributions. The baseline is $0.5 \pm 0.2 \times 10^{-8}$ uCi/ml. Add to this 0.3×10^{-11} uCi/ml from soils and 0.5×10^{-9} uCi/ml from direct aqueous discharges to yield the new activity of 0.5503×10^{-8} uCi/ml. This represents an increase of about 10 percent relative to the baseline average.

I-10

THIS PAGE IS INTENTIONALLY BLANK

APPENDIX J

DATA TO SUPPORT
PUBLIC HEALTH IMPACT ASSESSMENT

THIS PAGE IS INTENTIONALLY BLANK

APPENDIX J

DATA TO SUPPORT PUBLIC HEALTH IMPACT ASSESSMENT

J.1 Health Effects of Low Level Ionizing Radiation

Health effects resulting from low-level ionizing radiation may be categorized as somatic, affecting only the individual exposed, or genetic, causing effects that may be transferred to future generations. These two types of effects are discussed individually below. In addition, a brief discussion of the derivation of risk factors is presented along with some quantitative estimates of risk. The discussion that follows is based on reviews by the National Academy of Sciences Committee on Biological Effects of Ionizing Radiation (1980), Hobbs and McClellan (1980), and the International Commission on Radiological Protection (1966).

J.1.1 Somatic Effects

The somatic effect of primary concern from exposure to low-level radiation is carcinogenesis. Also very important are developmental effects on the unborn child including death, malformation, growth retardation, and functional impairment. Measurable effects have been observed at doses of 10-19 rads. Higher doses (greater than 400 rads) have been associated with impaired fertility or sterility and the development of cataracts. In addition, the hypothesis has been suggested that radiation contributes in a dose-dependent way to non-specific shortening of life span. There is no human evidence to support this hypothesis. Human populations providing empirical data on health effects of ionizing radiation are the survivors of the bombings at Hiroshima and Nagasaki, miners exposed to radon and its decay products, and patients treated with X-rays or a suspension of thorium oxide that emits alpha radiations. A wide range of animal experimentation supports the human data.

Cancers associated with exposure to radiation include leukemia, breast cancer, thyroid cancer, lung cancer, and cancers of some digestive organs. It is believed that cancer can be induced by radiation in any body tissue by radiation. The existence of such a relationship can only be inferred by statistical excesses above natural incidence, since

radiation-induced tumors are indistinguishable from those occurring naturally. It has recently become evident that the solid tumors are more important numerically than leukemia. The latent period for the solid tumors ranges from 10 to 30 years as compared with leukemia which usually appears within a few years of exposure. Hence, leukemia was the primary effect noted initially in survivors of the bombings. The data on several individual organs are discussed briefly below.

J.1.1.1 Leukemia. Extensive animal experimentation has been conducted to investigate radiation induction of leukemia. Some information can be gleaned from this work that is pertinent to humans. Induction at low doses rises less rapidly with increased dose in response to low-LET radiation than high-LET radiation. Incidence decreases above a certain dose, apparently due to lysis of cells in which malignant transformations may have been induced. Repair mechanisms seem to be more effective after low doses than high doses. Differences in types of leukemias and the importance of viruses in some species make direct extrapolation from animal to man difficult. Small sample sizes do not permit statistical assessment of risk at low doses.

Data on leukemia incidence in Japanese atomic-bomb survivors indicates that age at exposure, time after exposure, and type of leukemia are important factors in rise of radiation induced leukemia. Excess mortality by time period and age has been tabulated for acute and chronic granulocytic leukemia. This have been combined with dose estimates for both gamma and neutron radiation in deriving risk estimates. Models employed in estimating risks are discussed below in J.1.3, Derivation of Risk Factors.

Incidence of leukemia in ankylosing-spondylitis patients receiving x-ray treatment supports that from atomic bomb survivors. Excess risk is evident from 2 to 20 years after initial exposure and is most marked in older patients. The association of chronic granulocytic leukemia with neutron radiation is supported by little excess in patients treated with x-rays which do not include the neutron exposure.

J.1.1.2 Breast Cancer. Data indicates that the female breast is very susceptible to radiation carcinogenesis. Populations studied include

atomic bomb survivors, tuberculosis patients exposed to multiple fluoroscopic chest examinations, and women receiving localized x-ray treatment for acute postpartum mastitis. Dependence of effect on dose at very low levels appears to be linear for breast cancer. The dose-response relationship varies by age at exposure and hormonal and other host factors. Latent period appears to depend on age at initial exposure but not on dose. Data indicate a minimum latent period of five years, but are insufficient to determine a maximum period. If a maximum exists, it must be greater than 30 years.

J.1.1.3. Thyroid Cancer. Induction of thyroid cancer by radiation is evidenced by animal experimentation and study of several human populations including the atomic bomb survivors, several groups accidentally exposed to low-level radiation from fallout, and numerous exposures via therapeutic medical procedures. The most striking aspect of thyroid cancer, supported by both animal and human data, is the high survival rate. Of the several histological types of thyroid cancer, the type mostly highly malignant and fatal appears not to be associated with radiation exposure at all. Hence, information is reported as incidence rather than mortality as it is for most other malignancies associated with radiation exposure.

Animal experimentation indicates that external x-ray exposure of the thyroid is more effective in cancer induction than internal exposure to beta radiation from iodine-131. This may be explained in part by microdosimetry difference in the two types of radiation. Iodine-131 delivers an inhomogenous dose over short periods and is dependent on thyroid function for its effect. In addition, doses from internally emitted beta radiation are usually above 10,000 rads. Doses of 100 to 1500 rads of external radiation are generally associated with thyroid cancer and doses as low as 6.5 rads of external radiation may have induced thyroid malignancies.

Human data have provided substantial information important to risk assessment for thyroid cancer. There is no apparent relationship between effect and age at initial exposure. Women exhibit a three-fold increased incidence over men. Those with a Jewish ethnic background experience a greater increased risk of thyroid cancer. A minimum latent period of 10 years is suggested with peak incidence approximately 20 years after first exposure.

J.1.1.4 Lung Cancer. Radiation induced lung cancer occurs almost exclusively in the bronchial tree. Data is available from animal experimentation, patients receiving radiotherapy for ankylosing-spondylitis, Japanese atomic bomb survivors, and miners exposed to radon daughter in underground mines. The interaction of cigarette smoking with radiation in carcinogenesis is unclear. Recent evidence indicates that the association is not as strong as previously believed. Smoking does appear, however, to shorten the latent period. Uncertainty also remains over the dose-response relationship of local dose received from insoluble particles imbedded in the bronchial epithelial layer and uniformly distributed external dose. Unique problems in dosimetry are presented by this dilemma, and have been considered by numerous investigators. Variables which have been shown to affect the dose response relationship include age at initial exposure and age at appearance of cancer. Increased risk is first noted at age 35, and rises rapidly after that. Minimum latent period is approximately 10 years. Excess cancer has been observed as much as 50 years after initial radiation exposure. A linear dose-response relationship is assumed for risk estimation of lung cancer fatality.

J.1.2 Genetic Effects

Radiation exposure can produce two types of genetic disorders: those dependent on gene mutations or small deletions and those which depend on chromosomal changes, either total number or gene arrangement. Effects of genetic disorders are proportional to radiation dose. Much data employed in risk estimation is obtained from animal experimentation. Some manifestations of genetic disorders have been recognized in man, however, in response to radiation exposure. These include early losses in utero; chromosomal abnormalities in recognized abortions, stillbirths, or early deaths; congenital abnormalities; and specific visible detriment resulting from gene mutations as evidenced by familial anomalies.

Two methods are employed in estimating risk of genetic disorders in man due to radiation exposure. The first technique involves expected incidence in a population continuously exposed for many generations.

Accordingly, it is estimated that one to six percent spontaneous mutations in humans are due to background radiation. A relative or proportional increase of 0.02 to 0.004 per rem is expected. After many generations of increased exposure, a similar increase in human hereditary disorders that are maintained in the population would be found. The second technique estimates incidence of genetic disorders in a single population following exposure of the parents. It is estimated the 5 to 65 additional disorders will be observed per million liveborn offspring resulting from parental exposure to one rem before conception.

J.1.3 Derivation of Risk Factors

Radiation carcinogenesis is considered to be a stochastic effect. That is, its occurrence in an exposed population, rather than its severity in an affected individual, is directly proportional to dose. Stochastic effects are assumed to have no threshold; an effect will be produced in response to any dose provided the exposed population is large enough. On the basis of theories of the interaction of ionizing radiation with cells and the relative biological effectiveness of various types of radiation in eliciting effects, mathematical procedures relating radiation dose and cancer incidence (mortality) are applied to data on man and experimental animals. The general form of the equation that is fitted to dose response data is as follows:

$$F(D) = (a_0 + a_1D + a_2D^2) \exp (-b_1D - b_2D^2)$$

where D is the radiation dose in rads, $F(D)$ is the cancer incidence at dose D , and the parameters a_0 , a_1 , a_2 , b_1 , b_2 are positive. The spontaneous or background cancer incidence is represented by a_0 . This function becomes basically linear at very low doses with only the parameters a_0 and a_1 . Modification with the a_2 term allows a curve fitted expressing an upward or positive curvature at low dose. Including b_1 and b_2 expresses a downward or negative curvature at higher doses as might be expected from cell killing effects. Depending on which parameters are important (provide the best fit) this general form can be expressed as several distinct models: the linear, the quadratic, or the linear-quadratic (quadratic with a linear term). Finding the appropriate model is accomplished by an iterative weighted least-square

procedure. Empirical evidence of the actual form of the curve at very low doses including the existence of a threshold would be almost impossible to obtain based on the magnitude of the population required.

According to current mortality rates, about 164,000 individuals in a population of one million could be expected to die from cancer. Exposure of this population to a single dose of 10 rads would be expected to result in 766 additional cancer deaths according to the linear-quadratic model. Continuous lifetime exposure to one rad per year (total dose of about 75 rads) would result in an excess of about 3,000 cancer deaths, based on this same model. This is 0.5 percent and 3 percent above expected. Estimates of excess risk for individual organs and tissues (except for leukemia) are based on the linear model. Examples expressed as excess cancer cases per year per million persons exposed per rad are as follows: male thyroid, 2.2; female thyroid, 5.8; female breast, 5.8; male lung, 3.6; female lung 3.9. Much of the data upon which these risks are based are from epidemiological data in which exposure was at high dose. Thus they may over-estimate the risk somewhat. Including the quadratic term (using linear quadratic model) lower these values by a factor of three to six.

J.2 Health Effects of PCBs

A brief summary of the health effects of PCBs is given in this section to document the type of effects which might be expected and the levels necessary to produce those effects. An overview of the absorption, metabolism, and excretion of PCBs by the body is presented prior to the discussion of effects. Effects are considered by route of exposure and occupational or general community exposure. Subsequently, evidence relating to the carcinogenicity, mutagenicity, and teratogenicity of PCBs is described.

J.2.1 Absorption, Metabolism, and Excretion

PCBs are readily absorbed from the digestive tract, regardless of the degree or pattern of chlorination. Absorption through the respiratory system also occurs readily and is thought to follow a similar pattern. Since animal studies have shown that PCBs applied to the skin exert effects on the liver, it is assumed that PCBs are also absorbed through the skin (NIOSH, 1977).

Varying amounts of PCBs, depending upon degree and pattern of chlorination, are excreted in the feces, milk, and hair while only trace amounts are excreted in the urine. Metabolites of chlorinated biphenyls have been found in urine, feces, and milk. It appears that the lower chlorinated biphenyls are metabolized more readily than more highly chlorinated compounds. Decachlorobiphenyl, the most highly chlorinated biphenyl, has not been shown to be metabolized. As a result of this differential metabolism, the highly chlorinated compounds tend to accumulate in tissues (particularly those of high fat content) and may persist for years after intake is discontinued (NIOSH, 1977).

J.2.2 Occupational Exposure

Occupational exposure to PCBs involves either direct skin contact with PCB compounds or inhalation of and skin exposures to PCB vapors.

The most common effects of occupational exposure to PCBs are skin irritations and chloracne. Chloracne has been found to occur with exposure to PCB vapor concentrations as low as 0.1 mg/m^3 over a period of several months or at concentrations of PCBs in the blood of about 200 ppb. Concentrations of approximately 10 mg/m^3 were reported to be unbearably irritating to workers. Other effects associated with occupational exposure to PCBs include digestive disturbances; eye, nose, and upper respiratory tract irritation; liver injury; impotence; dry throat; asthmatic bronchitis; nausea; dizziness; and headache. Some abnormalities were found in liver function tests of workers exposed to 0.32 to 1.44 mg/m^3 . The investigators concluded that there were no adverse effects in workers with blood levels below 200 ppb.

J.2.3 Exposure of the General Population

Due to widespread occurrence of PCBs in the environment, detectable concentrations have been found in tissues and body fluids of a substantial portion of the U.S. population. As many as 62 percent of blood serum samples have been found to contain detectable concentrations of PCBs up to 30 ppb. PCBs have also been detected in many samples, of adipose tissues. In approximately 75 percent of the adipose samples, concentrations were less than 1 ppm, while the remainder were between 1 and 2 ppm. The most common PCB isomers found in blood and adipose tissue are penta-, hexa-, and heptachlorobiphenyls. Concentrations of PCBs found in blood were highly correlated with concentrations in adipose tissue. PCBs have been detected in whole human milk at ppb concentrations and in milk fat at ppm concentrations. The concentrations of PCBs in human milk were found to be similar or identical to those in blood and were positively correlated with adipose concentrations. It has been estimated that the common dietary intake for an average teenage male in the U.S. is 10 to 20 ug/day (NIOSH, 1977). Ambient air may contain up to 100 ng/m^3 . No adverse effects have been associated with body burdens of PCBs resulting from these general environmental exposures.

The effects of ingestion of PCBs by humans due to accidental contamination of rice oil used for cooking in Japan in 1968 have been well documented. The cooking oil was found to contain 2000 to 3000 ppm Kanechlor

400 (a chlorinated biphenyl containing 48 percent chlorine). By 1977, 1665 cases of PCB poisoning, referred to as "Yusho", had been identified. Initial symptoms of the disease included chloracne, pigmentation of the face, eyelids, gingivae and nails, hypertrophy of meibomian glands, and hypersecretion from the eyes. Also, signs of systemic effects such as loss of appetite, nausea, vomiting, weakness, and numbness of the extremities were reported. Six years after exposure, the lesions were less severe in 64 percent of the patients, however, systemic disorders remained. These systemic disorders included dullness, headache or heavy headedness, indefinite stomach ache, numbness of extremities, swelling and pain of joints, coughing and bronchitis-like symptoms, and nervous and endocrinological disorders.

Children exposed to the contaminated oil exhibited retarded growth and abnormal tooth development (Urabe, et al., 1979). Blood levels of PCBs in Yusho victims have remained somewhat higher than those in healthy people.

J.2.4 Carcinogenicity

After examining the results of several animal studies, NIOSH (1977) concluded that PCBs have potential carcinogenic activity in humans.

Carcinogenic effects of PCBs have been primarily associated with the liver. Binding of PCB metabolites to nuclear components of liver cells has been demonstrated in monkeys, rats, and in vitro experiments. This evidence is sufficient to arouse suspicions that PCBs could have carcinogenic potential in humans. Other animal studies have shown increased incidence of hepatomas, hepatocarcinomas, neoplastic nodules in the liver, and cholangiohepatomas in rats and mice. Also, one of the studies reported by NIOSH (1977) indicated dose-related incidence of leukemia in rats.

Studies of human exposure are not sufficient to confirm or deny the carcinogenicity of PCBs in humans. There is some evidence that Yusho victims may have an increased risk of cancer. Of the 31 deaths among Yusho patients as of 1979 and for which the cause of death was noted, 11 (35.4 percent) deaths resulted from malignant neoplasms. This percentage is somewhat higher than the normal rate of death due to neoplasms in this geographical area

(21.1 percent). However, these data are only preliminary results and cannot be considered conclusive.

J.2.5 Mutagenicity

According to NIOSH (1977) PCBs have little mutagenic potential; however, it is possible that they may alter the mutagenicity and carcinogenicity of other compounds by stimulating microsomal enzyme activities. Results of the Ames test on several PCBs and PCB mixtures and tests on rat spermatogonial and bone marrow cells proved negative.

J.2.6 Teratogenicity and Reproductive Effects

PCBs have been detected in the fetuses of both humans and animals indicating that placental transfer occurs. PCBs have not proven to be teratogenic in humans; however, other reproductive effects have occurred. Babies born to mothers who ingested "Yusho oil" during pregnancy exhibited dark brown pigmentation of the mucosa membrane and skin, a tendency to be small for date, eruption of teeth at birth, and tearing and redness of the eyes. Pigmentation disappeared gradually within two to five months. Yusho also developed in at least one baby exposed to PCBs only through nursing. Several children were born with pigmented skin several years after the mothers' exposure to the contaminated oil had ceased.

Animal studies have shown decreased birth weight. Teratogenic effects have been observed in dogs and pigs, however, at the maximum doses of the Yusho patients and at intake rates three to four times greater than those expected from inhalation of maximum reported occupational concentrations (NIOSH, 1977).

J.3 Health Effects of Polychlorinated Dibenzodioxins and Polychlorinated Dibenzofurans

J.3.1 Polychlorinated Dibenzodioxins

The group of chemicals referred to as polychlorinated dibenzodioxins (PCDDs) includes some of the most toxic compounds known to man. The most toxic compound in the group is 2,3,7,8-tetrachlorodibenzodioxin (TCDD) and the health effects of this particular chemical have been extensively studied. Unless otherwise noted, the information presented in this section refers only to the 2,3,7,8-TCDD isomer.

The toxic effects of 2,3,7,8 TCDD reported in humans are summarized in Table J-1. Initial symptoms of acute exposure to TCDD include nausea and vomiting; headache; and signs of respiratory tract, eye, and skin irritation (Taylor, 1979). The initial irritant effect is comparable to a chemical or thermal burn and results in redness edema, swelling pain, mucus membrane hypersecretion, and in severe cases, destruction of the tissues (Joiner, 1981; Taylor, 1979). Delayed effects which may appear later (weeks to months following the exposure include porphyria cutanea tarda (a severe disease associated with abnormal metabolism of porphyrins by liver), chloracne (a skin disorder), severe muscle pain, hyperpigmentation of skin, psychopathological changes, high blood lipids, and gastrointestinal problems. Pancreatitis, kidney disorders, and general liver failure occur less frequently.

Long-term effects of acute exposure to TCDD are difficult to assess in humans. In most studies, unmeasured exposure conditions, small sample size, and the possibility of exposure to other chemicals make it difficult to demonstrate a causal relationship. There is some indications of increased incidence of skin, lymphatic, and hematopoietic cancer among workers suffering acute exposure. However, this finding is not conclusive (Joiner, 1981).

Chronic exposure to lower levels of TCDD have also been examined in workers. Chloracne appears to be the earliest sign of TCDD poisoning and the most common effect reported following chronic occupational exposure (Taylor, 1979). Liver toxicity and uroporphyrin excretion have also been reported (Joiner, 1981).

Chronic oral exposure to TCDD induces multiple toxicologic effects in animals, the severity of which is dose dependent. Liver toxicity is the most consistently observed effect and is the primary effect occurring at low dose levels. Other pathological consequences include morphologic changes in liver, thymus, reproductive organs, and lymphoid, respiratory, and vascular tissues. These effects have been shown to occur in rats receiving 1.0 ug/kg/day and 0.1 ug/kg/day and in monkeys fed a diet containing 500 parts per trillion (ppt) TCDD. Rats fed 0.001 ug/kg/day for two years did not show any toxic

TABLE J-1. TOXIC EFFECTS OF 2,3,7,8-TCDD REPORTED
IN HUMANS

Dermatological

Chloracne
Porphyria cutanea tarda
Hyperpigmentation and hirsutism

Internal

Liver damage
Raised serum hepatic enzyme levels
Disorders of fat metabolism
Disorders of carbohydrate metabolism
Cardiovascular disorders
Urinary tract disorders
Respiratory tract disorders
Pancreatic disorders

Neurological

A. Peripheral

Polyneuropathies
Sensorial impairments (Sight, hearing, smell, taste)

B. Central

Lassitude, weakness, impotence
Loss of libido

Source: Reggiani, 1980 as shown in EPA, Region VI, 1981

effects although liver and adipose tissues contained 540 ppt TCDD at termination (Kociba, et al., 1979).

There is substantial evidence that TCDD exerts teratological and perhaps other reproductive effects. TCDD appears to decrease the ability of Rhesus monkeys to conceive. Also, monkeys which did conceive experienced a greater incidence of abortion or resorption of the fetus. These effects were seen in monkeys given a diet of 50 ppt and 500 ppt TCDD for seven months prior to breeding (Allen et al., 1979).

In mice, TCDD is teratogenic, causing birth defects and death of fetuses. The defects most frequently observed in mice and rats are cleft palate and hydronephrosis. The dose levels producing these effects range from 0.25 ug/kg to 9 ug/kg on days 10 to 13 of gestation. A daily dose of 0.01 ug/kg was sufficient to have negative effects on fertility, survival, and growth of pups in multigenerational studies of rodents (Joiner, 1981).

TCDD has been shown in several studies to be carcinogenic. Recent findings of the National Toxicology Program indicate that this chemical is carcinogenic in both oral (rats and mice) and dermal (mice) studies (NTP, 1980). TCDD given orally by gavage induced hepatocellular carcinomas, neoplastic liver nodules, and follicular cell thyroid adenomas. In a two-year feeding study, rats given 0.1 ug/kg/day experienced increased incidence of tumors of the hard palate, tongue, lung, and liver. At 0.001 ug/kg, no adverse effects appeared and at 0.01 ug/kg hyperplasia was noted (Kociba, 1979).

Tests of TCDD for mutagenicity have yielded conflicting results. The actual status of TCDD is still being evaluated.

J.3.2 Polychlorinated Dibenzofurans

Polychlorinated dibenzofurans (PCDFs) are similar in chemical structure to PCDDs and although they are generally less toxic, PCDFs appear to have biological effects similar to those of PCDDs. As with PCDD compounds, the 2,3,7,8-teratochlorodibenzofuran is thought to be the most toxic of the group and has received more attention.

Several PCDF compounds are reported to cause chloracne (Taylor, 1979). These include the trio-, tetra-, penta-, and hexachlodibenzofuran derivatives.

PCDFs have been detected in the PCB contaminated rice oil which caused the widespread poisoning referred to as Yusho disease in Japan. PCDFs were also found in the tissues of the Yusho victims. Both liver and adipose tissue contained detectable amounts of PCDFs but concentrations were highest in the liver. Analysis revealed that the PCDFs were primarily penta- and hexachlorodibenzofurans with only trace amounts of the tetrachloro isomers. Due to the presence of PCBs, the effects attributable to PCDFs cannot be determined.

A few studies have examined the acute toxic effects of PCDFs. Generally, PCDFs are less toxic than PCDDs although they produce similar effects. A comparison of the acute oral LD₅₀ values for tetrachlorodibenzodioxin (TCDD) and tetrachlorodibenzofuran (TCDF) are given in Table J-2. No information was available on the chronic toxicity, carcinogenicity, mutagenicity, or reproductive effects of PCDFs.

TABLE J-2. COMPARATIVE ACUTE ORAL TOXICITY OF
2,3,7,8-TCDD AND 2,3,7,8-TCDF

<u>Species</u>	<u>LD₅₀ TCDD (ug/kg)</u>	<u>LD₅₀ TCDF (ug/kg)</u>	<u>Approx. Ratio LD₅₀ TCDF/LD₅₀ TCDD</u>
Guinea pig	0.5-1.5	5-10	4
Monkey	30-70	1000	20
Mouse	150-300	6000	25

Source: EPA, Region VI, 1981

J.4 References

- Allen, J. R., D. A. Barsotti, L. K. Lambrecht and J. P. Van Miller. Reproductive effects of halogenated aromatic hydrocarbons on nonhuman primates. Proc. N.Y. Acad. Sci., 1979, 320, 419-425.
- Committee on Biological Effects of Ionizing Radiation. The Effects on Populations of Exposure to Low Levels of Ionizing Radiation. National Academy of Sciences, 1980.
- EPA Region VI. Incineration of PCBs -- Summary of Approval Actions: Rollins Environmental Services, Deer Park, Texas. Environmental Protection Agency, 1981.
- Hobbs, C.H. and R. O. McClellan. Radiation and Radioactive Materials. In: Doull, J., C. D. Klaassen, and M. O. Amdur (eds.). Casarett and Boull's Toxicology. The Basic Science of Poisons. 2nd Edition. Macmillan Publishing Co., Inc. New York, 1980, 497-530.
- International Commission on Radiological Protection. The evaluation of risks from radiation. Health Physics, 1966, 12, 299-302.
- Joiner, R. Toxicological Considerations. In: Study on State-of-the-Art of Dioxin from Combustion Sources by Research Committee on Industrial and Municipal Wastes. Arthur D. Little Inc, 1981.
- Kociba, R. J., D. G. Keyes, J. E. Beyer, R. M. Carreon and P. J. Gehring. Long-term toxicologic studies of 2, 3, 7, 8-tetrachlorodibenzo-p-dioxin (TCDD) in laboratory animals. Proc. N.Y. Acad. Sci., 1979, 320, 397-404.
- National Institute for Occupational Safety and Health (NIOSH). Criteria for a Recommended Standard. Occupational Exposure to Polychlorinated Biphenyls. Department Health, Education, and Welfare, 1977.
- National Toxicology Program (NTP). Carcinogenesis bioassay results. NTP Technical Bulletin. Department of Health and Human Services, 1980.
- Reggiani, G. Toxicology of TCDD and related compounds. Delivered at the Workshop in the Impact of Chlorinated Dioxins and Related Compounds on the Environment, Rome, Italy, Oct. 22-24, 1980.
- Taylor, J. S. Environmental chloracne: update and overview. Proc. N.Y. Acad. Sci. 1979, 320, 295-307.
- Urabe, H., H. Koda, and M. Asaki. Present state of Yusho patients. Proc. N. Y. Acad. Sci. 1979, 320, 273-276.

J-16

THIS PAGE IS INTENTIONALLY BLANK

APPENDIX K

PROCESS DESCRIPTION OF THE PROPOSED
PCB INCINERATION FACILITY, ORGDP

THIS PAGE IS INTENTIONALLY BLANK

APPENDIX K. PROCESS DESCRIPTION OF THE PROPOSED PCB
INCINERATION FACILITY, ORGDP

Process Operation	Process Description	Raw, Intermediate, and End Products Encountered
Area A-Receiving and Sorting Drum Handling	Unloading from trailer by lift truck sorted by waste type and stored in quarantine area where wastes received will be compared to manifest.	Delivered Wastes, Additives: Surfac- tants and Polymers (unspent fuel), Caustic, HCl
Tank Truck Unloading	Bulk liquids transported in PCB tanker or non-PCB tanker to bulk unloading station where contents will be checked against manifest and compatability with wastes in receiving tanks. Wastes pumped from trucks with nitrogen purge to re- ceiving tanks or to direct burn. Fuel oil and caustic unloaded to holding tanks.	Delivered Wastes, Caustic, Fuel Oil, Nitrogen
Area B-Process Storage	Process storage area consists of 11 holding tanks segregated by PCB content (5-50; 50-500; >500 ppm) and waste type (aqueous, non-aqueous). Pump transfer of wastes. Caustic diluted to 20 per- cent prior to caustic feed tank. Each waste tank has agitator.	Delivered Wastes, Nitrogen, Caustic, Water
Area C-Feed Preparation Drum Unloading	Drum opening specific for liquid or liquid/solid wastes. Drum opening in ventilated, enclosed unloading station. Separate bays for PCB and non-PCB wastes. Liquid/solid waste decanted using hydrau- lic knives for purging, mesh screen cover and shroud with nitrogen purge to prevent fires upon opening and to remove any off- gas. Drum tipped 120°, liquid removed, solids caught in mesh. Liquid pumped to storage tanks (PCB or non-PCB). Drum cov- ered with plastic by operator; strained solids and drum transferred to shredder. Equipment is flushed. Ventilation ex- hausts to atmosphere, air cleaning not indicated.	Delivered Wastes, Nitrogen, Water, Noise, Vibration

APPENDIX K. (Continued)

Process Operation	Process Description	Raw, Intermediate, and End Products Encountered
Liquid Waste Blending	Blending of primary, secondary, and aqueous liquid wastes. Wastes strained to remove solids. Handling of strained solids not described.	Strained Solids (unspecified)
Area D-Rotary Kiln Incineration	Liquid waste feed to burners. Solids shredded and discharged to feed conveyors which convey to feed chute into rotary kiln. Absorbant added by screw conveyor into rotary kiln. Ash from Combustion removed via ash trough and conveyor and deposited in primary ash box. Additional ash removed from secondary ash secondary slag box. Ash >50 ppm PCB recycled to combustion.	Fuel oil, Propane, Natural Gas, Process Water, Fire Water, Absorbant Material (unspecified)
Area E-Off-Gas Treatment	Off-gas from combustion directed to quenching venturi scrubber, wet electrostatic precipitator. Continuous monitoring of off-gas in stack, 20 percent caustic used to adjust pH in quench chamber venturi recycle water and ESP mist spray.	Delivered Wastes, Atmospheric Emissions, Fly Ash, Bottom Ash, Slag, Wastewater, Caustic, Process Water
Area F-Solid and Aqueous Waste	Liquid wastes generated from Area E is collected and sampled each 24 hour period. High PCB levels in water requires reeling water to aqueous liquid waste blending tank through filters and/or activated carbon beds. Acceptable water transferred to an onsite facility for treatment and subsequent discharge to the K-1700 NPDES Discharge. Solids removed during processing and spent activated carbon are dumped into drums and processed through the system.	Fly Ash, Bottom Ash, Slag, Off-Gas Treatment Wastewater, Activated Carbon, Fly Ash, Bottom Ash, Slag

Source: K/D-5222.

APPENDIX L

ACCIDENT PREVENTION AND SPILL CONTAINMENT
MEASURES PLANNED FOR THE PROPOSED FACILITY

THIS PAGE IS INTENTIONALLY BLANK

APPENDIX L

ACCIDENT PREVENTION AND SPILL CONTAINMENT MEASURES PLANNED FOR THE PROPOSED FACILITY

L.1 Accident Prevention Measures

Adequate instrumentation and control systems will be provided to ensure smooth operation of the process as well as prevent hazardous or unacceptable emissions to man and the environment. All field mounted instrumentation will be designed to be safe. Safety barriers will be provided for the transmittal of signals to other areas of the facility. The various process tanks will be equipped with an alarm system which will be monitored from the central control room. Lights will be incorporated to indicate the status of the pumps, agitators, valves, tank levels, temperature, pressure, and other selected functions. The operation of the entire incineration facility will be governed by a master interlock. These systems should prevent disasters and allow for personnel and environmental safety.

A system of administrative controls will be established to manage the safe operation of the incineration facility. These controls will involve internal operations at the facility as well as numerous interfaces with other facilities and organizations.

Ventilation will be provided for the drum storage/unloading areas, the control room, the lunch room, the laboratory, the maintenance shop, the power distribution room, and the restrooms and locker areas.

Fire protection for the drum handling building will be provided by an automatic dry pipe sprinkler system. A wet pipe system will be provided for the office and control building.

Standard industrial explosion and pressure safety features such as nitrogen blanketing of tanks, high pressure rupture discs on the tanks, and flame arrestors will be incorporated into the design of this incineration facility. Provision will be made for adding absorbant material to the incinerator feed conveyor in front of the shredder. Unusual pressure surges in the system will be relieved through the feed chute safety relief vent. A secondary safety relief vent will be provided to vent the flue gases in the event of a malfunction of the off-gas treatment section. The master interlocks will be designed to shutdown the incineration system if the temperature in either of the combustion chambers falls outside the specified range or the exit gas temperature from the secondary burner is too high.

Accident prevention measures which will be considered for the process of waste incineration include activities during receiving and sorting, storage, feed preparation, incineration, off-gas treatment, and explosion and pressure safety measures. These are discussed in the PSAR and the Conceptual Design Report (K/D-5222).

The drums will be unloaded to a quarantine area where the contents will be checked for agreement with the shipping manifest. The drums will then be sorted and stored in specifically designated areas.

The bulk liquid wastes will be received in tankers. The contents of each tanker will be checked relative to its shipping manifest and to compatibility with the contents of the appropriate receiving or storage tank. The bulk liquid wastes will be subsequently loaded into the designed receiving, storage or blending tank. Alternately, they may be transferred directly to the feed header of the kiln master burner or the feed header of the secondary master burner.

Each tank except those for fuel oil and caustic will have an agitator. The receiving tanks will have a volume of 19,000 liters (5,000 gal) each. PCB containing wastes will be segregated from those without PCB in the entire process storage area.

The unloading station will be designated to provide maximum containment for preventing worker exposure to hazardous chemicals. The liquid-solid decanting bays will each have a drum jig which will be equipped with hydraulic drum puncturing spikes as well as a meshscreen filter.

Various waste streams will be blended in the designated tanks. Each of the blending tanks will be agitated in order to achieve and maintain uniform blends. If the strainers in the outlet lines from the blending tanks should become plugged due to solids in the waste, the contents of the blending tank can be recycled through the grinder pump, thereby reducing the solids in the incinerator feed to acceptable size.

The incineration area will consist of a rotary kiln primary combustion chamber, mixing chamber, secondary combustion chamber, related liquid burner, solids feed system, and an ash removal system. Flue gases from the rotary kiln will pass through the mix chamber into the secondary combustion chamber. The secondary pilot burner will be used as an ignition source for

the secondary/master burner. The auxiliary secondary burner will be included to maintain the temperature in the secondary combustion chamber whenever the master burner might fail to do so.

Flue gases from the secondary combustion chamber will be quenched to their adiabatic saturation temperature by direct contact with sprays of fresh water in the quench chamber. The cleaned off-gases will pass to the stack which directs them up into the atmosphere.

Various solid and aqueous discharges from the incineration system will be collected, checked and transferred to existing disposal facilities on the Oak Ridge Reservation. Aqueous waste management will include overflow water from the ash trough, excess water from the quench chamber and scrubbers, firewater from the incinerator area, office and laboratory area, drum storage building, and the tank farm area.

Solid wastes from the strainers and filters will be dumped into drums which will then be processed through the incineration system. Spent carbon from either of the carbon beds will be collected in drums which will also be processed through the incineration system.

Accident prevention measures for transportation of the wastes include factors directly related to the container. These measures will reduce the probability of loss of containment (container failure). The factors are quality of new drums, quality assurance procedures during drum fabrication, inspection and written verification of drum condition and closure after loading of the waste, and quality control during package loading on the truck, and location and integrity of the bracing.

Measures to prevent accidents during transportation will include selection of experienced drivers, maintenance of driver's rest, and consideration of the necessity of relief drivers. Rigid vehicle inspection will be conducted before each use. Shipments will be planned to void adverse weather conditions and travel during periods of high traffic density near the large cities. The lead vehicle will be alert to unexpected road hazards such as bad roads, obstructions, and other hazards.

L.2 Spill Containment and Contamination Control

The spill prevention control and countermeasure (SPCC) plan for the proposed transportation of organic wastes to the incinerator facility, planned for operation in 1987, will be in effect at the Oak Ridge Gaseous Diffusion Plant (ORGDP) and will be in accord with 40 CFR Part 761.10 and 40 CFR 117.11. PCB spills threatening to enter or entering waterways exceeding 4.54 kg (10 lb) must be reported. As now envisioned, waste oil, PCBs, and other organic chemicals (such as trichloro-ethane, perchloroethylene, and trichloroethylene, which could be contaminated with very small concentrations of uranium) will be transported over designated highways in tankers and closed trailers from the Y-12 Plant, ORNL, Paducah, Kentucky, and Piketon, Ohio, to the waste incinerator facility at the ORGDP. All such materials would be transported in full compliance with the U.S. Department of Transportation and U.S. Environmental Protection Agency regulations (Long, 1981).

Emergency response teams at each plant will be "on call" for immediate response to transportation emergencies during movement of hazardous waste over public highways. In the event of a transportation accident involving hazardous waste, the nearest team would respond with personnel and equipment to assist the on-scene coordinator at the accident. The nature of the spill would dictate the equipment used for mitigation and cleanup, but would generally consist of oil/PCB sorbent materials, containment booms, pumps, hoses, steel drums, and earth-moving equipment (Long, 1981).

Drivers would be trained for initial response to transportation emergencies. In the event of an accident, the driver would immediately notify appropriate DOE contractor emergency response personnel. The driver would also provide local authorities with information and emergency instructions concerning the cargo. Shipping papers and manifests, carried on the driver's side of the cab, would provide emergency instructions and telephone numbers in the event that the driver was incapacitated. In addition, the truck would be readily identifiable as a DOE vehicle (Long, 1981).

Communications would play a vital role in emergency response. Hazardous waste shipments would be initiated only after the shift superintendents at each of the affected plants had been notified and had confirmed the

readiness of their respective emergency response team. State authorities would be notified before a shipment would be made through their states. The Chemical Transportation Emergency Center (CHEMTREC), usually the first to be contacted by local authorities during an emergency, would be notified of hazardous waste shipments. This would assure that calls to CHEMTREC would be promptly relayed to the appropriate DOE contractor emergency response personnel.

Detailed administrative procedures and in-depth training for all incinerator operators will help prevent abnormal incidents from occurring. All such procedures and training will be well documented and updated as necessary.

Any leaks or spills within the facility would be promptly reported to the shift superintendent, but cleanup actions would be initiated immediately by trained site personnel. Measures will be taken to assure that in the case of accidental release of PCB waste, no contamination of groundwater will occur.

The ORGDP shift superintendent would act as the emergency coordinator in the event of on-site emergencies. He would utilize the emergency squad which is composed of personnel from each normal working shift. These personnel are preassigned and routinely trained in emergency response.

It is very unlikely that a release of waste from this facility could escape the secondary containment system. If liquid waste were to escape the diked area, it could reach a small stream approximately 100-yards north of the facility and eventually reach Poplar Creek at K-1700. However, two separate oil and chemical "traps" are located in series within the stream, prior to its discharge into Poplar Creek. These traps will skim insoluble, floating chemicals, such as oil, and trap insoluble sinking chemicals, such as PCBs. Such materials could then be recovered with existing recovery equipment. Only water soluble chemicals, such as alcohol and machine coolants, could escape the traps.

In the unlikely event of a major release or explosion at the incinerator facility, operators would evacuate the area staying upwind of the facility. The shift superintendent would be notified immediately and a determination would be made as to whether any or all of the plant population

should be evacuated. Emergency personnel would wear self-contained breathing apparatus and full-body protection units when approaching the facility. Activities would be directed by the shift superintendent. All plant equipment and personnel would be available to the shift superintendent to assist in emergencies. Any resulting fires should be readily extinguished by in-place, automatic fire protection systems.

General countermeasure information, equipment lists and instructions, maps, and telephone numbers will be included in the facility SPCC plan. All of this information is also maintained in ready access in the ORGDP Central Control Facility.

L.3 References

K/D-5222. Conceptual Design Report For Compliance With Toxix Substances Control Act No. 83-OR-14. Goodyear Atomic Corporation and Union Carbide Corporation -- Nuclear Division, 1981.

Long, L. W., Environmental Management, Oak Ridge Gaseous Diffusion Plant, Union Carbide Corporation -- Nuclear Division. Personal Communication, April, 1981.

Preliminary Safety Analysis Report for Compliance with the Toxic Substance Control Act (TSCA) ORGDP Project No. 83-OR-14. Prepared for Union Carbide Corporation, Nuclear Division, Oak Ridge, Tennessee by Battelle Columbus Laboratories, Columbus, Ohio, June 1981.

APPENDIX M

ESTIMATION OF HEXACHLOROBENZENE PRODUCTION
FROM COMBUSTION OF PCB

THIS PAGE IS INTENTIONALLY BLANK

APPENDIX M

ESTIMATION OF HEXACHLOROBENZENE PRODUCTION FROM COMBUSTION OF PCB

Ahling and Lindskog (1978) have reported detecting hexachlorobenzene (HCB) in the flue gas from the combustion of PCB in a pilot scale incinerator. The experimental results are presented in Table M-1. A plot of HCB versus combustion temperature is given in Figure M-1.

TABLE M-1. RESULTS FROM THE COMBUSTION OF PCB

<u>Temperature (C)</u>	<u>Time (sec)</u>	<u>Oxygen (%)</u>	<u>HCB^a (mg/kg)</u>
685	1.9	14.0	2.9
690	3.0	12.5	1.8
780	1.9	12.0	1.3
845	1.9	8.2	1.4
850	3.0	8.5	1.7
925	3.8	2.5	22
970	1.6	---	35
1000	1.5	---	30

Source: Ahling and Lindskog (1978)

^a Only the tests showing HCB have been reproduced

Ahling and Lindskog interpret this data as implying that HCB increases with combustion temperature. Duvall, Rubey, and Mescher (1980) also reported detecting HCB in PCB combustion products, but the HCB concentration peaked sharply at about 720 C (1328 F) and then fell rapidly. Ahling and Lindskog had no data points above 1000 C (1832 F) to show whether a similar phenomena was being observed at an elevated temperature.

M.1 Technical Issues

There are several factors which must be considered when trying to use the Ahling and Lindskog data to predict the emissions from the proposed

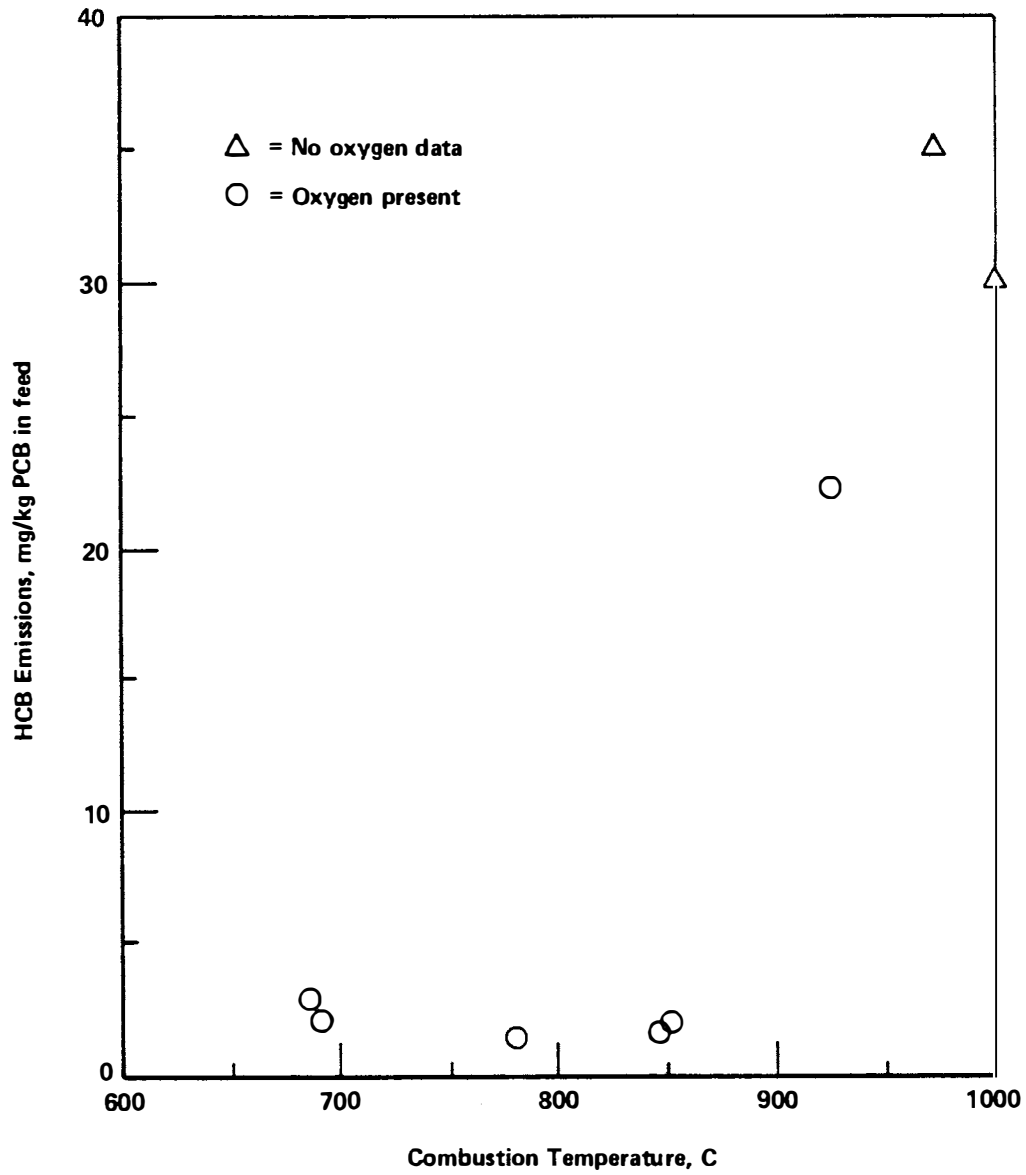


FIGURE M-1. HCB EMISSIONS FROM BURNING PCBS

incinerator. First, no correction was applied to the data for any zero blank. Second, the runs which show the highest level of HCB (mg/kg PCB) had the lowest PCB feed rates (approximately 10% of the others); this could cause a zero correction to be proportionally much larger for these points than for other data points. Third, no oxygen data is reported for two of the three runs, introducing the possibility that the oxygen could have been low. In the same article, Ahling and Lindskog reports that the residual HCB generated when burning pure HCB at 1000 C (1832 F) was only 20 mg/kg. Therefore, it is not likely, at the four second residence time used in the proposed incinerator, that there would be more HCB released from burning PCB than from burning pure HCB.

M.2 Conclusions

An extrapolation of the Ahling and Lindskog (1978) HCB destruction data shows emissions of about 0.003 mg/kg at 1200 C (2192 F). Extrapolation of the Duvall, et al. data shows about 0.3 mg/kg PCB at 1200 C (2192 F). If the Ahling and Lindskog data points without oxygen data are discarded^a, the remaining points can be extrapolated to 0.7 mg/kg. This value has been used for estimating the emissions from the proposed PCB incinerator since it is the highest of the three reasonable estimates.

M.3 References

Ahling, B., and Lindskog, A. Thermal Destruction of PCB and Hexachlorobenzene, The Science of the Total Environment, 1978, 10, 51-99.

Duvall, D.S., Rubey, W. A., and Mescher, J. A. High Temperature Decomposition of Organic Hazardous Waste. Proceedings of Solid and Hazardous Reduction Conference, Chicago, March, 1980.

40 CFR 761. Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution, and Use Prohibitions. U.S. Environmental Protection Agency.

^a It must be noted the EPA requirements for approval of a PCB incinerator include design conditions which will guarantee an excess of oxygen and continuous oxygen monitoring (40 CFR 761).

M-4

THIS PAGE IS INTENTIONALLY BLANK

APPENDIX N

COMMENTS ON THE DRAFT EIS
AND RESPONSES TO COMMENTS

THIS PAGE IS INTENTIONALLY BLANK

COMMENTS ON THE DRAFT EIS AND RESPONSES TO COMMENTS

Comments received by DOE during the public review and comment period are presented with associated responses. In addition, the relevant sections of the text are noted for verification of changes or modification. Comments to which responses have been provided include those made at a meeting of the Oak Ridge City Council and in letters from the following agencies and individuals:

- U. S. Environmental Protection Agency (Paul C. Cahill)
- Tennessee Valley Authority (Mohamed T. El-Ashry)
- Tennessee Department of Public Health (David McKinney)
- Ohio State Clearinghouse (Rose Metzger Roesch) including
 - Ohio Department of Natural Resources (Roger D. Hubbell)
 - Ohio Environmental Protection Agency (Kenneth A. Schultz)
- Kentucky Department for Natural Resources and Environmental Protection (Rose Marie Carr) including
 - Division for Consumer Health Protection (Irving Bell)
 - Division of Water (T. James Fries)
 - Office of Special Projects (Doyle Mills)
- Robert Peele, Commissioner, Roane County
- Erich M. Helbig of Knoxville, Tennessee
- Jennifer Worley of Knoxville, Tennessee

Responses to each letter of comment follow the letter and are keyed to the paragraph or numbered item in the letter. For the last two letters of comment, a copy of a responding letter has been provided.

Comment letters have also been received from the following agencies and individuals; these letters are incorporated at the end of the appendix even though no response is needed.

- Southwestern Power Administration (Paul A. Dols)
- Corps of Engineers (E. C. Moore)
- Corps of Engineers (C. E. Eastburn)
- Ohio Department of Transportation (Byrd Finley)
- Tennessee Department of Agriculture (Paul M. Koger)
- Public Library of Nashville (Leigh Connell)

East Tennessee Development District (Allen W. Neel)
A. L. Sandpiper Corporation (Albert E. Abel).

Oak Ridge City Council Meeting

On December 10, 1981, a public meeting was held with the Oak Ridge City Council at the request of the Council. The following is a synopsis of the comments, questions, and responses from that meeting.

1. Comment: How often has the incineration process been demonstrated?

Response: There are two rotary kiln incinerators in the United States which have been licensed by EPA for the purpose of disposing of PCBs. The rotary kiln technology is widely used in the United States and in Europe for destroying other wastes and in other applications (e.g., cement kilns). The components of the system for controlling air emissions are standard items of equipment.

2. Comment: What quality control measures will apply to the drums used for shipping the waste materials to the incineration facility?

Response: The drums will meet or exceed the DOT requirements for transporting hazardous materials. Drums will not be reused but will be shredded and burned in the incinerator. Drums will be inspected to ensure their integrity prior to shipment.

3. Comment: What are PCBs and what are the health effects associated with PCBs?

Response: PCB is an abbreviation for polychlorinated biphenyl. The PCB molecule consists of 12 carbon atoms in 2 benzene rings (hence, biphenyl) attached by 1 carbon-to-carbon bond. Two or more of the hydrogen atoms in the biphenyl molecule are replaced by chlorine atoms (hence, polychlorinated); there may be up to 10 such chlorine atoms in the PCB molecule.

PCBs are widely distributed in the environment because of the large number of common applications in which they were used since production began in 1929. Common uses of PCBs include transformers and capacitors (due to dielectric and heat transfer properties), cutting oils, hydraulic fluids, heat transfer fluids, paints, plasticizers, dye carriers, and carbonless paper.

PCBs are readily absorbed into the human body through the intestines and the lungs and may also be absorbed through the skin. The more highly chlorinated PCBs are not readily metabolized and tend to build up in fatty tissues over time. While high-level, short-term exposure to PCBs can cause acute health effects (including chloracne, nausea, numbness, and other effects which may last for many years), the major concern in the United States is the effects of the long-term, low-level exposures which may occur from PCBs in the environment. These effects include suspected carcinogenicity (cancer and leukemia), teratogenicity (birth defects), and other reproductive effects.

PCBs, especially the more highly chlorinated forms, are persistent once released into the environment. That is, they are not readily degraded by normal environmental processes. For this reason, the only safe method of disposal for large amounts or high concentrations of PCBs is their destruction.

4. Comment: Why are PCBs generated at the five DOE facilities?

Response: PCBs are not "generated" at the five DOE facilities. Rather, PCBs have been used at the facilities in electrical equipment and in other ways in which PCBs have commonly been used in industry. The largest use has been in transformers and capacitors due to the large amount of electrical equipment used in the facilities. As this equipment fails or is otherwise replaced, the PCBs in the equipment will require disposal.

5. Comment: Is the intent of the federal regulation the elimination of PCBs?

Response: In the Toxic Substances Control Act of 1976, Congress banned the further manufacture or import of PCBs. Under the law, the only purpose for which PCBs may be commercially transacted is disposal through a U.S. Environmental Protection Agency licensed process, and disposal of PCBs is regulated by EPA. For the concentrations of PCBs in the materials of the type now in service and in storage at the DOE facilities, the only generally approved method of disposal is incineration.

6. Comment: What is the method for disposing of the liquids decanted from the drums?

Response: The liquids will be burned in the incinerator.

7. Comment: What is the enrichment level of the uranium in the wastes? Is this a weapon-quality material?

Response: No materials will be incinerated in the proposed facility if the percentage of the uranium-235 isotope exceeds one percent of the total uranium. This compares to the naturally occurring ratio of seven-tenths of one percent. This material is well below the level of enrichment required for weapons use.

The total uranium concentration in the waste materials will average less than 200 ppm (0.02 percent). The highest concentration identified in the presently stored wastes is 10,000 ppm (one percent) in one container. Thus, both the total uranium content and concentration of the uranium-235 isotope will be small.

8. Comment: Will the effluents and emissions from the facility be sampled and how will this be accomplished? Will records of the sampling and other documentation be maintained?

Response: The gaseous emissions from the incinerator will be monitored on a continuous basis using standard, state-of-the-art sampling and analysis methods which will be specified in the detailed engineering phase. Criteria for such sampling are specified by EPA; the present criteria are shown in Section 2.1.1.7 of the EIS.

The liquid effluent from the facility will be retained and tested for organic contamination before being pumped to the K-1407 facility. Aqueous effluent which contains unacceptably high concentrations of organic chemicals will be treated with activated carbon and retested before release. Pollutants will not be discharged above the respective permit levels, which will be established in the NPDES permitting process.

Solid waste residues from the incinerator (ash and scrubber solids) will be analyzed for PCBs and other organic constituents. If the PCB concentration is greater than 50 ppm, this material will be re-incinerated and retested.

Detailed records will be maintained on the sampling of the emissions, effluents, and solid waste, as well as the materials received for disposal. Such documentation will be maintained indefinitely.

9. Comment: How was the dispersion of airborne emissions estimated and where are the places of highest impact?

Response: The dispersion of airborne emissions was estimated using standard models. As detailed in Section 4.2.1 and Appendix H of the EIS, the modeling took a conservative approach to estimating the concentration of pollutants at nearby residences, thus tending to overestimate those concentrations. One such conservative assumption was that the intervening ridges would not contribute to dispersing the pollutants, when, in fact that will be the effect of such ridges in the present case.

The residences of highest impact are identified on a new figure which has been added to Section 4.2.1. The small black squares on the figure represent residences in the area of highest long-term public exposure to pollutants from the proposed incinerator. [A similar figure was shown at the meeting.]

10. Comment: How was the analysis of the cumulative effects performed given the proposed Clinch River Breeder Reactor and the proposed Tennessee Synfuels Associates plant?

Response: The effects of the proposed incinerator are very small. An evaluation of the cumulative impacts of the proposed incinerator with the Clinch River Breeder Reactor showed no significant interaction between the impacts of the two facilities. When this EIS was prepared, data on the proposed Tennessee Synfuels Associates Plant were not available for the purpose of cumulative impact estimation.

11. Comment: The presentation described controls for airborne emissions of uranium and hydrochloric acid. What will be the emissions of other pollutants, such as sulfur dioxide, and how will these be controlled?

Response: The potential airborne emissions of concern from the proposed facility fall into three classes: products of incomplete combustion (organic compounds), soluble gases (hydrochloric acid, oxides of sulfur and nitrogen, etc.), and particulates (ash, metals, etc.).

The proposed incinerator is designed to operate at conditions (high temperatures, excess oxygen, retention time) which will ensure that the efficiency will exceed the required efficiency: conversion of 99.9 percent of the carbon to carbon dioxide, 99.99 percent destruction of other hazardous waste, and emissions of not more than 1.0 milligram of PCB per kilogram of PCB

in the solids fed to the incinerator. Only minute quantities of organic compounds should be emitted from the incinerator and operating controls will automatically shut down the waste feed to the incinerator if organic emissions exceed preestablished levels.

Soluble gases from the incinerator will be removed by water contact in three parts of the control system: the quench chamber, the venturi scrubber, and the packed-bed scrubber. The addition of caustic (sodium hydroxide) to the scrubber liquid will also increase the removal efficiency of the system. The amounts of sulfur, fluorine, and phosphorous in the waste materials will be low; chlorine, in the form of hydrogen chloride, is the major soluble gas of concern.

Particulates from the incinerator will be removed through contact with water in the quench chamber and the venturi and packed-bed scrubbers. The wet electrostatic precipitator will also remove particulates.

Note that the emissions shown in Table 4-5 are expressed in kilograms per year. This contrasts with the usual table of this sort in which emissions are given in tons per year.

12. Comment: The DEIS seems to indicate an additional flow of 750 gallons per minute to the K-1407 neutralization pit, which would place the total flow above the design capacity of the pit. Please explain.

Response: The proposed incinerator will add about 20 gallons per minute to the K-1407 facility. The present flow from the K-1700 outfall is 750 gallons per minute, 450 gallons per minute of which is from the K-1407 facility.

13. Comment: The presentation indicated that the drums will be sampled before shipment and on arrival at the facility. What analyses will be performed and how will the information be used? How will the incineration facility handle immiscible wastes?

Response: A complete waste characterization will be performed to identify the type and quantity of material in the drum. This analysis will involve analytical methods such as mass spectrometry and gas chromatography. The data will be used to limit the exposure of employees to hazardous materials, to determine the appropriate mix of wastes, air, and fuel in the

incinerator, and to ensure that wastes do not react violently when mixed. Separate burners are planned for aqueous and nonaqueous wastes.

14. Comment: There appears to be a typographical error in Table 2-4. The fourth entry under "Proposed Incinerator" should be "yes" rather than "no".

Response: The comment is correct. The typographical error is corrected in the Final EIS.

15. Comment: What are the sources and types of wastes which the incinerator will accept? Will any wastes be accepted from non-DOE facilities? Could a future decision be made to accept other wastes?

Response: The sources of wastes will be the five DOE facilities described in the EIS. These are the three gaseous diffusion plants, the Y-12 plant, and Oak Ridge National Laboratory. The wastes from these facilities will be primarily organic chemicals and oils which have trace contamination with uranium. No waste would be shipped to the facility if it contained uranium which could cause a criticality incident.

There are no plans to accept from any facility other than those identified in the EIS, nor is the facility designed to accept such wastes, particularly any wastes with higher levels of nuclear contamination.

16. Comment: What will happen to the ash from the incineration facility? Will the ash be radioactive or hazardous?

Response: The majority of the ash will be residue from dirt fed to the incinerator and from the drums and shredded capacitors. The ash will contain approximately 60 parts per million (0.006 percent) uranium; less than 50 parts per million PCB, and small amounts of other metals. The PCB and organic content should be very small; given the high heat of the incinerator, these materials should not be present in the ash. This ash, although not hazardous and comparable to coal ash in radioactivity, will be buried in a then existing landfill for low-level radioactive waste, managed by the Y-12 plant.

17. Comment: The presentation indicated that wastes will be stored in tanks at the facility prior to incineration. Have the risks of fire and explosion involving the tanks been assessed and what are those risks?

Response: The risks of fire and explosion were assessed in the Preliminary Safety Analysis Report (PSAR) on the proposed facility. The purpose for that report is to guide the final design to reduce possible risks to employees and to public safety. The PSAR identified three types of accidents as sufficiently probable and of sufficient adverse consequence to deserve further attention in the final design process. These all involved fire or explosion and one involved the storage of wastes in tanks.

A storage tank fire could either be internal to or external to the tank. As presented in Section 4.8.1.2 of the EIS, the probability of either type of fire occurring during a twenty-five year period was estimated to be between 1 in 100 and 1 in 10,000. The significant potential adverse consequences of either accident would be short-term exposure of incinerator employees to levels of PCBs above established occupational exposure levels.

18. Comment: The DEIS indicates that the preferred route from Piketon passes directly through downtown Oak Ridge. How was this route selected and why is it the preferred route?

Response: This route was selected in four steps. First, potential routes were identified by interviewing a number of people involved in shipping operations in the area, including personnel from each of the five facilities, the Oak Ridge Operations Office, and contract trucking firms in the area. These personnel identified their preferred and alternate routes and the reasons for their preference. Second, the routes which were identified were examined by driving the routes to identify potential hazards and other factors (width of pavement, stream and river crossings, etc.). Third, proposed routes were selected which minimize the exposure to hazards and to conditions which exacerbate the adverse impacts of an accident. Fourth, accident statistics were gathered on each segment of the proposed routes. From these statistics, hazardous segments were identified and examined to see if a safer segment could be used to replace the hazardous one. Based on this analysis, the proposed routes were selected. The route through downtown Oak Ridge is the safest and least hazardous alternative for the materials to be shipped from the Portsmouth Gaseous Diffusion Plant.

19. Comment: Will the shipments be made by contract carriers?

Response: Yes. The carriers which DOE normally contracts for shipment will be used. One of the factors in the selection of these carriers is their safety record and experience in handling hazardous materials.

20. Comment: What effect would changes in the Clean Air Act have on the proposed air emissions control system; specifically, would a less efficient system be used if the Clean Air Act were made less stringent?

Response: Because the facility is so small, it will be below the size at which regulations under as the Clean Air Act apply. The purpose for emission control equipment is not to meet clean air standards but to reduce air emissions to the lowest level reasonably achievable with state-of-the-art technology. If the Clean Air Act were made less stringent, the proposed air emissions control system would not be made less efficient.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JAN 12 1982

OFFICE OF
THE ADMINISTRATOR

Mr. J. F. Wing, Chief
Environmental Protection Branch
Oak Ridge Operations
Department of Energy
P.O. Box E
Oak Ridge, Tennessee 37830

Dear Mr. Wing:

In accordance with Section 309 of the Clean Air Act, as amended, the U.S. Environmental Protection Agency (EPA) has reviewed the Draft Environmental Impact Statement (DEIS) for the Incineration Facility for Radioactively Contaminated Polychlorinated Biphenyls and Other Wastes (DOE/EIS-00840).

The proposed facility is a state-of-the-art design for this type of incinerator, and the design is similar to that in use at other EPA approved facilities. Since most of the wastes are located at Oak Ridge, EPA agrees with DOE's decision to exclude other sites from detailed analysis in the EIS.

EPA has a number of regulations (40 CFR 761) under the Toxic Substances Control Act for the handling and disposal of PCBs. These regulations specifically exempt source, special nuclear, and by-product material (as these terms are defined in the Atomic Energy Act of 1954, as amended, and regulations issued under that Act.) This exemption may be found at 40 CFR 761.2 (e)(iv).

Table 2-1 suggests that not all the PCB contaminated materials are also radioactively contaminated. In such a case it would appear that some of the PCB material would be exempt from EPA's regulations and some of the material would not be exempt. Under the latter circumstance we recommend that the Department of Energy or its contractor obtain approval from EPA's Regional Administrator in Atlanta for this incineration under Annex I of EPA's PCB regulations (40 CFR 761.40). The final EIS should indicate whether this approval will be sought.

C081

JAN 18 1982

In addition to 40 CFR 761, EPA has a number of regulations for the disposal of hazardous wastes under the Resource Conservation and Recovery Act (RCRA), as amended (40 CFR 260 et seq.). Section 1004 (27) of the Act provides specific exemption for source, special nuclear, or by-product material (as defined by the Atomic Energy Act of 1954, as amended). Additionally, RCRA, Section 1006, states: "Nothing in this Act shall be construed to apply to ... any activity or substance which is subject to the ... Atomic Energy Act of 1954 (42 USC 2011 and following) except to the extent that such application (or regulation) is not inconsistent with the requirements of such Acts." EPA therefore believes that the proposed disposal operations of hazardous wastes from DOE's Atomic Energy Act facilities is exempt from the provisions of RCRA. It is recommended that DOE's views on the applicability of RCRA to its activities be presented in the final EIS.

Our detailed comments are enclosed. In keeping with EPA's procedures we have rated this proposed facility LO (lack of objections); we have rated the draft EIS as Category 2 (further information requested). Should you have any questions of if we can help you further, please call Dr. W. Alexander Williams (202-755-0790) of my staff.

Sincerely,



Paul C. Cahill
Director
Office of Federal Activities

Enclosure

Detailed Comments
of the
U.S. Environmental Protection Agency (EPA)
on the
Draft Environmental Impact Statement (EIS)
for an
Incineration Facility for Radioactively
Contaminated Polychlorinated Biphenyls
and
Other Wastes

- 1) Both Sections 2.2.1.9 and 2.2.1.10 would be greatly improved with flow diagrams.
- 2) The final EIS should discuss whether the proposed incinerator will accept PCBs or other wastes from DOE facilities outside the Oak Ridge Operations Area, other governmental facilities, or private sources.
- 3) The emission rates for Be and dioxins in Table 4-7 are not carried over from Table 4-5 properly. This discrepancy should be corrected.
- 4) Additional information (Section 4.2.2) should be presented on the Y-12 landfill site. Are the trenches lined? Does the site have a leachate collection system? Are there wells for monitoring groundwater? What is the direction of water flow in the trenches and in the land fill area?
- 5) The section on accidents Section 4.8 should include a discussion of accidental releases to water during transportation and operations. What procedures could be followed to keep accidentally spilled waste materials from entering drinking water?
- 6) The final EIS should indicate how the shipments of waste materials will be placarded during transportation. Will the wastes be placarded as flammable, radioactive, PCBs, all of these, or what?

U.S. Environmental Protection Agency

21. Comment (from paragraph 4): Please indicate whether or not DOE or its contractor will obtain approval from EPA - Region IV for incineration of PCB contaminated material under Annex I of EPA rules (40 CFR 761.40).

Response: Since it is contemplated that some PCB material that is not exempt from EPA regulation may be incinerated in the facility, at the appropriate time, DOE will seek EPA approval under 40 CFR 761.40 with regard to these materials.

22. Comment (from paragraph 5): It is recommended that DOE's views on the applicability of RCRA to its activities be presented in the final EIS.

Response: DOE is authorized by the Atomic Energy Act of 1954, as amended (AEA), to prescribe and enforce its own regulations and other requirements for the sound management of its AEA activities. DOE believes that, pursuant to section 1006(a) of the Resource Conservation and Recovery Act (RCRA), DOE AEA facilities such as the proposed incinerator are not subject to EPA's hazardous waste management regulations under RCRA, or any State requirements approved by EPA under RCRA.

DOE is committed to the sound management of all activities, including waste disposal, conducted under the AEA. As part of this effort, DOE is presently studying EPA's RCRA regulations to determine how best to assure that management of even those activities not directly regulated by RCRA will achieve the functional equivalent of EPA's regulations.

23. Comment (item 1 in enclosure): Sections 2.2.1.9 and 2.2.1.10 would be improved with flow diagrams.

Response: The text (actually Sections 2.1.1.9 and 2.1.1.10) identifies the solid and liquid waste management systems appropriately for the purposes of the discussion. While DOE agrees that flow diagrams assist the reader in understanding the overall relationships between various subsystems, DOE has opted not to include diagrams because the textual description is sufficient.

24. Comment (item 2 in enclosure): The final EIS should discuss whether the incinerator will accept PCBs from other sources.

Response: The proposed action description clearly indicates that the proposed incinerator will accept wastes only from the DOE facilities listed in Chapters 1 and 2 of the EIS. The capacity of the incinerator will be matched to the disposal needs of those facilities. Please also see the responses to Comment 15 (Oak Ridge City Council) and Comment 36 (TVA).

25. Comment (item 3 in enclosure): The emission rates for Be and dioxins in Table 4-7 are not carried over from Table 4-5 properly. This discrepancy should be corrected.

Response: DOE concurs with this statement. The beryllium and dioxin emission rates have been corrected in the Final EIS.

26. Comment (item 4 in enclosure): Additional information (Section 4.2.2) should be presented on the Y-12 landfill site. Are the trenches lined? Does the site have a leachate collection system? Are there wells for monitoring groundwater? What is the direction of water flow in the trenches and in the land fill area?

Response: The trenches are not lined and the site does not have a leachate collection system. For monitoring groundwater quality, there are twenty-five wells. Please also see the response to Comment 16, from the Oak Ridge City Council meeting, regarding the character of the ash and ash disposal plans, and the response to Comment 31 (TVA).

27. Comment (item 5 in enclosure): Consideration should be given to the environmental effects of transport accidents on potable water supplies, and associated mitigative control measures (Section 4.8.2).

Response: The DEIS indicated that the probability of contaminant release to the public water supply was extremely low because of the small waste quantities, the fate and transport mechanisms of PCBs, infrequent hauling schedules, and the low number of watercourses intersecting the proposed routes (see also Comment 55 from the Division of Water, Kentucky Department of Natural Resources and Environmental Protection). Studies of previous spills (see references below) suggest that the majority of spilled materials may be recoverable. The nature of PCBs and the other materials suggests that they are not likely to enter a water supply intake in significant quantities, even if a spill should occur.

In the event a spill occurs, State and local officials will be contacted and emergency response procedures implemented in accordance with the nature and extent of the accident.

DOE solicited information on public water supply intakes and the communities served from the States of Kentucky, Tennessee, and Ohio (October 30, 1981) in order to specify more precisely the potential public health risks associated with waste transport. The analysis in the EIS is based upon the best available information.

References

EPA 904/9-76-104. Study of the Distribution and Fate of Polychlorinated Biphenyls and Benzenes after a Spill of Transformer Fluid. Environmental Protection Agency, 1976.

EPA 910/9-77-039. Monitoring of Trace Constituents During PCB Recovery Dredging Operations: Duwamish Waterway. Environmental Protection Agency, 1977.

28. Comment (item 6 from enclosure): The Final EIS should indicate how the shipments of waste materials will be placarded during transportation.

Response: Motor vehicles transporting hazardous material will be placarded in accordance with DOT regulations (40 CFR 172.500). The placard will describe the material(s) being transported so that emergency response personnel can quickly identify the material and response appropriately should an accident occur. Section 2.1.1.1.3 has been revised to reflect this requirement.

TENNESSEE VALLEY AUTHORITY
KNOXVILLE, TENNESSEE 37902

DEC 28 1981

Mr. J. F. Wing, Chief
Environmental Protection Branch
Department of Energy
Post Office Box E
Oak Ridge, Tennessee 37830

Dear Mr. Wing:

This is in response to your request for comments on the draft impact statement entitled "Incinerator Facility for Radioactively Contaminated Polychlorinated Biphenyls and Other Wastes." In general, we think the draft EIS adequately addresses the environmental consequences of the proposed actions and adequately considers alternatives. We do have several comments which we hope are helpful to you in preparing the final statement.

Specific Comments

1. Section 3.1.5--We think the discussion of major faults in the Oak Ridge Reservation area and the occurrence of earthquakes should mention that the major faults (i.e., Copper Creek fault and White Oak Mountain fault) and their subsidiaries are considered seismically inactive and, therefore, do not contribute to the regional seismicity.
2. Section 3.8.2--This section implies that the DOE plants do not contribute any particulate emissions at all and we wonder whether this is the case. Also lead is one of the seven criteria pollutants and should be included.

We suggest that comparisons also be made of measured concentrations, the 3-hour and annual sulfur dioxide standards, and the annual particulates standard. If any monitoring data are available for any of the other criteria pollutants, they should also be included.

3. Section 4.1.3--We question whether a low-level radioactive disposal site is appropriate for the disposal of PCBs and other hazardous waste residues from the incineration process. We believe these residues should be disposed of in accordance with the applicable requirements defined by the U.S. Environmental Protection Agency (EPA). The low-level radioactive waste disposal site is not described in the environmental impact statement and such a site may not meet the EPA requirements.

Mr. J. F. Wing, Chief

DEC 28 1981

Also, the EIS does not discuss the burden to be placed upon the Y-12 site in terms of the concentration of non-PCB contaminants, anticipated waste volumes, or levels of radioactivity. The nature and extent of this environmental impact should be addressed.

4. Section 4.2.1--In the seventh paragraph of this section, reference is made to factors derived from Turner. It would be helpful to state these factors more specifically. Also in the next paragraph and in other places where average pollution concentrations are discussed, it should be stated whether they are arithmetic or geometric means.
- 5.. Section 4.2.1, Table 4-7--The two columns on the right side give the annual geometric mean concentrations for several pollutants. A geometric mean is usually used for particulate concentrations and the annual particulate standard is based on a geometric mean. For the other pollutants, annual concentrations are usually calculated as arithmetic means and the annual standards are also based on arithmetic means. If there is a specific reason why geometric means were used for these pollutants, we feel it should be stated.
6. Section 4.3.2--This section states that watering will mitigate the impacts from construction activity dust, but does not include a commitment to do any watering. Such a commitment should be included.
7. Appendix H, Page H-4--We suggest that discussion of the meteorological data used in estimating annual average concentrations of pollutants be included, along with a discussion of the extent to which these data are representative of the proposed incineration facility location.

General Comments

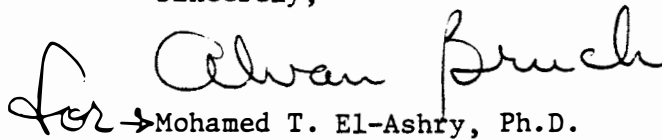
1. While we recognize that this incineration facility is being planned exclusively for the disposal of waste generated at DOE plants, we feel more consideration should be given to possible use of the proposed facility by others. We recognize the difficulty inherent in designing and operating a facility which would serve both public and private sector needs. However, given the need for such facilities and what appears to be excess capacity in the one planned, such an option should be explored.

DEC 28 1981

Mr. J. F. Wing, Chief

2. The construction and initial operation of the incinerator are coincident with construction in the near vicinity of the proposed Clinch River Breeder Reactor and possible construction of the Koppers Coal Liquefaction Project. A more detailed discussion of the potential cumulative socioeconomic impacts which will result from all three projects, along with such things as impact on the local highway transportation network, would be helpful.

Sincerely,

The signature is written in cursive and appears to read "Alvan Bruch".

for → Mohamed T. El-Ashry, Ph.D.
Assistant Manager of Natural
Resources (Environment)

Tennessee Valley Authority

29. Comment (item 1): The discussion (Section 3.1.5) of major faults in the Oak Ridge Reservation area and the occurrence of earthquakes should mention that the major faults and their subsidiaries are considered seismically inactive and, therefore, do not contribute to the regional seismicity.

Response: DOE agrees that the major faults do not contribute to the regional seismicity. This fact is pointed out in Section 4.8.1.4, which accesses the potential for earthquakes to occur. Parenthetically, DOE notes that the reference in Section 3.1.5, NUREG-0139, elaborates on this subject matter.

30. Comment (item 2): Section 3.8.2 implies that the DOE plants do not contribute any particulate emissions at all, and we wonder whether this is the case. Also lead is one of the seven criteria pollutants and should be included.

We suggest that comparisons also be made to measured concentrations, the 3-hour and annual sulfur dioxide standards, and the annual particulates standard. If any monitoring data are available for any of the other criteria pollutants, they also should be included.

Response: Section 3.8.3 does not imply that the DOE plants do not contribute particulate emissions. For the purposes of analysis, relevant information was extracted from the referenced documents in accord with the CEQ regulations which implement NEPA (40 CFR 1500-1508). The reviewer is encouraged to refer to these data sources for clarification of air concentrations and standards relating to other pollutants.

31. Comment (item 3): With regard to disposal of hazardous waste residues from the incineration process, the EIS does not address the following areas sufficiently: (1) a description of the low-level radioactive waste disposal site, (2) the impact of the disposal of incineration wastes (e.g., concentration of non-PCB contaminants, waste volumes, radioactivity levels), and (3) compliance with EPA standards.

Response: Sections 4.1.3 and 4.2.2 describe the proposed site, waste volumes, and other related data in the detail necessary to convey the basis for statements regarding site suitability and anticipated environmental

effects. Background documents are referenced for those individuals requiring more specific information on the site. The solid waste from the incinerator will not be hazardous and the level of radioactivity will be low, in the same range as the radioactivity in coal ash. Please see also the responses to Comment 16 (Oak Ridge City Council) and Comments 22 and 26 (EPA).

32. Comment (item 4). Please provide the factors derived from Turner in Section 4.2.1 and indicate whether geometric or annual means were used to calculate the annual average concentrations in paragraph 7 of this section.

Response: These factors, as shown below, show the variation of calculated concentration with sampling time:

<u>Sampling Time</u>	<u>Ratio of Calculated Concentration to 3-minute Concentration</u>
3 minutes	1.00
15 minutes	0.82
1 hour	0.61
3 hours	0.51
24 hours	0.36

The average annual concentrations referred to in Section 4.2.1 are arithmetic means.

33. Comment (item 5): Table 47 of Section 4.2.1 shows annual geometric mean concentrations for several pollutants, which are usually calculated as arithmetic means. Please state the reasons for this representation.

Response: Columns 4 and 5 of Table 4-7 were incorrectly labelled. The pollutant concentrations are arithmetic means. The table has been corrected.

34. Comment (item 6). Section 4.3.2 states that watering will mitigate impacts from construction activity dust, but the report does not include a commitment to this activity. Such a commitment should be included.

Response: DOE will design and operate the facility to meet all applicable environmental standards. Commitments to control technologies, such as dust suppression methods, are recognized to be essential to operating the

facility in an environmentally acceptable manner. DOE expects that this particular control strategy will be adopted during the permitting process.

35. Comment (item 7): We suggest that the meteorological data used in estimating annual average concentrations of pollutants be included in Appendix H, along with a discussion of the extent to which these data are representative of the proposed incineration facility location.

Response: The air quality analyses were conducted using the best available local data and the particulate emission rate estimated for the incinerator. The text in Appendix H has been revised to indicate the source of the meteorological data. DOE emphasizes that the conservative approach to the air quality analysis (which tends to overestimate air quality effects) has resulted in a finding of insignificant air quality impact.

36. Comment (second item 1). Consideration should be given to the use of the facility by both public and private sectors.

Response: The proposed action, as described in the EIS, does not involve acceptance of wastes from sources other than the five DOE facilities. The proposed size of the incinerator and the existing backlog are not compatible with such an action. A decision to accept wastes from other facilities would require a separate environmental review. At this time DOE does not consider the proposal for acceptance of both DOE and non-DOE wastes a reasonable alternative. Please also see the responses to Comment 15 (Oak Ridge City Council) and Comment 24 (EPA).

37. Comment (second item 2): The cumulative socioeconomic impacts which would result from the Clinch River Breeder Reactor, Koppers Coal Liquefaction Plant, and the incineration facility should be addressed.

Response: The socioeconomic analysis in this EIS established that there would be no significant impacts associated with the proposed incinerator. Analysis of the cumulative impacts was determined to be inappropriate on this basis. However, the environmental impact statements prepared for the Tennessee Synfuels Associates plant and Clinch River Breeder Reactor may be referred to for the results of the socioeconomic impact analyses associated with those projects.



STATE OF TENNESSEE
DEPARTMENT OF PUBLIC HEALTH
EAST TENNESSEE REGIONAL OFFICE
ALEX B. SHIPLEY REGIONAL HEALTH CENTER
1522 CHEROKEE TRAIL
KNOXVILLE, TENNESSEE 37920

December 7, 1981

Mr. J. F. Wing, Chief
Environmental Protection Branch
Safety and Environmental Control Division
Department of Energy, Oak Ridge Operations
P.O. Box E
Oak Ridge, Tennessee 37830

Re: Comments from Tennessee Water Quality
Control, Department of Public Health,
regarding the Draft Environmental Impact
Statement - Incinerator Facility for Radio-
actively Contaminated Polychlorinated
Biphenals and Other Wastes.

Dear Mr. Wing:

The following are this Division's comments regarding the above referenced Environmental Impact Statement. As proposed wastewater treatment facilities for this project will significantly modify effluent characteristics for an existing treatment facility and appropriate NPDES permits, a complete engineering report in accordance with Tennessee Water Quality Control permitting procedures will be required.

The following comments address significant water quality related questions. Upon receipt of requested data and D.O.E. response to T.W.Q.C. comments, final questions will be formalized in an expedient manner.

We appreciate the opportunity for input into your planning process. If we may further assist, please advise.

Sincerely,

A handwritten signature in dark ink, appearing to read "David McKinney".

David McKinney
Assistant Basin Manager
Tennessee Water Quality Control

ADM/lwm B/3

cc: Ken Bunting - TWQC Nashville
Paul Davis - TWQC Permit Section - Nashville

1) Page 2-22 (2.1.1.10) Liquid Effluent Control:

- a) In order to determine the impact of the proposed waste treatment system upon existing NPDES permits and receiving streams, it will be necessary to submit a complete engineering report to this Division in accordance with normal permitting procedure. Following review of this document, specific comments and questions will be forwarded.
- b) Methods and procedures for sampling and analyzing purge flow should be defined.
- c) The engineering report should address all aspects of the proposed project including specifics for the activated carbon system. The definition and criteria used to determine ". . . acceptable levels of organics" should be identified.

2) Page 2-25 (2.1.2.3.) Liquid Wastes:

- a) Methods and procedures for sampling and analyzing storm and fire water, and ash pit water, should be defined. Detection limits, parameters, and criteria for determining acceptable levels of contamination should be identified.

3) Page 2-27 (2.1.2.5) Effluent Migration:

- a) NPDES effluent limitations and discharge criteria will be based upon water quality considerations. The availability of funding, federal or otherwise, is exterior to the permitting process.

4) Page 2-31 (2.1.3.2.) Transport Accident:

- a) A description of the transport vehicle should be provided. Compartmentalized tankers may provide increase protection for partial loads.

5) Page 2-32 (2.1.3.2) Transport Accident

- a) The impact of PCB, solvents, and/or uranium released to surface waters from accidental spills would require response and assessment. Characterization of the loss of up to 17,000 lbs. of PCB as not significant when compared to the total U.S burden is irrelevant.
- b) This section should include a worst case scenerio in the event of maximum PCB loss to high quality free flowing stream during critical flow (3-Q-20).

6) Page 2-33 (2.1.3.4.) Spill Containment and Control

- a) This Division will request a copy of the E.P.A. approved SPCC plan should this facility become operational.

7) Page 3-9 (3.6) Aquatic Ecology

- a) T.W.Q.C. completed extensive fish sampling of the Clinch River and Lower Poplar Creek in 1978 to determine heavy metals concentrations in fish. The results of this work have been provided to D.O.E. If the fishery report referenced here is from collections since 1978, we request a copy of this data including any analytical results for organics or heavy metals.

8) Page 3-2 (3.8.3) Water:

- a) In order to evaluate the background levels in Poplar Creek and the Clinch River, please provide a copy of the data used to determine the mean and range values for heavy metals referenced here and in Table D-2; sample locations, mile points, methods and procedures should be included.

9) Page 3-13 (3.8.4) Biota

- a) As in comment #7, please supply the data referenced here including species, weight, length, sex, and sample location.

- b) Page 3-14: This section should identify present ORGDP operations which may be contributing to the total metal/organic burden in the fishery. In addition, those past activities known to have contributed to the existing burden should be identified.

With regard to low flow considerations, please supply data indicative of "...severe local impacts..." resulting from existing discharges during critical conditions.

10) Page 4-18 (4.2.3.1) Direct Impacts:

- a) Neither best management practice or best available technology criteria recognize dilution as an acceptable treatment scheme.
- b) Page 4-19: Please provide information regarding "...respective permit limits" for referenced organics. Are limits established for an existing NPDES permit or are limits anticipated under future permits?
- c) It is unclear if sediment transport predictions for PCB in the Clinch River are based on actual hydrological modeling; if so, please provide model description. A mile point for anticipated PCB deposition should be provided; if sampling data exist to support the concept of concentrated chlorinated-organic deposition, such information should be provided.

11) Page 4-20 - Table 4-8, Impact on Poplar Creek:

- a) Table 4-8 should be revised to reflect effects on Poplar Creek during the 3-Q-20 year low flow and maximum discharge from treatment facilities; daily maximum poundage should be computed for each parameter instream and in the effluent. Poplar Creek receives effluents from several other D.O.E. discharges which should be included as background and evaluated during B 3-Q-20 low flow; the combined impact of all discharges should be addressed.

12) Page 4-12, Paragraph #2:

Dilution of a treated effluent within an instream mixing zone cannot be considered as a component of a waste treatment scheme.

13) Page 4-26 (4.3.2.) Construction Activities:

A detailed erosion/siltation control plan should be included as part of the site preparation engineering plan.

14) Page 4-63 (4.9.2.) Water Resources

Unavoidable impacts are inadequately described as this EIS fails to consider critical case situations including impacts upon Poplar Creek during 3-Q-20 yr. low flow conditions.

ADM/lwm/pg B/4

Tennessee Department of Public Health

38. Comment (items 1 and 2): The report should address all aspects of the proposed project, including the following areas:

- A complete description of the activated carbon system (Section 2.1.1.10)
- Specification of criteria to be used in determining "acceptable levels of organics" (Section 2.1.1.10)
- Methods of analyzing and sampling purge flow (Section 2.1.1.10); storm and firewater, and ash pit water (Section 2.1.2.3).

Response: Detailed engineering design, construction, and operational plans and procedures such as those illustrated above will not be prepared and, hence, will not be available, until sometime after authorization has been received from Congress, that is, after a decision is made to proceed with the proposed project. This decision will be made subsequent to the issuance of the Final EIS. When completed, these documents will be available on request from DOE at the addresses listed on the cover sheet. The criteria for acceptability of liquid effluents may be established as part of the review process under the EPA regulations for operation of a PCB incinerator.

39. Comment (item 3): NPDES effluent limitations and discharge criteria will be based on water quality considerations. The availability of funding is exterior to the permitting process (Section 2.1.2.5).

Response: DOE agrees with this statement. The proposed treatment facility is discussed, however, in order to establish its potential effect on the effluent discharge relative to that from the existing treatment facility. The analysis had already indicated that the proposed incineration facility would have minimal effect on the water quality of Poplar Creek.

40. Comment (item 4): A description of the transport vehicle should be described in Section 2.1.3.2. Compartmentalized tankers may provide increased protection for partial loads.

Response: A detailed description of the vehicle will be developed if a decision is made to proceed with the proposed project. This type of information would be developed as part of the detailed engineering design and construction plans which, when completed, will be available on request from DOE at the address listed on the cover sheet.

41. Comment (item 5): With regard to Section 2.1.3.2 on transport accidents, there are two comments:

- The impact of PCB, solvents, and/or uranium released to surface waters from accidental spills would require response and assessment.
- This section should include a worst case scenario in the event of maximum PCB loss to a high-quality, free-flowing stream during critical flow (3-Q-20).

Response: The impact of contaminants on surface waters should a transport accident occur are addressed in Section in Section 4.8.2.3. Section 4.8.2.3 (a new section added to the FEIS) considers the water quality impacts from an accident during critical flow conditions. Please also see the response to Comment 27 (EPA) and Comment 55 (Division of Water, Kentucky Department of Natural Resources).

42. Comment (item 6): An approved SPCC plan will be requested should the facility become operational.

Response: DOE will provide a SPCC for the facility on request, should it become operational.

43. Comment (items 7 and 9a): The State of Tennessee requests the sampling data, including analytical results on organics and heavy metals, referenced in Section 3.6. In addition, the sampling data referenced in Section 3.8.4 should be specified in greater detail.

Response: The supporting document referenced in Section 3.6, "Ecological Studies of Biotic Communities in the Vicinity of the Oak Ridge Gaseous Diffusion Plant" (ORNL/TM-6714), was forwarded to the Tennessee Department of Public Health at the time of publication in 1981; DOE would be pleased to send additional copies on request. With regard to the request for greater specificity of sampling data, DOE refers the reader to the referenced document for further information. DOE has summarized the pertinent results for the purposes of the EIS, in accord with the requirements of the regulations which implement NEPA (40 CFR 1500-1508).

44. Comment (item 9b). Section 3.8.4 should identify present and past ORGDP operations which may be contributing to the total metal/organic burden in the fishery. With regard to low flow considerations, please supply

data indicative of "...severe local impacts..." resulting from existing discharges during critical conditions.

Response: Although data on baseline conditions are relevant to the assessment of impacts, data on past operations are not relevant to the analysis of impact of the proposed incinerator. The data supporting the statement of severe local impacts is provided in the cited document (DOE/EA-0106) which was routinely provided to the Tennessee Department of Public, and is available from DOE on request.

45. Comment (item 8). The data used to determine the heavy metal mean and range values in addition to associated methods and procedures (Section 3.8.3 and Appendix D) should be provided to the State of Tennessee for evaluation.

Response: The referenced reports, routinely provided to the State of Tennessee, address the assumptions, baseline data, and methodology; an additional copy of the referenced reports will be provided on request. In the attempt to adhere to the NEPA mandate of providing brief, concise documents, DOE has elected not to include this supportive data. DOE has been careful to document all data sources to ensure traceability. The reader, therefore, can pursue an area of interest further by referring to the associated data sources.

46. Comment (items 10a and 12): Neither the best management nor best available technology criteria recognize dilution as an acceptable treatment method (Sections 4.1.2 and 4.2.3.1).

Response: The discussion does not present dilution as a treatment alternative. Dilution is recognized as occurring and must be included as a parameter in the impact analysis.

47. Comment (item 10b). Are standards established for the discharge of organic contaminants (e.g., PCBs, hexachlorobenzene, benzofurans, and dioxins)? (Section 4.2.3.1).

Response: Limitations for the organic contaminants in liquid discharges will be established as a part of the NPDES permit approval process.

48. Comment (item 10c). Are the PCB sediment transport predictions in the Clinch River based on actual hydrological modeling? What is the basis for the statement of concentrated chlorinated-organic deposition? (Section 4.2.3.1).

Response: Hydrological modeling was not completed as part of the analyses. Sufficient data exists to support the statement that PCBs will be concentrated on sediment. The reader is encouraged to consult the referenced documents for further information.

49. Comment (items 11 and 14): The effects on Poplar Creek during the 3-Q-20 year low flow and the maximum discharge from treatment facilities should be assessed. (Section 4.3.2.1, Table 4-8).

Response: DOE has analyzed the effects for the contaminants based on a flow rate of 23.5 cfs. The results of this analysis are shown in the table (next page). As with the case of average flow conditions (Table 4-8), there are no significant differences in the Poplar Creek with and without the facility during the 3-Q-20 low flow.

50. Comment (item 13). A detailed erosion/siltation control plan should be included as part of the site preparation engineering plan (Section 4.3.2).

Response: DOE concurs with this statement. An erosion/siltation control plan will be prepared as part of the detailed engineering efforts should DOE decide to proceed with the proposed project.

EFFECTS OF FACILITY DIRECT AQUEOUS DISCHARGES ON WATER QUALITY IN POPLAR CREEK AT LOW FLOW

Effect	Chloride	Fluoride	Sulfate (as SO ₄)	Phosphate (as P)	Sodium	Uranium	Lead	Beryllium	Total Dissolved Solids	Total Suspended Solids
Estimated Concentration to K1407 from incinerator (mg/l) ^a	5700	280	32	52	4100	10	2.4	3 x 10 ⁻⁷	10900	830
Precipitation/Adsorption Effects ^b	No	Moderately	No	Yes	No	Yes	Yes	No	Minor	Yes
K1700 Concentration (mg/l)										
Present ^d	37	0.86	116	0.85	52	0.32	0.01	<0.0004	367	<u>11</u>
Future ^c	184	6.18	114	1.46	157	0.43 ^k	0.04	<0.0004	612	<u>21</u>
Poplar Creek Concentration Downstream from K1700										
Present (mg/l) ^d	<u>6</u>	<u><0.2</u>	<u>34</u>	<u>0.25</u>	7	<u>0.006</u>	<u><0.01</u>	<u><0.0004</u>	<u>186</u>	7
Future (mg/l) ^d	<u>17</u>	<u><0.59</u>	<u>34</u>	<u>0.30</u>	15	<u>0.015^l</u>	<u><0.01</u>	<u><0.0004</u>	<u>204</u>	8
Increase (percent) ^e	180	190	0	18	111	143	Neq.	0	10	11
Standard or Guideline (mg/l)	250 ^h	1.0 ^f	250 ⁱ	0.10 ^m	--	37.89 ^m	0.05 ^f	--	500 ^f	30 ^j
Future Percent of Standard or Guideline	6.7	58.9	13.6	296	--	<0.1	20	--	40.8	26

Note: The value for comparison to the standard is marked by underline

Sources: Computations based on sources given below

a Based on process mass balance.

b Used to correct concentrations for particulate removal during treatment.

c Based on 20 gal/min PCB facility inflow and 750 gal/min other inflows.

d Based on estimated 3-0-20 low flow in Poplar Creek near juncture with Clinch River at 23.5 cubic feet per second (10,458 gal/min) derived from USGS data for Poplar Creek at Mile 14.1 plus East Fork of Poplar Creek at Mile 3.5, adjusted for drainage basin area.

e Percent increases do not coincide with those for present and future concentration in this table. These are rounded to fewer decimal places than reflected in detailed calculations.

f-j Denotes following sources of benchmarks: f) Tennessee Stream Standard, q) Department of Energy Concentration Guideline, h) U. S. EPA Secondary Drinking Water Standard, i) U.S. EPA Water Quality Criterion (Red Book), or j) NPDES Permit Level. (See Y/UB-15).

k Equivalent to 3.38×10^{-7} uCi/ml based on a specific activity of 7.81×10^{-7} Ci/g for maximum enrichment level of 1.0 percent U-235 (Long, June 26, 1981).

l Equivalent to 1.15×10^{-8} uCi/ml based on above conversion between concentration and activity.

m Calculated from concentration guideline of 3×10^{-5} Ci/ml (DOE Manual, Appendix 0524, Annex A, Table II).



STATE CLEARINGHOUSE

30 EAST BROAD STREET • 39TH FLOOR • COLUMBUS, OHIO 43215

• 614 / 466-7461

January 5, 1982

Mr. J. F. Wing, Chief
U. S. Department of Energy
Environmental Protection Branch
P. O. Box E
Oak Ridge, Tennessee 37830

RE: Review of Environmental Impact Statement/Assessment Report
Title: Draft EIS for Construction of Incineration Facility for PCB's at Diffusion
Plant in Oak Ridge, Tennessee. Storage until built is at Piketon Facility, Ohio
SAI Number: 36-471-0015

Dear Applicant:

Your Environmental Impact Statement/Assessment was received on the above date. The review process will now begin at the state level. You may expect notification that the review has been completed no later than 40 days following the receipt date of a draft Environment Impact Statement/Assessment and 32 days for a final Environmental Impact Statement/Assessment.

A State Application Identifier Number (SAI) has been assigned to your Environmental Report. Please refer to this number in all future contacts with the State Clearinghouse.

Sincerely,

A handwritten signature in cursive script that reads "Rose Metzger Roesch".

Rose Metzger Roesch
A-95 Coordinator



N-33

Ohio Department of Natural Resources

OFFICE OF OUTDOOR RECREATION SERVICES
Fountain Square • Columbus, Ohio 43224 • (614) 265-6395

December 30, 1981

J.F. Wing, Chief
Environmental Protection Branch
Safety and Environmental Control Division
Department of Energy
Oak Ridge Operations
P.O. Box E
Oak Ridge, Tennessee 37830

Re: Draft Environmental Impact Statement -
PCB Incineration Facility

Dear Mr. Wing:

The Department has had only a brief opportunity to review the above-referenced document. The proposed action basically entails the storage, transportation and eventual incineration of radioactively contaminated polychlorinated biphenyls (PCBs) and other wastes. While we are concerned about the safety and efficiency of all phases of this proposed operation, we are of necessity particularly interested in storage and packaging at, and shipping from the Piketon Plant near Portsmouth.

We are concerned that this environmental statement was apparently not sent directly to this Department, the Ohio Environmental Protection Agency (OEPA) or the State Clearinghouse. The OEPA has responsibility and authority under the Toxic Substances Control Act. Was not the OEPA a primary contributor to the scoping of issues (reference: public scoping meeting, Columbus, Ohio, March 3, 1981)? The Department has previously expressed concerns with on-going discharges to surface waters from the Piketon Plant site and with the need for a better evaluation of hydrologic conditions and the potential for aquifer contamination at the site. Such comments were contained in the State of Ohio response (Ned E. Williams, Director, OEPA, April 18, 1977) to the Draft EIS: Portsmouth Gaseous Diffusion Plant Site prepared by the U.S. Energy Research and Development Administration (ERDA). The ERDA response indicates that in the absence of data, monitoring would be installed.

J.F. Wing, Chief
December 30, 1981
Page Two

N-34

It is our understanding that the ultimate responsibility for ensuring safe storage and packaging of these radioactive PCBs falls with the U.S. E.P.A. as specified in 40 CFR 761. Compliance of the operation with the above regulations should greatly decrease the likelihood of an accident creating adverse impacts to resources of concern to the Department.

Similarly, transportation of these toxic materials from Piketon to Oak Ridge should be done in a manner which reduces the chance of an accident. While the preferred transportation alternative (Alternative 1) is not the shortest route nor the route crossing the fewest streams or rivers, it does appear to be the safest. Avoidance of population centers, access for emergency vehicles, roadway quality and percent of four lane highway along the route all contribute to the greater safety of this alternative.

In summary, the Draft EIS appears to adequately address pertinent aspects of this proposed operation. We reserve the right to make additional comments should other information come to light or should we have an additional opportunity to review the proposal.

Sincerely,



Roger D. Hubbell, Chief
Office of Outdoor Recreation Services

RDH/dh

cc: Judy Brachman, Administrator
State Clearinghouse
Kent Kroonemeyer, USFWS
Ken Schultz, OEPA

Ohio Department of Natural Resources

51. Comment (paragraph 2): Please explain why the DEIS was not forwarded to ODNR, the Ohio Environmental Protection Agency (OEPA), or the State Clearinghouse?

Response: The DEIS was forwarded to 12 offices or officials of the State of Ohio on publication, and additional copies were sent to the State Clearinghouse on request. Chapter 6 of the DEIS lists those to whom the DEIS was sent upon publication; listed are three addressees at the Ohio EPA and one at the Ohio Department of Natural Resources. As part of the original mailing, a copy was sent to the Governor of Ohio for forwarding to the State Clearinghouse.

Mr. J. F. Wing, Chief
Environmental Protection Branch
Oak Ridge Operations
Department of Energy
P.O. Box E
Oak Ridge, Tennessee, 37830

December 30, 1981

Dear Mr. Wing:

A copy of the Draft Environmental Impact Statement for the proposed PCB incinerator at Oakridge was forwarded to the Ohio Environmental Protection Agency by the Ohio Department of Natural Resources, Wildlife Division.

I feel that my office, Emergency Response, should only comment on two aspects of the draft proposal. The first is storage and the second item is transportation.

On page S2 it is stated that the proposed facility would be operational in 1987. The USEPA Final Ban Rule (44 FR 31514) requires all PCB's placed in storage prior to 1/1/83, to be disposed of by 1/1/84. Will an exemption to allow extended storage be granted by USEPA? USEPA's Final Ban Rule also establishes guidelines for the construction of suitable PCB storage facilities as well as specific record keeping requirements for these storage facilities; will these requirements be met?

The USEPA recently awarded a PCB Inspection Compliance Grant to my Office; it is possible that we may wish to inspect the current PCB storage area at the Piketon Gaseous Diffusion Plant sometime during 1982.

In reviewing the transportation portion of the draft EIS, several questions arise. My first comment concerns the selection of the proposed transportation route. The proposed route appears to be the safest available at this time. How often will shipments be made and what total volume of PCB's will constitute a shipment? Given that unexpected accidents do happen, what emergency response provisions will be provided? Would a cleanup contractor be hired or will DOE/Goodyear provide emergency response for cleanup?

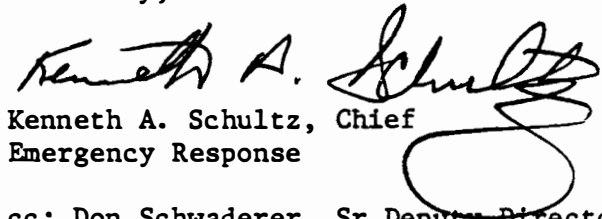
What would be the approximate maximum PCB concentration in any single drum shipped; likewise, what would be the maximum radioactivity of any single container?

You may send any response to my comments to:

Kenneth Schultz, Chief
Emergency Response
Ohio Environmental Protection Agency
361 E. Broad Street
Columbus, Ohio 43215

If you would care to discuss any of the issues covered by my letter, please feel free to call me, at 614-466-6542.

Sincerely,

A handwritten signature in dark ink, appearing to read "Kenneth A. Schultz". The signature is fluid and cursive, with a large, stylized "S" at the end. It is positioned above the typed name and title.

Kenneth A. Schultz, Chief
Emergency Response

cc: Don Schwaderer, Sr Deputy Director
Col. James Williams, ODSA, Rad, Preparedness
Ronald Dunson, PUCO, Transportation Division

Ohio Environmental Protection Agency

52. Comment (paragraph 3): Will DOE be applying for an exemption to allow extended storage of PCBs and will associated requirements in the EPA final rule (44 FR 31514) be met?

Response: The only PCBs to be stored by DOE past the EPA deadline (40 CFR 761.42) would be those which are also radioactively contaminated. Pursuant to paragraph four of the U.S. EPA letter (page N-10), DOE does not plan to ask for an extension for the storage of these materials. DOE procedures for storage and recordkeeping with respect to PCB contaminated materials are and will continue to be consistent with those set forth in the EPA regulation.

53. Comment (paragraph 5): How often will shipments be made and what total volume of PCBs will constitute a shipment? What emergency provisions will be provided? Would a clean-up contractor be hired or will DOE or Goodyear provide emergency response for clean-up?

Response: Based on the stored waste inventories of PCB and non-PCB wastes at the Paducah and Portsmouth facilities, the disposal periods for solid and liquid wastes (35 months for liquids and 58 months for solids) and an average vehicle load of 15,000 g, estimates of the annual trips from each facility, required for disposal of the backlog, are:

<u>Facility/Waste Type</u>	<u>Total Trips</u>	<u>Trips/Year</u>
Paducah		
liquids	21	7
solids	60	12
Portsmouth		
liquids	15	5
solids	40	8

Trips would be less frequent after the backlog is disposed, averaging seven to eight from Paducah and three to four from Portsmouth (see Section 2.1.1.1.3 and Appendix A).

A spill prevention and contamination control plan will be developed. Also, as indicated in another response to a comment, DOE will develop an emergency handbook detailing procedures in the event of an accident. Whether

or not a clean-up contractor will be hired will depend on the accident location, and the nature and extent of the spill. Further details on this subject matter will be developed during detailed planning stages should Congress decide to authorize and appropriate funds for the proposed project.

54. Comment (paragraph 6): What would be the approximate (1) maximum PCB concentration and (2) maximum radioactivity in a single drum shipped?

Response: In a single drum, the maximum PCB concentration could be 100 percent. The maximum radionuclide content could be 10,000 ppm of uranium of which 1 percent could be U₂₃₅ isotope; this would represent approximately 1.64×10^{-3} Curies.

Jackie Swigart
Secretary



John Y. Brown, Jr.
Governor

COMMONWEALTH OF KENTUCKY
DEPARTMENT FOR NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION
OFFICE OF THE SECRETARY
OFFICE OF SPECIAL PROJECTS

CAPITAL PLAZA TOWER
FRANKFORT, KENTUCKY 40601
PHONE (502) 564-7320

December 22, 1981

Mr. J. F. Wing, Chief
Environmental Protection Branch
Oak Ridge Operations
Department of Energy
P. O. Box E
Oak Ridge, Tennessee 37830

Dear Mr. Wing:

The Kentucky Department for Natural Resources and Environmental Protection serves as the State Clearinghouse for environmental impact statements (EISs). Comments on the Draft Environmental Impact Statement - Incineration Facility for Radioactively Contaminated Polychlorinated Biphenyls and Other Wastes that the Department has received from state agencies are attached.

In addition, comments from the Division of Water, Bureau of Environmental Protection and the Office of Special Projects within the Kentucky Department for Natural Resources and Environmental Protection are included.

These comments are submitted for your consideration in preparing the final EIS on this project.

Sincerely,

A handwritten signature in cursive script that reads "Rose Marie Carr".

Rose Marie Carr
Environmental Review Officer
Office of Special Projects

RMC:kp

Attachment



N-41

COMMONWEALTH OF KENTUCKY

FRANKFORT 40621

BUREAU FOR HEALTH SERVICES

M E M O R A N D U M

TO: Elzie L. Barker
Office of Policy and Budget

FROM: Irving Bell, Director *IB*
Division for Consumer Health Protection

SUBJECT: Radiation Control Section Comments on
Draft EIS Incineration Facility for
Radioactivity Contaminated Polychlorinated
Biphenyls and Other Wastes - October, 1981

DATE: December 4, 1981

The technical staff of the Radiation Control Section has reviewed this document and found that as stated on page S-6 (Impacts on Human Health) the low level of ionizing radiation emitted from this facility would be less than that emitted from a reference coal fire power plant and that the radiological health impact would be insignificant. As it relates to the emissions of PCBs from this facility, the Radiation Control Section staff feels that the Kentucky Division for Air Pollution and the Division of Hazardous Materials would be the appropriate staff to comment on this section.

IB:DTC:smb



Jackie Swigart
Secretary

John Y. Brown, Jr.
Governor

COMMONWEALTH OF KENTUCKY
DEPARTMENT FOR NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION
BUREAU OF ENVIRONMENTAL PROTECTION
DIVISION OF WATER
18 REILLY ROAD
FT. BOONE PLAZA
FRANKFORT, KENTUCKY 40601

M E M O R A N D U M

TO: Environmental Review Officer
Office of Special Projects

FROM: T. James Fries, Chief *T. J. Fries*
Planning and Standards Branch
Division of Water

DATE: December 14, 1981

SUBJECT: DEIS, Oak Ridge Gaseous Diffusion Plant, Radioactive Wastes
Incineration Facility, Oak Ridge, Tennessee, EIS 81-22

Attached are the Division of Water's comments for the Draft Environmental Impact Statement on the Radioactive Wastes Incineration Facility of the Oak Ridge Gaseous Diffusion Plant, located in Oak Ridge, Tennessee, EIS 81-22.

TJF:TK:abw

Attachment

cc: Doug Allgeier, Division of Water
George Schureck, Division of Water

RECEIVED

DEC 15 1981

DEPT. NATURAL RES. & ENV. PROT.
POLICY & PROGRAM ANALYSIS

DNREP Environmental Review

Division of Water

Project Number: 81-22

Project Title: DEIS, Oak Ridge Gaseous Diffusion Plant, Radioactive Wastes Incineration Facility, Oak Ridge, Tennessee

The Division of Water has reviewed the Draft Environmental Impact Statement on the radioactive waste incineration facility at the Oak Ridge Gaseous Diffusion Plant at Oak Ridge, Tennessee, EIS 81-22. The Division's comments relate to water supply and wastewater.

- Section 2.1.3.2, Accident analysis—transportation.

The probability of releases of radioactive polychlorinated biphenyls and other wastes into any waters of the Commonwealth appears minimal due to infrequent haul schedules, small wastes quantities, and low number of water-courses intersecting the proposed route.

- Section 2.4 and appendix B, alternate routes.

Alternative number 1 will pose the least water contamination threat according to the data presented in Appendix B. Therefore, the Division of Water concurs with the selection of the preferred alternative.

- Section 4.8.2. Transportation accidents and releases.

No consideration was given to the environmental waste effects as a result of transportation accidents. These include wastes entering water mains and sanitary, storm, and combined sewers and the resulting impacts of drinking water and wastewater treatment.

In the event of an accident which results in the release of radioactive PCBs and other wastes, an extensive water sampling program would be required to insure that there are no adverse health effects. This sampling, coupled with spill control and contamination prevention measures, could result in the closing of water and wastewater treatment plants which could thereby create water shortages and sanitation problems. Consideration should be given to and plans for providing emergency supplies of potable water and emergency wastewater treatment should be included in the FEIS.

- Section 4.8.2.2, Transportation accident scenarios.

Using a list of all populated areas through which the preferred routes will pass, an emergency notification guide should be prepared. The guide should list for each populated segment a 24-hour telephone number for the local water

and wastewater authority. The drivers of the vehicles containing these wastes should have instructions to notify these local authorities so that appropriate action could be taken to protect:

- the intakes and facilities of water treatment plants,
- wastewater treatment plants by having the spilled material held in interceptors or bypass the plant, and
- the operators of water and wastewater treatment plants.

T. James Fries
T. James Fries Chief, Planning and Standards Branch
 Division of Water

12/14/81
(Date)

Kentucky Department for Natural Resources and Environmental Protection
Division of Water

55. Comment (Section 2.1.3.2): The probability of releases of radioactive polychlorinated biphenyls into any waters of Kentucky appears minimal due to infrequent haul schedules, small waste quantities, and low number of water courses crossing the proposed route.

Response: DOE agrees; this comment also applies to waters in the States of Ohio and Tennessee.

56. Comment (Sections 4.8.2 and 4.8.2.2): Consideration should be given to effects of transport accidents on potable water supplies. An emergency notification guide should be prepared for delineating appropriate response procedures.

Response: See Comment 55 above and the response to Comment 27 (EPA).

The DEIS indicated that the probability of contaminant release to the public water supply was extremely low because of the small waste quantities, the fate and transport mechanisms of PCBs, infrequent hauling schedules, and the low number of watercourses intersecting the proposed routes. Studies of previous spills suggest that the majority of spilled materials may be recoverable. The nature of PCBs and the other materials suggests that they are not likely to enter a water supply intake in significant quantities, even if a spill should occur.

In the event a spill occurs, State and local officials will be contacted and emergency response procedures implemented in accordance with the nature and extent of the accident.

DOE solicited detailed information on public water supply intakes and the communities served from the States of Kentucky, Tennessee, and Ohio in order to specify more precisely the potential public health risks associated with waste transport. The analysis in the EIS is based on the best information available.

A detailed emergency notification guide will be prepared as part of detailed planning should DOE decide to proceed with the proposed project.

Jackie Swigert
Secretary



John Y. Brown, Jr.
Governor

COMMONWEALTH OF KENTUCKY
DEPARTMENT FOR NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION
OFFICE OF THE SECRETARY
OFFICE OF SPECIAL PROJECTS

CAPITAL PLAZA TOWER
FRANKFORT, KENTUCKY 40601
PHONE (502) 564-7320

M E M O R A N D U M

TO: Rose Marie Carr, EIS Coordinator
Office of Special Projects

FROM: Doyle Mills, Environmental Supervisor *DM*
Office of Special Projects

DATE: November 30, 1981

SUBJECT: EIS Review of DOE/EIS-0084D

Pursuant to the request of Rich Shogren, I have reviewed the U.S. Department of Energy Environmental Impact Statement for the Incineration Facility for Radioactively Contaminated Polychlorinated Biphenyls and other wastes. This document is identified as DOE/EIS-0084D.

I have reviewed the document from the standpoint of radiation and the transportation of radioactive contaminated material through the Commonwealth on its way to the Oak Ridge Gaseous Diffusion Plant.

According to the report, about 60 percent of the wastes shipped would contain detectable concentrations of uranium. Throughout the report, DOE refers to uranium or low-assay enriched uranium which all have very specific meanings when used as radionuclides. However, in the report one finds the phrases "trace quantities of radionuclides" and "primarily enriched uranium" used quite frequently, but nowhere did I note a table or chart which would list those radionuclides likely to be in the waste. From annual environmental monitoring reports of the Paducah Gaseous Diffusion Plant there appear to be radionuclides other than uranium in the streams. Hence, one must conclude either the radionuclide list put forth is inadequate or wastes containing other than uranium will not be shipped for PCB destruction. A clarification is needed.

The transportation aspect of the shipments takes up a major part of the report. They have reviewed alternatives to land transportation (i.e., rail and barge) and have concluded that each of the alternatives has enough undesirable aspects not to displace land transportation. They have reviewed the accident possibilities and concluded that the actual damage occurring in a total release of contents accident would have minimal impact. This is due to past accident experience and their analysis of recoverability of the material. They prefer to put the emphasis on accident prevention (i.e., avoiding rush-hour traffic, bad weather, narrow roads, etc.).

Their review of alternative routes seems to be reasonable and to be based on prevention. Their conclusion that from Portsmouth (Piketon), it is best to travel through Kentucky on I-75 seems reasonable. The I-64, I-75 alternative presents heavy traffic and heavily populated areas that present problems. The Maysville-US 68 alternative presents narrow roads, population concentrations and places of heavy traffic. Their conclusion, that from Paducah it is best to travel along US 60 to I-24, is the only feasible route that would appear consistent with some Kentucky roads.

In the discussion on the number of shipments of such material, it is not clear how many shipments are anticipated before the current backlog is eliminated. After the backlog is removed, apparently seven to eight annual shipments will originate from Paducah and three to four from Portsmouth.

In summary, the implied other radionuclides need to be stated or a statement that they will not be shipped for incineration needs to be included. This could make a difference in the needs of state emergency response teams. Also, a clarification on the estimated number of shipments to eliminate the backlog (and estimated length of time) is needed to evaluate an appropriate notification schedule (daily, weekly, monthly, etc.).

DM:kp

Kentucky Department for Natural Resources and Environmental Protection
Office of Special Projects

57. Comment (paragraph 3): Either the implied other radionuclides need to be specified or a statement that waste containing contaminants other than uranium radionuclides will not be shipped to the site for PCB destruction.

Response: No waste has been currently identified which contains radionuclides other than uranium daughter products. Some future wastes may contain non-uranium radionuclides. Any waste having non-uranium radionuclides will be evaluated with respect to the advisability of feeding that waste to the incinerator. Concurrent with this evaluation will be an investigation of alternative disposal methods for that waste. In no case would any waste be incinerated if the risk to public health and safety would be greater than the risks identified in the EIS.

58. Comment (paragraph 6): A clarification on the estimated number of shipments to eliminate the waste backlog (and length of time) is needed to evaluate an appropriate notification schedule.

Response: Please see the response to Comment 53 (Ohio EPA).

130 Oklahoma Ave
Oak Ridge, TN 37830
Dec 9, 1981

J. R. Wing, Chief
Environmental Protection Branch
Oak Ridge Operations
Department of Energy
P.O. Box E
Oak Ridge, TN 37830

Comments On DES For Incineration Facility For U-contaminated
PCB's And Other Waste

Summary:

The DES on the proposed waste incinerator seems to make a strong case for applying an incinerator to handle the 5-plant organic waste including PCB's and some uranium. The wisdom of using an incinerator is not obvious for the inorganic wastes mentioned unless the waste forms are badly mixed. In some cases good cases are made for the unimportance of projected concentrations of hazardous substances. A relatively poor case is made for the particular facility design proposed; in fact that design and the performance to be demanded from it are not well enough specified. The environmental, health, and safety risks are not actually quantified in the sense that effluents seem to be estimated in terms of output from some roughly comparable incinerators. While this is a good first step, these weaknesses should be corrected in the FES by

- a) defining the proposed facility and process with much greater specificity,
- b) specifying quantitatively how tolerance levels of the various hazardous or damaging substances will be established or what the maximum values of those tolerances will be, and
- c) clarifying exactly what process monitors and controls, both continuous and intermittent, will be applied to assure that pollutants and hazardous substances emitted from the facility do not cause these tolerances to be exceeded. In the FES, effects should be estimated in terms of concentrations actually to be monitored and controlled at the proposed facility.

As specific alternatives to the incompletely specified conceptual design, I request that the following suggestions to reduce effluents of hazardous materials be considered as alternatives by the design team and the FES:

- a) Use ventillation air from the drum unloading area etc. as air makeup to the incinerator when it is operating.
- b) Filter water effluent from the incinerator and stack-gas cleanup systems near the incinerator rather than settling it after combination with the rest of the plant runoff.

- c) Continuously monitor the stack gas for PCB's or for chlorinated hydrocarbon fragments for process control and to permit stopping PCB input quickly if the tolerance is exceeded.

Except for the problems identified above, the DES seems to follow reasonable lines. For clarity, however, a map of the local area seems essential to make understandable the relationship between the proposed site and the populated areas discussed. If linear responses are assumed, I suppose the population densities at the various offsite points would be important.

Details:

1. It was reasonable for early conceptual studies to be based on the performance of similar incinerators on somewhat similar waste material. However, it seems that by the time of the FES the quantities of effluents considered should depend on maximum output concentrations that are to be fixed by direct monitoring and control of effluent streams. That is, the effluent quantification in the DES seems to depend on nominal performance rather than on performance to be assured by process monitoring, and it is suggested that this type of quantification will be inappropriate for the FES. (Page 2-20 suggests that only O_2 , CO , and CO_2 will be chemical control quantities.
2. The DES does not say anything very specific about the proposed design. Therefore, it is impossible to consider major variations of incinerator design.
3. At many points in the DES text there are references to "acceptable" levels of various pollutants and potentially hazardous substances. For these portions of the DES to have meaning, the tolerances for acceptability must be given, or at least the principles must be stated upon which the tolerances are to be based.
4. Hoods and other ventilation structures are mentioned in the text, but quantities of air are not given. Considerable amounts of evaporated organic chemicals are assumed in the DES to be released to the atmosphere from these areas. When the incinerator is in operation, the air from some or all of these ventilator outputs could be blown into the incinerator. In this way much of the evaporation loss could be burned, improving safety for both the worker and the public.
5. Pollutants can usually be more efficiently removed from waste streams at points close to major sources. The alternative of settling/filtering the liquid waste stream from the proposed incinerator and stack scrub to remove solids close to the source, rather than combining flow with a plant-wide waste stream, should be explicitly considered in the FES.

N-51

6. An accident considered in the DES is the handling and shredding of a liquid-filled drum as if it contained only solids. Design could prevent this accident, since liquid-filled drums do not handle (tip or roll) like solid-filled drums. (There is, of course, a continuum of mixtures of liquids and solids and viscosities of liquids that could partly confuse such a "smart" drum handler.)

I would appreciate receiving a copy of the FES for this facility. It should be built with the "best available" reliable technology.

Sincerely,

A handwritten signature in dark ink, appearing to read "R. Feelle". The signature is fluid and cursive, with the first letter "R" being large and prominent. The last name "Feelle" is written in a more compact, cursive style.

Robert Feelle, Commissioner
Roane County 4th District

Robert Peele, Roane County Commissioner

59. Comment (summary, paragraphs 1 and 2; items 2, 4 and 5): Please provide more detailed information about the proposed facility design so that alternative design considerations can be reviewed to determine potential impacts. Potential control schemes such as returning air from vents/hoods to the incinerator and treating individual liquid waste streams (rather than combined waste streams) should be considered.

Response: DOE agrees that the proposed facility should be designed to achieve economic and environmental performance criteria. At this point in time, the proposed facility is a concept design. Detailed engineering plans serving as the basis for procurement of services and equipment have not been prepared and will not be drawn up until the detailed engineering phase, which is contingent on Congressional authorization and appropriation of funds for the project. This phase of the project, detailed engineering and design, will address the aforementioned areas of concern (e.g., alternative treatment schemes). Detailed plans, when completed, will be available on request from DOE at the address on the cover sheet. Please also see the response to Comment 38 (Tennessee Department of Public Health).

60. Comment (summary, paragraph 3): A map should be provided to illustrate the relationship between the proposed site and the populated areas in Section 4.2.1.

Response: DOE agrees with this comment and has incorporated a map, Figure 4-1, into Section 4.2.1.

61. Comment (item 1): The effluent quantification in the DEIS depends on nominal performance rather than performance to be assured by process monitoring. This quantification may not be appropriate for the FEIS.

Response: Effluents were estimated using concept design information or information from analogous facilities. In the absence of actual operating data from the facility, DOE has relied on information that best approximates the actual operating conditions and equipment designs. Process monitoring will be employed to ensure that the emissions and effluents from the facility do not exceed levels stated in the EIS.

62. Comment (item 3): "Acceptable" levels of various pollutants should be described in terms of tolerances or the principles upon which these tolerances are to be based.

Response: DOE has used the term acceptable to refer to a performance standard that must be achieved if the facility is to be permitted under EPA rules. In the case of PCB contaminated solid wastes, for example, the concentration level expected to be specified in the permit is 50 ppm. Should the residue PCB concentration exceed this level, it will be returned to the incinerator to be burned. DOE has been careful to define tolerance levels within the report.

63. Comment (item 6): An accident considered in the DEIS is the handling and shredding of a liquid-filled drum as if it contained only solids. Design could prevent this accident, since liquid-filled drums do not handle (tip or roll) like solid-filled drums.

Response: DOE recognizes that the design features of equipment will be important accident preventive measures. The accident analysis on an explosion in the incinerator shredder was conducted to establish a worst case situation should preventive measures fail.

December 24, 1971

Mr. J.F. Wing, Chief
 Environmental Protection Branch, Oak Ridge Operations
 Dept. of Energy
 P.O. Box 1
 Oak Ridge, Tennessee 37830

Subject: Comments Relative To Draft EIS-Incinerator Facility for Radioactively Contaminated Polychlorinated Biphenyls & Other Wastes

Note: The "Contamination" is by radioactive MATERIALS , - repeat MATERIALS, (MATERIALS THAT ARE RADIOACTIVE DO NOT become non-radioactive when moved through an incinerator!).

Apparently there is a gross ignorance of, or a viciously deceptive employment of, the proper use of language, even in the title of this simple minded government-self-serving project's paperwork.

Chief Wing:

There are three obvious needs or requirements for any process that is to change the chemical composition of materials that contain radioactive materials at several sites. None of these needs or requirements are recognized within the draft EIS!

Let me attempt to overcome the ignorance displayed by the draft EIS.

- 1.) Most all chemical processes, of which incineration is one such, are not 100% effective or complete in a single pass. Surely you must recognize the need for a multi-pass process. (Even the housewife multi-passes the carpet when vacuum cleaning, thus the concept should not be beyond the capacities of even government employees to grasp in mind.)

The proposed incinerator is a SINGLE PASS PROCESS!

I am aware that the EPA has required multi-pass processes in other situations.

- 2.) Inasmuch as the materials that are to be chemically process contain radioactive materials, --- which after decades of governmental welfare-scientist-gloriously-funded efforts appear to be unremovable or separable ---, the need or requirement is for wholly solid containment of the resultant chemically processed materials. That is, such that the radioactive materials are not dispersed into the surrounds where life is imposed upon for much more than the relatively short span of the current individual's lives. (The prissy numbers displayed in the text, for the seemingly minute quantities DO NOT total the RADIOACTIVE MATERIALS for the total time of operation of the facility, as to their quantity, --- and it is yet beyond human capacities to evaluate the minute contamination's effects upon critical metabolic processes of life, especially within a circumstance where many other variables exist.)

The proposed incinerator fails ,even in concept, to meet or recognize the fundamental need or requirement for wholly solid containment.

The real inefficient economics that has lead to the radioactive materials contaminating the chemicals to be processed leads in reality to the need for continued economic inefficiency associated with wholly solid containment. (As usual, governmental ideas of economic efficiency lead to some-like cutting holes in the parachute after jump, in order to save cloth.)

/the /

December 26,1981

within the draft EIS

- 3.) With the rather extensive number of pages/devoted to the TRANSPORT of radioactive MATERIAL contaminated chemicals into Tennessee, and across the mountains after traveling across Kentucky, and with the recent Knoxville News Sentinel blurb telling us "It would fit in this room," (Fri. 12-11-81, page A-3), the obvious, really most obvious, need or requirement for a portable process equipment (providing a solids output) is existant.

The draft EIS failed, again, to mention the alternative of moving the process equipment to the sites of the existing and continuing-ly generated wastes. There is a wierd sense of moving the mountain to Mohammed, displayed, with not only the tax payer's money but also with quite real potential impact on the lives and health of the taxpayer and his heirs for some generation to come.

Yes I am aware that this government, Federal and State, will allow much more vicious hazardous materials to be hauled past the public on the highway and in residence. But reasonable and prudent men should recognize that passive acceptance cannot and willnot, — most certainly willnot, continue! Putting the matter very bluntly, after the first spill the next "spill" can be right on some governmental family's doorstep.

As evident within the draft EIS it was prepared by a committee without leadership of sufficient quality for the task involved. The options examined for processing of the chemicals is are hardly consistant with the "state-of-the-art" even though they are within the limited perview of Battelle Columbus Division which is or has recently been soliciting private monies to build a catalogue*of processes for converting PCB's. (Generally there is a ban upon "marriage" between close cousins, but not so with the migration of personnel and contracts from DOE to Battelle, from Oak Ridge.

* See Number 23, June 1981, Battelle Today, published by Battelle.

I want to point up one constructive option, in regard to a multi-pass (multi-stage in this type of equipment), potentially solids outputing, portable, class or type of processing equipment. It derives from an individual's ingenuity and is expounded in the news-stand publication Science & Mechanics, Winter 1981, pages 52,52,108,109,110. (I am NOT saying that the equipment for this purpose exists as an off-the-shelf equipment, but it is certainly more correctly aimed toward the three needs or requirements noted herein.)

I live in a minerals rich State, here in Tennessee, from which we can find that material that can be processed along with the radioactive-material-contaminated-chemicals for isolatable-solids-output from such process. Further, such would provide Tennessee private industry with a market for product, exported from the State when shipped with the portable equipment to other sites.

Combined with the oncoming commercial practice of magnetic levitation of molten metals, such as for containment of poured furnace melts, the employment of electric power for processing is consistant with the thrust of the scheme that generated the wastes, — even though the "scheme" has a demonstrated miserable lack of efficiency, and is most interruptable.

For \$1.35 plus Tenn. State Tax you can examine the article and proceed to contact the named firm and individuals. I am not involved with them in any way.

With a sense of insult & pity,

Rich Mc. Kelly

5508 #2 FIFTH ST.
T 97910

Erich M. Helbig

64. Comment (item 1): How will the incineration facility be designed to insure complete destruction of hazardous materials and PCBs?

Response: As DOE describes in Section 2.1.1 of the EIS, the incinerator will be designed to achieve a destruction and removal efficiency of 99.99 percent for hazardous wastes other than PCBs and emission of less than 1 mg PCB per kg PCB in the solids feed stream. The incinerator will involve a rotary kiln and an afterburner, with the latter having a retention time of approximately 4 seconds; in incineration technology, a long retention time (such as 2-4 seconds) is the functional equivalent of recycling or multiple processes. Sampling protocols will be established to monitor waste streams and, thereby, measure the incinerator efficiency. Ash or scrubber liquid containing unacceptable levels of wastes will be treated or re-incinerated.

EPA has licensed other incinerators similar in concept to the proposed facility.

65. Comment (item 2): The incinerator concept will lead to dispersal of the radioactivity into the environment.

Response: The reader is referred to Table 4-5 which identifies the maximum uranium emissions per year; Table 4-8, which shows that almost no additional uranium would be released to the Clinch River; and Tables 4-10 through 4-13 which address the effects of those emissions and effluents on human health. Under the most conservative assumptions (those which tend to show a larger rather than smaller adverse impact), no significant adverse impact on human health could be identified.

66. Comment (item 3): The EIS should address the alternative of having portable process equipment to treat the wastes.

Response: DOE does not consider this alternative to be a reasonable one because of facility capital and operating costs and the impacts evolving from the operation of a "portable facility". Portable equipment would have to be decontaminated, dismantled, moved, reassembled, and tested three times each year, due to regulations preventing storage of PCBs for more than one year. Three sets of permits and three sets of personnel also would be required.

Costs associated with such operation would be clearly larger than those for a stationary facility. The risk and impacts of accidents during transportation of the equipment would not be negligible. At this time, the incineration technology proposed in this report represents the most feasible alternative on the basis of technical, economic, and environmental factors.

67. Comment: (Objects to contract with Battelle for preparation of the EIS; cites Battelle's other work in PCB disposal research).

Response: Battelle is a major, independent, not-for-profit research organization with a substantial expertise in PCB disposal and in environmental impact assessment. Battelle has examined a number of state-of-the-art disposal technologies for private firms and government agencies.



United States Department of the Interior

FISH AND WILDLIFE SERVICE
 PLATEAU BUILDING, ROOM A-5
 50 SOUTH FRENCH BROAD AVENUE
 ASHEVILLE, NORTH CAROLINA 28801

December 23, 1981

Mr. J. F. Wing, Chief
 Environmental Protection Branch
 Oak Ridge Operations
 Department of Energy
 P.O. Box E
 Oak Ridge, TN 37830

Re: 4-2-82-121

Dear Mr. Wing:

This is in reference to the endangered species aspects of the Draft Environmental Impact Statement for the proposed Incineration Facility for Radioactively Contaminated Polychlorinated Biphenyls and Other Wastes at Oak Ridge, Roane County, Tennessee (DOE/EIS 0084D).

Section 7(c) of the Endangered Species Act of 1973, as amended, requires Federal agencies authorizing or conducting a construction project which requires preparation of an Environmental Impact Statement to formally request a list of endangered or threatened species which may occur within the impact area of the proposal. Our records indicate that the Service has not been requested to provide a list for this project.

Section 3.7 of the Environmental Impact Statement states that five species of federally listed terrestrial fauna may occur in the project area. In addition to these species, our records indicate that the following species may also occur in the area:

CLAMS

- Appalachian monkeyface pearly mussel - Quadrula sparsa (E) (historically known from the Clinch River)
- Dromedary pearly mussel - Dromus dromas (E) (historically known from the Clinch River)
- Orange-footed pearly mussel - Plethobasus cooperianus (E) (historically known from the Clinch River)
- Turgid-blossom pearly mussel - Epioblasma turgidula (E) (historically known from the Clinch River)
- Fine-rayed pigtoe - Fusconaia cuneolus (E) (historically known from Poplar Creek)
- Rough pigtoe - Pleurobema plenum (E) (historically known from the Clinch River)
- Shiny pigtoe - Fusconaia edgariana (E) (historically known from the Clinch River and Poplar Creek)

In addition to listed and proposed Endangered and Threatened species, there are species which, although not now listed or officially proposed for listing as Endangered or Threatened, are under status review (SR) by the Service and may be listed at some time in the future. Status review species are not legally protected under the Endangered Species Act and the biological assessment requirements do not apply to them. However, we would appreciate any efforts you might make to avoid adversely impacting them. The following species under status review may occur within the project area:

SNAILS

Spiny river snail - (Io fluviialis) (recorded from the Clinch River)

PLANTS

False foxglove - Aureolaria patula

Appalachian bugbane - Cimicifuga rubifolia

Yellow fringeless orchid - Platanthera integra

Carey's saxifrage - Saxifraga careyana

Sullivant's sullivantia - Sullivantia sullivantii

Section 7(c) and regulations being prepared to implement Section 7(c) also require the Federal agency or the designated non-Federal representative proposing a major Federal action to conduct and submit to the Service a biological assessment to determine the effects of the proposal on listed and proposed Endangered and Threatened species. The biological assessment shall be completed within 180 days after the date on which initiated or within a time frame mutually agreed upon between the agency and the Service and before initiating the proposed action. If the biological assessment is not begun within 90 days, this list must be verified informally (via phone) with us prior to initiation of your assessment. We do not feel that we can adequately assess the effects of the proposed action on listed and proposed Endangered and Threatened species or Critical Habitat without a complete assessment. When conducting a biological assessment, the Federal agency or the designated non-Federal representative must, at a minimum:

1. Conduct a scientifically sound on-site inspection of the area affected by the action, which must, unless otherwise directed by the Service, include a detailed survey of the area to determine if listed or proposed species are present or occur seasonally and whether suitable habitat exists within the area for either expanding the existing population or potential reintroduction of populations;
2. Interview recognized experts on the species at issue, including those within the Fish and Wildlife Service, the National Marine Fisheries Service, state conservation agencies, universities, and others who may have data not yet found in scientific literature;
3. Review literature and other scientific data to determine the species' distribution, habitat needs, and other biological requirements;
4. Review and analyze the effects of the action on the species, in terms of individuals and populations, including consideration of the cumulative effects of the action on the species and habitat;
5. Analyze alternative actions that may provide conservation measures;

6. Conduct any studies necessary to fulfill the requirements of (1) through (5) above;
7. Review any other relevant information.

Should you require additional information on this subject, please contact Mr. Gary Henry, Mr. Robert Currie, or Ms. Nora Murdock in the Asheville Area Office, FTS 672-0321, commercial 704/258-2850, ext. 321.

After the assessment has been completed and reviewed, it is the responsibility of the Federal agency to determine if the proposed action "may affect" any of the listed species or Critical Habitats or if it is likely to jeopardize the continued existence of proposed species or result in the destruction or adverse modification of any Critical Habitat proposed for such species. If the determination is "may affect" for listed species the Federal agency must request in writing formal consultation from this office. Requests for formal consultation must include: (1) a description of the action to be considered; (2) a description of the specific area that may be affected by the action; (3) a description of any listed species or Critical Habitat that may be affected by the action; (4) a description of the manner in which the action may affect any listed species or Critical Habitat and an assessment of any cumulative effects; (5) reports including any environmental impact statement, environmental assessment, or biological assessments prepared; and (6) any other relevant available information on the action, the affected listed species, or Critical Habitat.

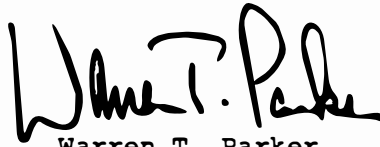
In addition, if the proposed action is likely to jeopardize the continued existence of proposed Endangered or Threatened species or result in the destruction or adverse modification of proposed Critical Habitat, the Federal agency must confer with this office for assistance in identifying and resolving potential conflicts at an early stage in the planning process.

Attention is also directed to Section 7(d) of the Endangered Species Act, as amended, which underscores the requirement that the Federal agency and/or the permit or license applicant shall not make any irreversible or irretrievable commitment of resources during the consultation period which, in effect, would deny the formulation or implementation of reasonable alternatives regarding their actions on any listed Endangered or Threatened species.

N-61

If we can be of further assistance, please advise.

Sincerely yours,

A handwritten signature in dark ink, appearing to read "Warren T. Parker". The signature is fluid and cursive, with the first name "Warren" being more prominent and the last name "Parker" following in a similar style.

Warren T. Parker
Acting Area Manager

cc:

Mr. Bob Hatcher, Wildlife Res. Agency, Nashville, TN
Program Administrator, TN Heritage Program, Nashville, TN
Director, FWS, Washington, DC (OES)
Regional Director, FWS, Atlanta, GA (ARD-FA/SE)
Field Supervisor, ES, FWS, Cookeville, TN



N-62

Department of Energy
Oak Ridge Operations
P.O. Box E
Oak Ridge, Tennessee 37830

JAN 11 1982

Mr. Warren T. Parker
Acting Area Manager
Fish and Wildlife Service
Plateau Building, Room A5
50 So. French Broad Avenue
Asheville, NC 28801

Dear Mr. Parker:

RE: 4-2-82-121 CONSIDERATION OF POTENTIAL PRESENCE OF THREATENED OR
ENDANGERED SPECIES RELATING TO THE INCINERATION FACILITY FOR RADIO-
ACTIVELY CONTAMINATED POLYCHLORINATED BIPHENYLS AND OTHER WASTES

Thank you for your letter of December 23, 1981, which was generated subsequent to your review of the Draft EIS for the subject proposed incineration facility. This letter is intended to serve as the DOE's formal consideration of the potential of the incinerator to impact threatened or endangered species in the overall project area and is intended to supplement the Draft EIS's Section 4.4, "Impacts on Terrestrial and Aquatic Ecology." The DOE believes that there is no potential for impacts to any endangered, threatened, or under status review species.

As indicated by Page 2-2 of the Draft EIS, the proposed location of the incinerator is on the eastern side and within the fenced-in confines of the Oak Ridge Gaseous Diffusion Plant (ORGDP). The ORGDP has been in existence, in one form or another, since the early 1940's. Currently, its prime mission is the separation of uranium isotopes by the gaseous diffusion method. The plant encompasses 640 acres and employs 4500 persons. It is more completely described in the enclosed environmental assessment.

The proposed incinerator site consists of five acres of cleared land with one tree on it. The site is the square clear area in the enclosed photo. Much of the site had been covered by substantial buildings a few years ago. The site is underlain by sewage pipes and undoubtedly gravel and concrete. In recent years, the site has been intermittently utilized as a storage yard. The surface of most of the site is covered with weeds. During most of the 1940s a large community shopping and living complex bordered the site less than 200 meters away.

JAN 11 1982

One of the prime bases utilized to determine that the proposed incinerator will not affect threatened or endangered species is the recently completed Appendix XXI of the Tennessee Synfuels Associates Environmental Impact Report, enclosed. The Appendix was prepared by the Life Sciences Division of Environmental Research and Technology, Inc. (ERT). ERT utilized field surveys and literature searches to generate its report. Appendix XXI examines the potential for the presence of endangered, threatened, and under status review species of federal concern and species which are endangered, threatened, or of special concern from the Tennessee Wildlife Resources Agency's and the Tennessee Department of Conservation's viewpoint. Of the threatened, endangered, or under status review terrestrial species considered by ERT and the DOE, none of them would favor the habitat which currently exists on the five acres under consideration for the incinerator, which at best might be likened to old fields habitat. In fact, the Appendix concludes that there is no evidence that any federally listed threatened or endangered species is present in the western end of the Oak Ridge Reservation or its general environs. Therefore, the physical emplacement of the incinerator is not expected to impact any species of concern to the U.S. Fish and Wildlife Service or its state counterparts.

With regard to the potential for impacts to species which are removed from the five acre incinerator site, we are of the opinion that the incinerator would not cause any effect upon species of concern. This is based upon the conclusions of Appendix XXI and a consideration of Section 4. of the Draft EIS which describes the expected environmental consequences of the proposed action.

Incinerator emissions will be controlled by several control devices, such that emissions to the air will be miniscule; in many instances to be emitted in terms of fractions of kilograms per year. The incinerator exhaust will comply with extremely tight emissions standards designed to afford maximal protection to the environment. Emissions will all be of a de minimis nature, well below any of the significance levels of the Environmental Protection Agency which trigger a Prevention of Significant Deterioration review. The ambient air around the proposed incinerator site is quite clean and is not expected to be significantly, or in some cases, even measurably degraded. Therefore, no impacts to wildlife are anticipated.

Similarly, aqueous effluents to Poplar Creek and ultimately the Clinch River will have no expected impacts to species of concern. An insignificant and nondetectable increase in PCBs over the lifetime of the incinerator is expected in the aquatic systems downstream of ORGDP (see Section 4.2.3.1 of the Draft EIS). Most other discharged materials

W. T. Parker/FWS

- 3 -

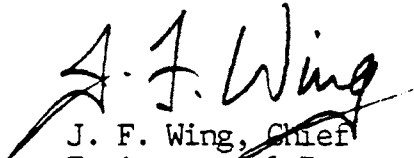
JAN 11 1982

will likewise not generate differences in their Poplar Creek concentrations. For all other discharged materials, concentrations will change minimally and no impacts are expected upon species of concern.

Given the minimal nature of the expected environmental impacts of the proposed incinerator, its small size and location within an already existing industrial plant, and in light of the recent biological assessment produced by TSA, providing an up-to-date field and literature survey of the potential for the presence of species of concern, it is our opinion that the proposed incinerator project will not affect any federal or state listed species or critical habitats, nor is the project likely to jeopardize the continued existence of proposed species or result in the destruction or adverse modification of any critical habitat proposed for such species.

If you have any questions about this letter, please feel free to contact Gabe Marciante of my staff at FTS 626-0850, or myself at 626-0845.

Sincerely,



J. F. Wing, Chief
Environmental Protection Branch
Safety and Environmental
Control Division

SE-331:GJM

CC:

Ralph Cooper, BCL, w/copy of FWS letter
Regional Director, FWS/Atlanta
Bob Hatcher, TN Wildlife Resources/Nashville
Lida Whitaker, DOE/HQ
Program Admin., TN Heritage Program/Nashville
Larry Long, ORGDP K-303-7
M. A. Travaglini

Environmental Protection
Branch, Chief
Mr. J. F. Wing

Jennifer Worley
Rt 16 Box 28
Knoxville, Tn 37920
615-577-7694

I'm upset over the proposed incineration facility in Oak Ridge. I know there must be alternatives for disposing of our radioactive waste but I feel we can reduce, drastically, the production of this waste. We have; I have not seen enough publicity on this proposal. I'm requesting further information; I have the 'Draft Environmental Impact Statement'. Will smoke be released from the plant, will it be contaminated, if so what effect will this have on East Tenn. and the people who live in this area?

Jennifer Worley
12-9-81



Department of Energy
Oak Ridge Operations
P.O. Box E
Oak Ridge, Tennessee 37830

DEC 30 1981

Ms. Jennifer Worley
Route 16 Box 28
Knoxville, TN 37920

Dear Ms. Worley:

In regard to your letter of December 9, 1981 we are enclosing a copy of the following for your consideration:

1. The Federal Register Notice of Intent, February 10, 1981
2. Newspaper advertisement of the Public Scoping Meeting and list of papers in which it was published
3. The Department of Energy news release and the list of media to which it was sent
4. The Briefing Document which was distributed at the Public Scoping meeting.

We feel that the environmental concerns you have expressed are adequately addressed in the Draft Environmental Impact Statement under Section 2.1.2, Page 2-23 and in Chapter 4.0, Page 4-1. The finding in these sections is that the health and environmental effects of the incinerator will be insignificant.

We thank you for your interest in the project.

Sincerely,

J. F. Wing, Chief
Environmental Protection Branch
Safety and Environmental
Control Division

SE-331:MAT

Enclosures

COPY



N-67

Department of Energy
Southwestern Power Administration
Post Office Box 1619
Tulsa, Oklahoma 74101

December 21, 1981

Mr. J. F. Wing
Chief, Environmental Protection Branch
Safety and Environmental
Control Division
Department of Energy
Oak Ridge Operations
P. O. Box E
Oak Ridge, Tennessee 37830

Dear Mr. Wing:

Thank you for including Southwestern Power Administration among the reviewers of your DOE/EIS-0084D Environmental Impact Statement for your proposed PCB incinerator facility.

After review of the draft, we have no comments to offer other than encouragement in this endeavor. We look forward to the review and ultimate Headquarters, DOE, approval of your final EIS.

Sincerely,

Paul A. Deis
General Engineer



DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1070
NASHVILLE, TENNESSEE 37202

IN REPLY REFER TO

24 DEC 1981

ORNED-P

Mr. J. F. Wing, Chief
Environmental Protection Branch
Oak Ridge Operations, Department
of Energy
PO Box E
Oak Ridge, TN 37830

Dear Mr. Wing:

Thank you for the opportunity to comment on the Draft Environmental Impact Statement (DEIS) concerning the proposed incineration facility for radioactively contaminated polychlorinated biphenyls and other wastes. Since the proposed action does not appear to involve environmental impacts related to Corps of Engineers jurisdiction by law or special expertise, I have no comment on the DEIS.

If I can be of future assistance, please do not hesitate to contact me.

Sincerely,


E. C. MOORE
Chief, Engineering Division




DEPARTMENT OF THE ARMY
LOUISVILLE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 59
LOUISVILLE, KENTUCKY 40201

ORLPD-R

13 November 1981

Mr. J. F. Wing, Chief
Environmental Protection Branch
Department of Energy
Oak Ridge Operations
P.O. Box E
Oak Ridge, TN 37830

Dear Mr. Wing:

We have reviewed the Draft Environmental Impact Statement for proposed construction of an incinerator to burn polychlorinated biphenyls and other organic wastes at the Oak Ridge Gaseous Diffusion Plant in Oak Ridge, Tennessee.

The proposed action will not affect any projects or programs of the Louisville District Corps of Engineers.

Thank you for the opportunity to comment.

Sincerely,

A handwritten signature in dark ink, appearing to read "C. E. Eastburn", is written over the typed name.

C. E. EASTBURN
Colonel, Corps of Engineers
District Engineer



OHIO Department of TRANSPORTATION

James A. Rhodes/Governor
David L. Weir/Director
25 South Front Street
P. O. Box 899
Columbus, Ohio 43216

November 25, 1981

J. F. Wing
Environmental Protection Branch
Department of Energy
P.O. Box E
Oak Ridge, Tennessee 37830

Re: Draft EIS-Incinerator Facility
for Radio Actively Contaminated
Polychlorinated Biphenyls and
other Wastes

Dear Mr. Wing:

This is in response to your November 4, 1981 request for comments on the above described document. The report has been circulated in the Bureau of Environmental Services and we do not have any comments to make concerning the information contained therein.

Very truly yours,

A handwritten signature in dark ink, reading "Byrd Finley, Jr.", with a stylized flourish at the end.

Byrd Finley, Jr., P.E.
Administrator
Bureau of Environmental Services

BF: ft3



TENNESSEE DEPARTMENT OF AGRICULTURE

Ellington Agricultural Center
Nashville, Tennessee 37204
Telephone (615) 741-1531

WILLIAM H. WALKER III
Commissioner

November 13, 1981

Mr. J. F. Wing
Department of Energy
Oak Ridge Operations
P. O. Box E
Oak Ridge, Tennessee 37830

Dear Mr. Wing:

This is to advise that we have reviewed the Draft Environmental Impact Statement for an Incinerator to burn Polychlorinated Biphenyls and other organic wastes contaminated with small quantities of radioactivity, principally uranium, and we have no negative comments.

Sincerely,

A handwritten signature in cursive script that reads "Paul M. Koger".

Paul M. Koger
Deputy Commissioner

PMK:bms

RICHARD FULTON, MAYOR

METROPOLITAN GOVERNMENT OF NASHVILLE AND DAVIDSON COUNTY

THE PUBLIC LIBRARY OF NASHVILLE
AND DAVIDSON COUNTY
THE BEN WEST LIBRARY
EIGHTH AVENUE, NORTH AND UNION
NASHVILLE, TENNESSEE 37203

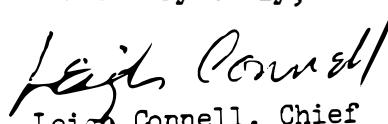
11 November 1981

U. S. Department of Energy
Oak Ridge Operations
P. O. Box E
Oak Ridge, Tennessee 37830

Attn. J. F. Wing, Chief, Environmental Protection
Branch, Safety & Environmental Control Division

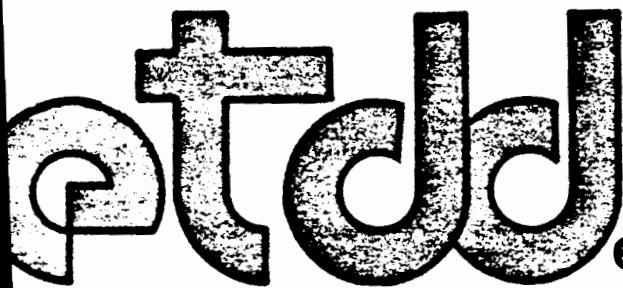
Please delete us from your distribution list, as we
no longer have room to house the material you have
been sending us.

Yours very truly,



Leigh Connell, Chief
Reference Division

N.B. You have as our mailing address:
City of Nashville Public Library
ATTN: Mr. David Marshall Stewart
Chief Librarian
Eighth Avenue North & Union
Nashville, TN 37203



east tennessee development district

December 21, 1981

counties
anderson
blount
campbell
claiborne
cocke
grainger
hamblen
jefferson
knox
loudon
monroe
morgan
roane
scott
sevier
union

Mr. J. F. Wing, Chief
Environmental Protection Branch
Safety and Environmental
Control Division
U. S. Department of Energy
Oak Ridge Operations
P. O. Box E
Oak Ridge, TN 37830

Dear Mr. Wing:

cities
alcoa
blaine
caryville
clinton
berland gap
dandridge
farragut
friendsville
gatlinburg
greenback
harriman
huntsville
jacksboro
ferson city
jellico
kingston
knoxville
lafollette
lake city
lenior city
loudon
luttrell
adisonville
maryville
ynardville
orristown
ew market
v tazewell
newport
norris
oak ridge
oakdale
r springs
oneida
rrottsville
ladelphia
on forge
an center
rockford
ockwood
rutledge
evierville
eetwater
tazewell
o plains
wnsend
vonore
vartburg
ite pine

SUBJECT: Result of Regional Review
U. S. Department of Energy - Draft EIS, Incinerator Facility
for Radioactively Contaminated Polychlorinated Biphenyls and
Other Wastes

The East Tennessee Development District has completed its review of the
above mentioned draft environmental impact statement, in its role as a
regional clearinghouse to review federally-assisted projects.

ETDD has no comments concerning this report at this time. However, ETDD
or other reviewing agencies may wish to comment further at a later time.

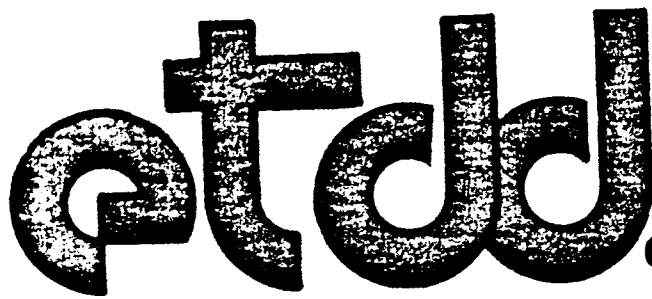
We appreciate the opportunity to work with you in coordinating projects
in the region.

Sincerely,


Allen W. Neel
Executive Director

AWN/tg

cc Mr. Mike Jones, Tennessee State Clearinghouse



east tennessee development district

November 13, 1981

counties
anderson
blount
campbell
claiborne
cocke
grainger
hamblen
jefferson
knox
loudon
monroe
morgan
roane
scott
sevier
union

MEMORANDUM

TO: Mayor A. K. Bissell, Oak Ridge
Mr. Gerald Largen, Roane County Executive

FROM: Trudy Garrett, Project Review Coordinator

SUBJECT: Regional Review Notification and Request for Comments
U. S. Department of Energy - Draft EIS, Incinerator
Facility for Radioactively Contaminated Polychlorinated
Biphenyls and Other Wastes

cities
alcoa
blaine
caryville
clinton
cumberland gap
dandridge
farragut
friendsville
gatlinburg
greenback
harriman
huntsville
jacksboro
jefferson city
jellico
kingston
knoxville
lafollette
lake city
lenoir city
loudon
luttrell
madisonville
maryville
maynardville
morristown
new market
new tazewell
newport
norris
oak ridge
oakdale
oliver springs
oneida
parrottsville
philadelphia
pigeon forge
pittman center
rockford
rockwood
rutledge
sevierville
sweetwater
tazewell
tellico plains
townsend
vonore
wartburg
white pine

The East Tennessee Development District is reviewing the above mentioned draft environmental impact statement and preparing to submit comments to the U. S. Department of Energy.

It is usual policy of federal agencies to send copies of such documents to affected units of local government. If you have not received a copy, please contact me or the U. S. Department of Energy in Oak Ridge.

If you wish to comment upon the accuracy of the statement as a fair assessment of the potential environmental impacts of the project, comments should be received by the East Tennessee Development District not later than December 21, 1981. If questions arise which require additional time for review or which will require a conference between affected parties, you should let us know as soon as possible but not later than December 21, 1981. Your comments will be conveyed to the U. S. Department of Energy and will be considered in preparing the recommendations of the East Tennessee Development District.

Your assistance in reviewing this proposal will be greatly appreciated. Please feel free to contact me at any time if you need further information.

TG/tg

cc Mr. J. F. Wing, U. S. Department of Energy, Oak Ridge Operations

A. L. SANDPIPER CORPORATION

Albert E. Abel
President

2917 North Star Road
Columbus, Ohio 43221
(614) 488-5871

December 21, 1981

Mr. J. F. Wing, Chief
Environmental Protection Branch
Oak Ridge Operations
Department of Energy
P.O. Box E
Oak Ridge, TN 37830

Dear Mr. Wing:

I have reviewed the Draft Environmental Impact Statement, titled, "Incineration Facility for Radioactively Contaminated Polychlorinated Biphenyls and Other Wastes" (DOE/EIS-0084D). I support the proposed disposal of these materials by thermal destruction and am favorably impressed with the level of consideration given to the environmental impact of such a program.

A. L. Sandpiper Corporation is presently developing new technology for hazardous waste destruction which may prove ideally suited to your application. Sequential gasification, or SEGASTM, is a high temperature process employing a thermal steam reformation mechanism in conjunction with thermal decomposition of carbon-based materials to produce a product gas composed chiefly of carbon monoxide and hydrogen. The process does not require mixing of air with the feedstream to provide the necessary heat of reaction, thus greatly reducing the downstream scrubber requirements, reactor size and energy requirements, and eliminating potential formation of toxic nitrogen compounds.

The non-catalytic process allows for continuous, efficient conversion of a broad range of feedstreams, due to its ability to accommodate a variety of temperature, pressure and residence time requirements.

SEGAS reactors are designed to operate as totally enclosed systems, allowing a significant degree of control over release of emissions to the atmosphere. Product gases, once scrubbed, can be safely flared or used to supply the energy necessary to drive the process.

Battelle Columbus Laboratories has recently completed an evaluation of the SEGAS process. For their study, they chose PCB's as the waste to be destroyed (although they indicate the process should be equally applicable to a wide variety of hazardous wastes). The study indicates potentially substantial economic advantage of the

Mr. F. J. Wing
Department of Energy

December 21, 1981

page 2

SEGASTM process over conventional incineration. A comparison of the capital and operating costs for a 600 gallon per hour stationary facility is shown below:

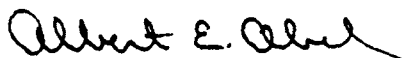
	<u>Feed rate</u> <u>gal/hr.</u>	<u>Feed stream</u> <u>undiluted</u>	<u>Capital cost</u> <u>\$ Million</u>	<u>Operating cost</u> <u>\$ Gallon</u>
SEGAS	600	Aroclor 1254	2.44	0.41
Incineration	600	Aroclor 1254	7.39	1.20

At the present time, A. L. Sandpiper Corporation is preparing to begin a laboratory-scale development program with Battelle, which is expected to result in the completion of the first commercial-scale reactor (600 gallons/hour) by early 1985. Although SEGAS technology has been directed primarily toward the liquid and sludge markets, design concepts are presently under review to extend the technology to solids. If the system appears to satisfy your needs on other points, consideration could be given to acceleration of the solids schedule, targeting incorporation of solids handling capability by mid 1985.

I feel the SEGAS process may be ideally suited to your particular needs and would welcome the opportunity to discuss our program with you in greater detail.

Thank you for your consideration.

Sincerely,



Albert E. Abel
President

AEA:c