U.S. Department of Energy

**Environment, Safety and Health
Office of Environmental Audit**

**Environmental Survey
Preliminary Report**

**Y-12 Plant
Oak Ridge, Tennessee**

MASTER

PREFACE
TO
THE DEPARTMENT OF ENERGY
Y-12 PLANT
ENVIRONMENTAL SURVEY PRELIMINARY REPORT

This report contains the preliminary findings based on the first phase of an Environmental Survey at the Department of Energy (DOE) Y-12 Plant, located at Oak Ridge, Tennessee. The Survey is being conducted by DOE's Office of Environment, Safety and Health.

The Y-12 Survey is a portion of the larger, comprehensive DOE Environmental Survey encompassing all major operating facilities of DOE. The DOE Environmental Survey is one of a series of initiatives announced on September 18, 1985, by Secretary of Energy, John S. Herrington, to strengthen the environmental, safety and health programs and activities within DOE. The purpose of the Environmental Survey is to identify, via a "no-fault" baseline Survey of all the Department's major operating facilities, environmental problems and areas of environmental risk. The identified problem areas will be prioritized on a Department-wide basis in order of importance in 1988.

The findings in this report are subject to modification based on the results from the Sampling and Analysis phase of the Survey. The findings are also subject to modification based on comments from the Oak Ridge Operations Office concerning the technical accuracy of the findings. The modified preliminary findings and any other appropriate changes will be incorporated into an Interim Report. The Interim Report will serve as the site-specific source for environmental information generated by the Survey, and ultimately as the primary source of information for the DOE-wide prioritization of environmental problems in the Survey Summary Report.

November 1987
Washington, D. C.

MASTER

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EXECUTIVE SUMMARY

Introduction

This report presents the preliminary findings from the first phase of the Environmental Survey of the Department of Energy (DOE), Y-12 Plant, conducted November 10 through 21 and December 9 through 11, 1986.

The Survey is being conducted by a multidisciplinary team of environmental specialists, led and managed by the Office of Environment, Safety and Health's Office of Environmental Audit. Individual team members are outside experts being supplied by a private contractor. The objective of the Survey is to identify environmental problems and areas of environmental risk associated with the Y-12 Plant. The Survey covers all environmental media and all areas of environmental regulation. It is being performed in accordance with the DOE Environmental Survey Manual. This phase of the Survey involves the review of existing site environmental data, observations of the operations performed at Y-12, and interviews with site personnel.

The Survey team developed a Sampling and Analysis Plan to assist in further assessing certain environmental problems identified during its on-site activities. The Sampling and Analysis Plan is being executed by DOE's Argonne National Laboratory. When completed, the results will be incorporated into the Y-12 Plant Environmental Survey Interim Report. The Interim Report will reflect the final determinations of the Y-12 Plant Survey.

Site Description

The Y-12 Plant occupies 811 acres (3.3 square kilometers [km²]) in the eastern end of the Oak Ridge Reservation, in eastern Tennessee. The 37,000 acres (150 km²) of Federally-owned property comprising the Oak Ridge Reservation also encompasses the Oak Ridge National Laboratory and the Oak Ridge Gaseous Diffusion Plant. The Y-12 Plant is located about 20 miles (32 km) west of Knoxville and about 3 miles (5 km) southwest of the center of the City of Oak Ridge. The Y-12 Plant is operated by Martin Marietta Energy Systems, Inc., under contract with DOE.

The primary mission of the Y-12 Plant is the processing of source and special nuclear materials and the production of component parts that are shipped to other DOE sites for final assembly into nuclear weapons. The Y-12 Plant also provides support to the weapons design laboratories, other Oak Ridge Reservation activities, and other government agencies. Key production activities at Y-12

involve the fabrication of parts from uranium; nonradioactive metals, principally iron, steel, aluminum, and copper; and also plastic, ceramics, and carbon. Source and special nuclear materials processed at Y-12 include enriched uranium, depleted uranium, and depleted uranium alloy. Lithium and beryllium metals are also processed at the Y-12 Plant. The Y-12 Plant has been in continuous use since 1943, when it was originally constructed as part of the Manhattan Project.

Summary of Findings

The major preliminary findings of the Environmental Survey of the Y-12 Plant are as follows:

- Past waste disposal practices in Bear Creek Valley have resulted in contamination of groundwater with volatile organic compounds (VOCs), heavy metals, nitrate, and radionuclides. Additionally, runoff of contaminated soils and discharge of groundwater from this area into surface waters have caused degradation of Bear Creek waters and sediments. VOCs are also being emitted to the atmosphere through standpipes and vents at the Bear Creek Valley Waste Disposal Area. Characterization and remedial planning is well under way.
- Both groundwater and soil contamination are present in the main plant area. Contaminant plumes of sulfate, chloride, nitrate, high alkalinity, and high conductivity have been detected in groundwater. Accidental loss and spillage of mercury at the main plant area has resulted in soil contamination. Groundwater infiltrating basements and drains at the plant site is transporting mercury-contaminated soil to surface waters of East Fork Poplar Creek. Remedial action to reduce groundwater infiltration and mercury transport through the plant storm-water drainage system is under way.
- Past waste disposal practices, along with accidental loss and spillage of process materials, have resulted in the contamination of the floodplains of East Fork Poplar Creek and Bear Creek. Contaminants found at elevated concentrations include mercury, PCBs, cadmium, and nitrate/nitrites. The Oak Ridge Interagency Task Force is studying the extent of off-site contamination.
- The six existing waste disposal sites at Chestnut Ridge are potential sources of groundwater contamination. Groundwater investigations are in progress at all of these sites. Preliminary data (i.e., elevated gross beta activity, variable specific conductance, and total organic halogens) suggest that groundwater contamination may be present at the Chestnut Ridge Sediment Disposal Basin.

Overall Conclusions

The Survey found no environmental problems at the Y-12 Plant that represent an immediate threat to human life. The preliminary findings identified at Y-12 by the Survey do indicate that the site is affected by a number of substantial environmental problems, most of which are a legacy of past practices when environmental implications and consequences were not as well understood. The most pressing problems facing the site at present appear to be off-site contamination of the East Fork Poplar Creek floodplain as a result of past, and to a lesser extent, current discharges and releases from Y-12; and on-site groundwater contamination at the Bear Creek Valley Waste Disposal Area with subsequent degradation of surface waters and sediments of Bear Creek.

The environmental problems described in this report vary in terms of their magnitude and risk. Although the Survey-related sampling and analysis being performed at the Y-12 Plant will assist in further identifying environmental problems at the site, a complete understanding of the significance of some of the environmental problems identified requires a level of study and characterization that is beyond the scope of the Survey. Actions currently under way or planned at the site, particularly those in response to the Memorandum of Understanding between the Oak Ridge Operations Office, EPA Region IV, and the State of Tennessee, as well as related Orders for Correction and Federal Facilities Compliance Agreements, will contribute toward meeting this requirement.

Transmittal of Results

The findings of the Environmental Survey of the Y-12 Plant were shared with the Oak Ridge Operations Office and the site contractor at the Survey closeout briefing held November 21, 1986. Since that time, informal coordination with the site and with representatives of the Oak Ridge Operations Office has been ongoing in an effort to gather additional environmental information and data not available during the on-site Survey activities. Those problems that involve extended studies and multi-year budget commitments will be the subject of the Environmental Survey Summary Report and the DOE-wide prioritization.

Within the Office of Environment, Safety and Health, the Office of Environmental Guidance and Compliance has immediate responsibility for monitoring environmental compliance and the status of the Y-12 Plant Survey findings. The Office of Environmental Audit will continue to assess the environmental problems through the program of systematic environmental audits that will be initiated toward the conclusion of the DOE Environmental Survey in 1988.

1.0 INTRODUCTION

The purpose of this report is to present the preliminary findings made during the Environmental Survey, November 10 through 21 and December 9 through 11, 1986, of the Department of Energy's (DOE) Y-12 Plant (Y-12) at Oak Ridge, Tennessee. As a preliminary report, the contents are subject to revisions in the Interim Report, based on the Oak Ridge Operations Office review and comments on the technical accuracy, the results of the sampling and analyses, and other information that may come to the Survey team's attention prior to issuance of the Interim Report. Y-12 is operated for DOE by Martin Marietta Energy Systems, Inc.

The Y-12 Survey is part of the larger DOE-wide Environmental Survey effort announced by Secretary John S. Herrington on September 18, 1985. The purpose of this effort is to identify, via "no fault" baseline Surveys, existing environmental problems and areas of environmental risk at DOE facilities, and to rank them on a DOE-wide basis. This ranking will enable DOE to more effectively establish priorities for addressing environmental problems and to allocate the resources necessary to correct these problems. Because the Survey is "no fault" and is not an "audit," it is not designed to identify specific isolated incidents of noncompliance nor to analyze environmental management practices. Such incidents and/or management practices will, however, be used in the Survey as a means of identifying existing and potential environmental problems.

The Y-12 Environmental Survey was conducted by a multidisciplinary team of technical specialists headed and managed by a Team Leader and Assistant Team Leader from DOE's Office of Environmental Audit. A complete list of the Y-12 Survey participants and their affiliations is provided in Appendix A.

The Survey team focused on all environmental media, using Federal, state, and local environmental statutes and regulations, accepted industry practices, and professional judgment to make the preliminary findings included in this report. The team carried out its activities in accordance with the guidance and protocols in the Environmental Survey Manual (May 1986). Substantial use of existing information and of interviews with knowledgeable field office and site-contractor personnel accounted for a large part of the on-site effort. The Survey Plan is presented in Appendix B and a summary of the site-specific Survey activities is presented in Appendix C. Appendix D includes several documents from state and Federal agencies that prescribe actions and schedules for the resolution of environmental issues. Appendix E includes responses from Oak Ridge Operations to the Status Report that was submitted following the Y-12 Environmental Survey. Appendix F is a list defining

symbols, abbreviations, and acronyms used in this report. Appendix G presents data on waste waters discharged from various buildings.

The preliminary Survey findings, in the form of existing and potential environmental problems, are presented in Sections 3.0 and 4.0. Section 3.0 includes those findings that pertain to a specific environmental medium (e.g., air or soil), whereas Section 4.0 includes those that are non-media specific (e.g., waste management, radiation, and quality assurance). Because the findings are highly varied in terms of magnitude, risk, and characterization, and consequently require different levels of management attention and response, they are further subdivided into four categories within Sections 3.0 and 4.0.

The criteria for placing a finding into one of the four categories are as follows:

- Category I includes only those findings which, based upon the information available to the Team Leader, involve immediate threat to human life. Findings of this type shall be immediately conveyed to the responsible Environmental Safety and Health personnel at the scene or in control of the facility or location in question for action. Category I findings are those environmental problems where the potential risk is highest, the confidence in the finding, based on the information available, is the strongest, and the appropriate response to the finding is the most restrictive in terms of alternatives.
- Category II findings encompass one or more of the following situations:
 - Multiple or continuing exceedances, past or present, of a health-based environmental standard where there is immediate potential for human population exposure, or a one-time exceedance where residual impacts pose an immediate potential for human population exposure.
 - Evidence that a health-based environmental standard may be exceeded, as discussed in the preceding situation, within the time frame of the DOE-wide Survey.
 - Evidence that the likelihood is high for an unplanned release due to, for example, the condition or design of pollutant abatement or monitoring equipment or other environmental management practices.

- Noncompliance with significant regulatory procedures (i.e., those substantive technical regulatory procedures designed to directly or indirectly minimize or prevent risks, such as inadequate monitoring or failure to obtain required permits).

Category II findings include those environmental problems where the risk is high but where the definition of risk is broader than in Category I. The information available to the Team Leader is adequate to identify the problem but may be insufficient to fully characterize it. Finally, in this category, most discretion is available to the Operations Offices and Program Offices as to the appropriate response; however, the need for that response is such that management should not wait for the completion of the entire DOE-wide Survey to respond. Unlike Category I findings, a sufficient, near-term response by the Operations Office may include further characterization prior to any action taken to rectify the situation.

- Category III findings encompass one or both of the following criteria:

- The existence of pollutants or hazardous materials in the air, water, groundwater, or soil resulting from DOE operations that pose or may pose a hazard to human health or the environment.
- The existence of conditions at a DOE facility that pose or may pose a hazard to human health or the environment.

Category III findings are those environmental problems for which the broadest definition of risk is used. As in Category II, the information available to the Team Leader may not be sufficient to fully characterize the problem. Under this strategy, the range of alternatives available for response, and the corresponding time frames for response, are the greatest. Environmental problems included within this category will typically require lengthy investigation and remediation phases, as well as multiyear budget commitments. These problems will be included in the DOE-wide prioritization effort to ensure that DOE's limited resources are used effectively.

In general, the levels of pollutants or materials that constitute a hazard or potential for hazard are those that exceed some Federal, state, or local regulations for release of, contamination by, or exposure to such pollutants or materials. However, in some cases, the Survey may determine that the presence of some nonregulated material is in a

concentration that presents a concern for local populations or the environment that is sufficient to be included as an environmental problem. Likewise, the presence of regulated materials in concentrations that, even though below those established by regulatory authorities, nevertheless present a potential for hazard or concern, may be classified as an environmental problem. In general, however, conditions that meet regulatory or other requirements, where such exist, should not present a potential hazard and will not be identified as environmental problems.

Conditions that pose or may pose a hazard are generally those which are violations of regulations or requirements (e.g., improper storage of hazardous chemicals in unsafe tanks). Such conditions present a potential hazardous threat to human health and the environment and should be identified as an environmental problem. Additionally, potentially hazardous conditions are those where the likelihood of the occurrence of release is high.

The definition of the term environmental problem is broad and flexible to allow for the wide differences among the DOE sites and operations. Therefore, a good deal of professional judgment must be applied to the identification of environmental problems.

- Category IV findings include instances of administrative noncompliance and management practices that are indirectly related to environmental risk, but are not appropriate for inclusion in Categories I-III. Such findings can be based upon any level of information available to the Team Leader including direct observations by the team members. Findings in this category are generally expected to lend themselves to relatively simple, straightforward resolution without further evaluation or analysis. These findings, although not part of the DOE-wide prioritization effort, will be passed along to the Operations Office and appropriate Program Office for their action.

Based on the professional judgment of the Team Leader, the findings within categories are arranged in order of relative significance. Comparing the relative significance of one finding to another, either between categories within a section or within categories between sections, is neither appropriate nor valid. The categorization and listing of findings in order of significance within this report is only the first step in a multi-step iterative process to prioritize DOE's problems.

The next phase of the Y-12 Survey is sampling and analysis (S&A). Argonne National Laboratory, the S&A team for Y-12, will begin taking samples in February 1987. Prior to sampling, an S&A plan will

be prepared by DOE and ANL in accordance with the protocols in the draft Survey Manual. The S&A plan will be designed to fill existing data gaps or weaknesses. The results generated by the S&A effort will be used to assist the Survey team in further defining the existence and extent of potential environmental problems identified during the Survey.

An Interim Report will be prepared 6 to 8 weeks after the completion of the S&A effort. The Interim Report will incorporate the results of the S&A effort as well as any changes or comments resulting from the review of the Preliminary Report. Based on the S&A results, the preliminary findings and observations made during the on-site Survey may be modified, deleted, or moved within or between categories. The Interim Report will serve both as the site-specific repository for information generated by the Survey, and ultimately as the site-specific source of information for the DOE-wide prioritization of environmental problems.

It is clear that certain of the findings and observations contained in this report, especially those in Category II, can and should be addressed in the near-term (i.e., prior to the DOE-wide prioritization effort). It is also clear that the findings and observations in this report vary greatly in terms of magnitude, risk, and characterization. Consequently, the priority, magnitude, and timeliness of near-term responses will require careful planning to ensure appropriate and effective application. The information in this Preliminary Report, albeit provisional, will assist the Oak Ridge Operations Office in the planning of these near-term responses.

Responses by Oak Ridge operations to the preliminary findings presented at the conclusion of the on-site Survey activities and summarized in the Y-12 Survey Status Report prepared for DOE management are attached to this report as Appendix E.

2.0 GENERAL SITE INFORMATION

2.1 Site Setting

The Oak Ridge Reservation (ORR) is located in eastern Tennessee, about 32 km (20 miles) west of Knoxville and about 5 km (3 miles) southwest of the population center of the City of Oak Ridge (Figure 2-1). The ORR is contained within the corporate limits of the City of Oak Ridge. The Y-12 Plant is part of the 37,000-acre ORR, which also encompasses the Oak Ridge National Laboratory and the Oak Ridge Gaseous Diffusion Plant (Figure 2-2). The Y-12 Plant is situated in the eastern end of the Reservation in the Bear Creek Valley with the Cumberland Mountains rising to an elevation of 900 meters (3,000 feet) or more about 16 km (10 miles) to the northwest, and the Great Smoky Mountains reaching over 2,000 meters (6,600 feet) about 112 km (70 miles) to the southeast. The plant occupies an area about 1.1 km (2/3 mile) wide by 5.1 km (3.2 miles) long, and consists of 811 acres (Figure 2-3). About 300 buildings are situated in that area (Figure 2-4).

Except for Knoxville and the City of Oak Ridge, the land within 80 km (50 miles) of the ORR is predominately rural, used largely for residences, small farms, and pasturage of cattle. The Tennessee and Clinch Rivers are the major streams flowing through the area; the Clinch River forms the southeastern border of the ORR. The area is ideally suited for recreational activities such as fishing, boating, water skiing, and swimming. Based on 1980 census data, the major population center within the 80-km radius is Knoxville, with 183,139 people, and the City of Oak Ridge is second with 27,662 people. The populations of other cities and towns in the area are listed in Table 2-1, and the population densities for the 80-km radius are depicted in Figure 2-5. It should be noted that Figures 2-1 and 2-5 are centered on the ORR and that most of the 10-km radius area of these figures is the ORR. Fewer than 5,000 people live within that 10-km radius (MMES, 1986a).

Oak Ridge has a mild climate with warm, humid summers and cool winters. No extreme conditions prevail in temperature, precipitation, or winds. Spring and fall are usually long, and the weather is normally dry and sunny with mild temperatures. Severe storms such as tornadoes or high-velocity winds are rare. The mountains frequently divert hot, southeasterly winds that develop along the southern Atlantic coast. The small drainage areas of Bear Creek (7.4 mile²) and East Fork Poplar Creek (30 mile²) and the topography of the area make it unlikely that flash floods will occur in these streams. The floodplain areas within the Y-12 Plant area are shown in Figures 2-6 and 2-7. Only three buildings are identified as being within the 100-year floodplain of East Fork Poplar Creek: 9404-7 (Stores), 9404-8 (Weld Test Shop), and 9419-2 (Utilities). The system of dams operated by the Tennessee Valley Authority preclude flash floods in the Clinch and Tennessee Rivers downstream

FIGURE 2-1

LOCATION MAP OF OAK RIDGE RESERVATION Y-12 PLANT, OAK RIDGE RESERVATION

FIGURE 2-2

MAP OF THE OAK RIDGE RESERVATION
Y-12 PLANT, OAK RIDGE RESERVATION

2

OAK RIDGE Y-12 PLANT AND
Y-12 PLANT, (

GE

FIGURE 2 - E

D SELECTED WASTE DISPOSAL AREAS
AK RIDGE RESERVATION

KEY

Building	Location	Function
81-10	B-11	Process Storage
81-22	B-15	Process Storage
1601-1	D-6	Eliza-1 Switchyard Controls
1601-2	B-14	Storage
9102-1	B-6	ORNL Engineering Technology
9102-2	B-6	ORNL Engineering Technology
9103	D-13	Central Computing Facility
9104-1	B-6	ORNL Engineering Technology
9104-2	B-6	ORNL Engineering Technology
9104-3	B-6	ORNL Engineering Technology
9105	B-7	ORNL Fusion Energy
9106	D-7	General Offices
9107	D-14	DOE Transportation Safeguard
9108	B-6	ORNL Engineering Technology
9109	D-7	Employee Relations
9110	C-11	Production Staff Offices
9111	D-12	Engineering Offices
9112	D-12	Engineering Offices
9114	D-16	Rust/DOE Offices (under construction)
9201-1	B-8	General Shops
9201-2	B-7	ORNL Fusion Energy
9201-3	B-6	ORNL Engineering Technology
9201-4	C-12	Production
9201-5	C-13	Production
9201-5E	C-13	Production
9201-5W	C-14	Production
9201-5N	D-14	Production
9202	C-7	Development
9203	C-6	Development
9203A	C-6	Development
9204-1	B-10	ORNL Engineering Technology
9204-2	C-11	Production
9204-2E	C-11	Production
9204-3	B-10	ORNL Isotope Separation
9404-4	C-14	Production
9206	C-6	Development
9206	C-10	Production
9207	D-6	ORNL Biology
9208	D-6	ORNL Biology
9210	D-6	ORNL Biology
9211	D-6	ORNL Biology
9212	D-10	Production

9213	A-14	Guard Training
9215	D-11	Production
9217	B-8	General Shops
9217-1	B-8	Filter House
9219	D-4	ORNL Biology
9220	D-6	ORNL Biology
9224	D-6	ORNL Biology
9401-1	C-6	ORNL Energy
9401-2	B-12	Production
9401-3	B-12	Steam Plant
9401-4	B-16	Low-Level Waste Processing
9401-5	B-16	Uranium Chip Oxidizer
9401-6	B-16	Waste Processing
9404-1	B-8	Warehouse
9404-2	B-8	Utilities
9404-3	B-7	Utilities
9404-4	B-7	Utilities
9404-5	A-6	Paint Shop
9404-6	C-9	Utilities
9404-7	B-10	ORNL Storage
9404-8	B-9	Weld Test Shop
9404-9	C-11	Rubber Shop
9404-10	C-11	Utilities
9404-11	C-12	Utilities
9404-12	C-12	Utilities
9404-13	C-13	Utilities
9404-14	C-13	Utilities
9404-16	C-15	Utilities
9404-17	C-12	Utilities
9404-18	C-12	Utilities
9404-20	C-14	Utilities
9404-21	A-11	Utilities
9409-2	B-8	Cooling Tower
9409-3	A-7	Cooling Tower
9409-4	A-7	Cooling Tower
9409-6	C-9	Cooling Tower
9409-10	C-11	Cooling Tower
9409-12	C-12	Cooling Tower
9409-13	B-13	Cooling Tower
9409-15	B-10	Cooling Tower

9409-16	B-11	Cooling Tower
9409-17	C-10	Cooling Tower
9409-18	C-7	Cooling Tower
9409-19	D-6	Cooling Tower
9409-20	C-15	Cooling Tower
9409-22	D-11	Cooling Tower
9409-23	D-10	Cooling Tower
9409-24	D-11	Cooling Tower
9409-26	D-12	Cooling Tower
9409-27	D-11	Cooling Tower
9409-28	D-5	Cooling Tower
9409-29	D-6	Cooling Tower
9409-30	C-6	Cooling Tower
9409-31	C-7	Cooling Tower
9409-32	D-5	Cooling Tower
9409-33	D-10	Cooling Tower
9416-2	A-7	Water Treatment
9416-9	A-11	Water Treatment
9416-10	C-14	Water Treatment
9416-16	B-11	Water Treatment
9416-24	A-13	Water Storage
9418-1	B-10	Utilities
9419-4	B-7	Utilities
9419-5	B-7	Utilities
9418-6	B-6	Utilities
9418-9	B-9	Utilities
941-1	B-6	ORNL Engineering Technology
9410-2	B-10	Utilities
9420	C-17	Rust Engineering
9422	B-10	ORNL Fusion Energy
9510-2	B-10	Storage
9610	B-4	Storage
9611-2	B-10	Sewage Pumping Station
9616-6	B-18	West End Waste Treatment Facility (under construction)
thru 9616-8

9720-4	B-3	Stores
9720-6	B-14	Warehouse
9720-8	B-2	Maintenance Offices/Shops
9720-7	B-3	Warehouse
9720-8	B-4	Shipping & Receiving/Stores
9720-10	B-12	Storage
9720-11	B-12	Storage
9720-11	B-13	Storage
9720-12	B-16	Storage
9720-13	B-16	Storage
9720-14	B-16	Storage
9720-15	B-16	Storage
9720-16	C-17	Rust Engineering
9720-16	C-16	Rust Engineering
9720-17	C-10	Process Storage
9720-18	B-16	Storage
9720-19	C-11	Production
9720-20	C-6	Maintenance
9720-21	B-4	Storage
9720-22	C-16	Storage
9720-24	C-15	Storage
9720-25	B-16	Storage
9720-26	B-16	Storage
9720-27	A-17	Storage
9720-28	B-17	Low-Level Waste Storage

9720-49	B-11	Storage
9720-30	C-10	Storage
9720-31	B-18	Waste Storage
9720-32	B-16	Storage
9720-33	B-16	Storage
9720-34	C-6	Storage
9720-36	A-17	Storage
9720-38	B-12	Dispatching Storage
9720-39	B-6	ORNL Storage
9720-40	B-8	Storage
9721	D-11	Biodenitrification Facility
9722-2	C-8	Utilities
9723-1	C-8	Changehouse
9723-3	C-8	Maintenance
9723-4	C-8	Changehouse
9723-6	C-8	Maintenance
9723-8	C-4	Changehouse
9723-10	C-10	Offices
9723-11A	C-10	Quality Division Offices

9723-14	C-11	Product Certification Offices
9723-16	D-12	Rust Engineering
9723-18	D-12	Changehouse
9723-19	D-13	Changehouse
9723-21	D-13	Utilities
9723-24	C-8	Changehouse
9723-26	D-11	Offices/Changehouse
9727-3	B-12	Utilities
9727-4	B-12	Utilities
9728	C-6	Laundry
9729	B-C	Storage
9731	C-9	Classification/Development/ ORNL Motion Picture Photography ORNL Engineering Technology
9732-3	B-8

Department of Energy

Build

3

KEY (continued)

33-1	C-6	Engineering Offices
33-2	C-6	Engineering Offices
33-3	C-6	Engineering Offices
33-4	C-6	Engineering Offices
34	C-6	Maintenance Administration
35	C-6	ORNL Analytical Chemistry
36	C-6	Engineering Offices
37	C-6	Electrical Maintenance/Standards Laboratory
38	B-4	Production
39	C-6	Engineering Offices/Reproduction
43-2	D-6	ORNL Biology
44	B-10	Utilities
52	C-6	Utilities
53	C-3	Maintenance Storage
54	C-4	Maintenance
54-1	C-17	Rust Engineering

9754-2	C-4	Gasoline Filling Station
9755	C-3	Storage
9764	C-7	ORNL Engineering Technology
9765	C-6	Editorial-Graphic Arts/TV Studio/Photography/Engineering Offices
9767-1	B-10	Utilities
9767-2	C-10	Utilities
9767-3	D-6	Utilities
9767-4	C-11	Utilities
9767-5	D-6	Utilities
9767-6	D-4	Utilities
9767-7	D-6	Utilities
9767-8	B-7	Utilities
9767-10	D-11	Utilities
9767-12	C-13	Utilities
9768	C-10	Utilities
9769	D-6	ORNL Biology
9771	C-8	Mail
9802-1	C-14	Utilities
9803	B-13	Utilities
9804	B-12	Utilities
9805	C-11	Production
9805-1	C-11	Utilities
9806	C-12	Maintenance
9811	B-11	Waste Incinerator

9812	D-11	Production
9813	C-7	Storage
9814	C-17	Rust Engineering
9815	D-11	Storage
9816	A-17	Fire Training
9817	A-17	Fire Training
9818	D-11	Biodegradation Facility
9819	C-17	Rust Engineering
9820	D-10	Storage
9821-1	D-15	Production
9821-2	D-14	Production
9821-3	D-15	Production
9821-4	D-15	Production
9822	B-11	Utilities
9823	B-17	Coal Sampling Station
9824-1	D-15	Physical Testing
9824-2	C-16	Physical Testing
9824-3	D-15	Physical Testing
9824-4	A-10	Production
9824-5	A-15	Production
9825	D-14	Development
9827	B-17	Rust Engineering
9828-1	D-10	Filter House
9828-2	D-10	Filter House
9828-3	D-10	Filter House
9828-4	A-18	Scrap Monitoring Station
9831	C-17	Rust Engineering
9832	B-17	Storage
9840-1	D-7	Guard Post No. 7
9840-2	B-16	Guard Post No. 33
9840-3	B-7	Guard Post No. 12
9840-4	D-7	Guard Post No. 25

9149-5	D-8	Guard Post No. 2
9149-6	D-9	Guard Post No. 14
9149-7	C-8	Guard Post No. 9
9149-23	C-10	Guard Post No. 8
9149-24	B-17	Inactive Guard Post
9149-25	A-14	Guard Post No. 44
9149-26	D-7	Guard Post No. 8
9149-27	C-4	Inactive Guard Post
9149-28	A-10	Guard Post No. 28
9149-29	B-3	Guard Post No. 32
9149-30	D-12	Guard Post No. 11
9149-31	D-14	Guard Post No. 40
9150	B-4	Storage
9150-1	D-11	Storage
9150-2	B-4	Storage
9150-3	C-13	Utilities
9150-4	B-11	Utilities
9150-5	B-11	Utilities
9150-6	B-11	Utilities
9150-7	D-10	Physical Testing
9150-8	D-10	Utilities
9150-9	D-6	ORNL Biology
9150-10	C-8	Health Physics
9150-11	A-10	Radio Transmitter
9150-12	A-10	Radio Transmitter
9150-13	C-7	Fire Alarm Monitor Station
9150-14	D-7	ORNL Biology
9150-15	D-12	Storage
9150-16	D-4	Environmental Monitor
9150-17	A-17	Environmental Monitor
9150-18	B-3	Maintenance Storage
9150-19	D-10	Plant Laboratory
9150-20	D-10	Dispatching
9150-21	D-11	Production
9150-22	D-11	Emergency Generator
9150-23	B-10	Emergency Generator
9150-24	B-6	Switchgear Room

Single numbers preceded by a dash only are office trailers.

TABLE 2-1

**POPULATION OF CENTRAL EAST TENNESSEE TOWNS
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**

Anderson County

Town/City	Population
Clinton	5,245
Lake City	2,335
Norris	1,374
Oak Ridge	27,662
Oliver Springs	3,600

Blount County

Friendsville	694
Alcoa	6,870
Maryville	17,478

Knox County

Knoxville	183,139
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Loudon County

Greenback	546
Lenoir City	5,446
Loudon	3,940

Morgan County

Wartburg	761
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Roane County

Harriman	8,303
Kingston	4,441
Rockwood	5,767

Sevier County

Sevierville	4,566
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**TABLE 2-1
POPULATION OF CENTRAL EAST TENNESSEE TOWNS
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE
PAGE TWO**

Union County

Town/City	Population
Luttrell	962
Maynardville	924

Campbell County

Caryville	2,039
Jellico	2,769
Jacksboro	1,620
LaFollette	8,176

Source: MMES, 1986a.

2

LEGEND

100 YEAR FLOOD PLAIN

500 YEAR FLOOD PLAIN

MAXIMUM PROBABLE FLOOD

(ORNL)
9204-3
(Beta-3)

9419-2

SOURCE: Adapted from Y-12 Engineering Mechanics/Tennessee Valley Authority Drawing.

EAST FORK :
YI

FIGURE 2

OPLAR CREEK FLOOD PLAIN (CENTRAL SECTION)
12 PLANT, OAK RIDGE RESERVATION

2

EAST FORK PC
Y-1

FIGURE 2

PLAR CREEK FLOOD PLAIN (EASTERN SECTION)
2 PLANT, OAK RIDGE RESERVATION

from the Oak Ridge Reservation. The year-round mean temperature is 15°C (59°F), with a January mean of about 3.5°C (38°F) and a July mean of about 25°C (77°F). Recorded maximum and minimum temperatures are 38°C (100.4°F) and -18°C (-0.4°F).

Total annual precipitation (water equivalent) is 136 centimeters (cm) including approximately 25 cm of snowfall, with monthly precipitation peaking in January and February. Winter months are characterized by passing storm fronts of low intensity and long duration. Rainfall peaks in early winter, early spring, and again in mid-to-late summer, when heavy rains associated with thunderstorms are common. The year's minimum precipitation usually occurs in the fall. Typically in October, slow-moving high-pressure cells suppress rain and, while remaining nearly stationary for many days, provide mild, clear, dry weather. Poor air dilution (and thus the primary air pollution episodes) occurs with the greatest frequency and severity during this period.

Oak Ridge is one of the country's calmest wind areas. Because of this, providing relief from the summer's humidity through ventilation is difficult. The atmosphere can be considered to be in an inversion status about 36 percent of the time. The daily up- and down-valley winds, however, provide some diurnal exchange. The prevailing wind directions are from the northeast (down-valley) and southwest (up-valley).

2.2 Overview of Major Site Operations

The three major facilities at the Oak Ridge Reservation (Oak Ridge Gaseous Diffusion Plant, Oak Ridge National Laboratory, and the Y-12 Plant) are managed by Martin Marietta Energy Systems, Inc., under a contract administered by the Oak Ridge Operations Office of the Department of Energy. This report deals only with the activities at the Y-12 Plant and five ORNL divisions (Biology, Engineering Technology, Fusion Energy, Operations [Stable Isotope Enrichment Group], and Analytical Chemistry) located at Y-12.

The Y-12 Plant was originally constructed in 1943 as part of the Manhattan Project. Its initial mission was the separation of fissionable isotopes of uranium (U-235) by the electromagnetic process. Uranium-235 was the fissionable material used in the world's first atomic bomb, which was detonated on August 5, 1945. Over the ensuing years, Y-12 has become a highly sophisticated nuclear weapons component manufacturing and development engineering organization.

2.2.1 Present Operations

As can be seen in Figure 2-4, the production portion of the Y-2 Plant, which covers 811 acres, is a heavily developed area with a high density of buildings and roads. The work force at the Y-12 Plant is composed of about 7,000 people in the engineering, skilled and semi-skilled crafts, technical, and administrative support areas.

The Y-12 Plant has four principal missions: (1) defense responsibilities related to the production of nuclear weapons components and support to the DOE weapons design laboratories, (2) processing of source and special nuclear materials, (3) providing support to other Martin Marietta Energy Systems installations, and (4) providing support to other governmental agencies. Activities associated with these missions include recovery of enriched uranium from obsolete weapons and scrap materials, processing of enriched uranium compounds from other DOE sites, production of lithium compounds, and fabrication of uranium (enriched and depleted) and other materials into finished parts and assemblies.

Components produced at Y-12 are used in most of the underground nuclear weapons tests that are conducted by the weapons design laboratories.

2.2.1.1 Metal Preparation

Processing of Enriched Uranium

Much of the enriched uranium (U-235) processed in the Y-12 Plant is reclaimed uranium that ranges from high-grade metal to a trace of uranium contained in such salvage as mop water, mops, gloves, cloth and paper wipes, etc. Very pure unalloyed uranium scrap is broken, melted, and recast. Chips from machining are briquetted and also are recast.

Combustible materials including metal chips, contaminated cloth, paper, carbon molds, etc., are burned in special burners or furnaces to concentrate the uranium in an ash, which is subsequently leached with nitric acid to recover the uranium as uranyl nitrate solution. Alloys and less-pure uranium are also dissolved in nitric acid to produce a uranyl nitrate solution. Various extraction and evaporation techniques are used to purify the uranyl nitrate, which is denitrated to uranium trioxide (UO_3) by heating. The UO_3 is reduced to uranium dioxide (UO_2) with hydrogen, and then is converted to uranium tetrafluoride (UF_4) by treatment with hydrogen fluoride (HF) gas. The UF_4 is finally reduced to uranium metal with calcium. In addition, enriched uranium from the Savannah

River and Idaho Chemical Processing Plants, in the form of uranyl nitrate solution and uranium trioxide, is processed into uranium metal by the same process.

After the metal is cast, rough parts are sent to the Fabricating Division for machining. Billets are sent to a rolling mill, where forming and heat-treating steps prepare parts for machining. Salvageable material is returned for reprocessing.

Processing of Depleted Uranium

Virgin depleted uranium metal is used to make alloy and other products that must have high purity and also have narrow assay limits. Parts returned to the foundry for reworking are recast, as is massive scrap uranium from the rolling mill. Cast billets are pickled in nitric acid and then processed in a rolling mill, where strips of depleted uranium are prepared for use in the manufacture of uranium alloys. Shapes of the unalloyed metal are prepared by rolling, forming, and heat-treating operations in preparation for machining.

Processing of Depleted-Uranium Alloy

Strips of depleted uranium and other alloying components are melted in an arc-melt shop and formed into ingots. The cooled ingots are trimmed with cut-off saws to remove ends with high impurity concentrations. Several ingots are then welded together and remelted to form larger ingots. Billets are cut to size and are forged. Surface defects are ground out. After heat treatment, the billets are subjected to rolling, forming, and annealing operations as required by the part, and then sent to fabrication shops for finishing.

Processing of Lithium

Lithium metal is stored under mineral oil to protect it from atmospheric moisture. When the lithium is to be used, the oil is washed off with mineral spirits. The lithium is loaded into a reactor in a relatively dry atmosphere and is reacted with deuterium. The resulting lithium deuteride is crushed, ground, and formed into rough parts by pressing and sintering. The rough parts are then ready for machining.

Recycled lithium parts and compacted lithium dust from machining operations are reacted with water in preparation for chemical purification. Calcium and iron are removed from the solution by precipitation with oxalic acid. After filtration, the solution is made acidic with dilute hydrochloric

acid. Evaporation yields solid lithium chloride, which is electrolyzed to lithium metal and chlorine gas.

Processing of Beryllium

Selected parts are manufactured by machining beryllium metal. Molded shapes are formed in gloveboxes, by the application of heat and pressure to beryllium oxide powder contained in a mold. These shapes are then finish machined to remove surface imperfections. Waste beryllium metal from machining is recycled if possible; that not recycled is buried. Some aqueous wastes containing suspended insoluble materials are filtered and the beryllium-containing solids are buried.

Various Related Functions

A variety of products are prepared by mixing, pressing, and sintering powders of tungsten, nickel, and iron, which are subsequently finished by machining.

Carbon foam shapes are produced from a urethane foam that is cured, heated, and carbonized to drive off volatiles. Other activities include intermediate metal annealing steps, electropolishing of some uranium parts, and electroplating.

2.2.1.2 Metal Fabrication

The primary function in metals fabrication is the production of weapons parts. A secondary purpose is to provide support to other Y-12 divisions, as well as other activities at the Oak Ridge Reservation, in the fabrication of parts, in tooling, and in producing other required mechanisms and devices. To provide these services, more than 1,200 machine tools of various types are used.

The fabrication processes include such unit operations as vacuum casting, arc melting, electron-beam melting, and powder compaction. The compacted materials are worked into mill products such as sheet and plate, extrusion, or forgings, that are then formed to shape and to approximate dimensions. Finally, the shapes are machined to finished dimensions and certified. Some limited consolidation of individual parts into subassemblies also takes place in this division.

Raw materials consist of cast, rolled, and forged uranium metal parts, powdered metal blanks, iron, steel, aluminum, copper, plastic, ceramics, and carbon.

2.2.1.3 Product Certification

The Plant Analytical Laboratory provides services in atomic and x-ray spectroscopy, molecular spectroscopy, mass spectrometry, chromatography, thermal analysis, physical testing, wet-chemical analysis, and record-keeping on samples received.

The Physical Testing Department certifies the mechanical and physical properties of Y-12 products. The operations and processes include ultrasonic and magnetic testing, radiography, penetrant testing, magnetic-particle testing, and mechanical-equipment inspection.

The Dimensional Inspection Department ensures that purchased materials meet the required specifications and that the fabricated products conform to dimensional requirements.

2.2.1.4 Assembly Processes

The Assembly Division performs three major functions:

- Assembly of parts into weapons components.
- Disassembly and evaluation of components and reclamation of materials.
- Receipt, storage, and shipment of components and materials.

The processes used in these activities include vapor degreasing, electropolishing, pickling, coating, vacuum baking, solvent wiping, metallurgical joining, adhesive bonding, mechanical stacking, machining, painting, and leak testing.

2.2.1.5 Support Activities

In support of operations at the Y-12 Plant are the cafeteria, steam plant, maintenance facility, central water treatment facility, sanitary sewer system, storm drainage system, holding ponds, and waste burial grounds.

2.2.1.6 ORNL Activities at Y-12

Several ORNL divisions conduct operations in facilities at the Y-12 Plant. The Biology Division conducts research in health and genetic-related fields using laboratory animals, mainly rats and mice, in large numbers. The Engineering Technology Division is engaged in work related to the

Liquid-Metal Fast Breeder Reactor, the Molten Salt Reactor, the Gas-Cooled Reactor, and other advanced reactor concepts. The Fusion Energy Division is conducting research to develop fusion power reactors for economical production of electric power. The Operations Division prepares enriched stable isotopes by electromagnetic separation. The Analytical Chemistry Division houses its analytical spectroscopy group at Y-12.

2.2.2 Past Operations Resulting in Environmental Contamination

2.2.2.1 Past Operations Involving Mercury

Current environmental contamination has resulted from the large-scale use of mercury from 1950 to 1963 in lithium isotope separation processes. The following information is based on a summary of the report of the Union Carbide Corporation--Nuclear Division (UCND) Mercury Task Force, which was appointed by the Y-12 Plant Manager in 1983 to study this use of mercury (UCND, 1983a).

In natural lithium, 92.5 percent of the atoms are the lithium-7 isotope and only 7.5 percent are the lighter lithium-6 isotope (GE, 1983). Lithium enriched in lithium-6 is used in hydrogen or thermonuclear weapons. Three different processes were used at Y-12 to separate these lithium isotopes. All used a lithium amalgam, a solution of lithium in mercury. This amalgam can be produced by forcing lithium into mercury with an electric current.

In the Orex process, a chemical exchange of lithium between an organic solution of lithium and a lithium amalgam, was used to obtain the lithium-6-enriched product. Development work on this process occurred in Building 9733-1 and a pilot plant operated in Building 9202 until 1954 (see Figure 2-4 for building locations). The more successful Elex process was an electrically driven chemical exchange process. It was analogous to the process used in chlor-alkali plants in which mercury is used as a cathode in the electrolytic preparation of chlorine and sodium hydroxide from brine. Development work was carried out in Building 9733-2, a pilot plant operated in Building 9201-2 (Alpha-2), and a production-scale plant was located in Building 9204-4 (Beta-4). (The buildings in the 9201 series are also referred to by the older designation "Alpha." Those in the 9204 series are called "Beta.")

The Orex and Elex processes were superseded by the Colex (column exchange) process, which was used on a production scale from 1955 to 1963. The Colex process was a chemical exchange between two phases, an aqueous solution of lithium hydroxide and a lithium amalgam. Lithium-6 became slightly more concentrated in the mercury phase than in the aqueous phase. Useful degrees of

enrichment and large quantities of products were produced by repeated contact between phases as the materials were pumped through a series of columns. A Colex pilot plant operated in Alpha-2. Major production plants were located in Buildings 9201-4 and 9201-5 (Alpha-4 and Alpha-5). The Colex equipment in Alpha-5 was dismantled in 1966, but that in Alpha-4 remains.

Auxiliary operations included receipt and transfer of mercury into pipelines. This work was carried out by Rust Engineering in an open-air shed on the site of current Building 9103, northwest of Alpha-5. A mercury roasting furnace was operated in Building 81-10. This furnace recovered mercury by distilling the metal from sludges, wastes, dirt, and similar materials.

The UCND Mercury Task Force concluded that 2.0 million pounds of mercury were lost or not accounted for as a result of all the above operations. Known losses to the environment in air, soil, water, and sediment are estimated to be 0.7 million pounds of the 2.0 million pounds total. Soil on-site was estimated by the Task Force to contain 428,000 pounds of mercury.

Much of the mercury lost to the surface water system was in a soluble form or present as a finely divided suspension. Mercury is absorbed onto silt particles and can be transported hundreds of miles downstream from a source. An additional estimated 230,000 pounds have moved beyond East Fork Poplar Creek and are presumably in sediments in Poplar Creek, the Clinch River, and the Tennessee River. The floodplain and sediments of East Fork Poplar Creek, on-site and off-site, are calculated to contain another 9,000 pounds.

2.2.2.2 Past Disposal Practices

Past disposal practices at the Bear Creek Valley Waste Disposal Area (BCVWDA) west of the plant have led to environmental contamination by oils and coolants, uranium, solvents, heavy metals, and nitrate (G&M, 1985a). Three separate land-disposal sites are included in the BCVWDA (Figures 2-3 and 2-8). These are the S-3 Pond near the headwaters of Bear Creek, the Oil Landfarm farther downstream, and the Burial Grounds. Methods of disposal in these areas included piping liquids into unlined impoundments, applying liquid wastes directly on the land surface, backfilling excavated trenches with waste materials, and pouring liquids into standpipes.

SOURCE: MMES, 1984.

FIGURE 2 - 8

BEAR CREEK VALLEY WASTE DISPOSAL AREA Y-12 PLANT, OAK RIDGE RESERVATION

The S-3 Ponds were built in 1951 as a disposal site for liquid wastes. Their use was discontinued in 1984. The four 2.5×10^6 gallon ponds were designed to maximize rates of evaporation and percolation. They were used for disposal of nitric acid solutions of uranium, dilute acids, machine coolants, caustic solutions, bio-denitrification sludges, and concentrated acids with a pH of less than 2.0. Other radionuclides, including technetium and transuranics, were present in addition to uranium.

The Oil Landfarm operated from 1973 to 1982. In this area, waste oils and coolants were applied to the surface of nutrient-adjusted soil, so that soil microbial activity could slowly degrade the wastes. The Oil Landfarm site also includes an inactive sanitary landfill, two areas formerly used for burning combustible wastes, and an area used for treatment and disposal of reactive and explosive chemicals and gas cylinders.

The Burial Grounds consist of several subsites designed as Burial Grounds A, B, C, and D and two Oil Retention Ponds. Both solid and liquid wastes were disposed of in these areas. Liquids were drained into standpipes, rock pits, or trenches. Standpipes were perforated pipes installed vertically into trenches previously used for solid waste disposal. Liquids generated from floor cleaning operations, known as mop waters, were handled by this method. Waste oils (some of which contained PCBs) and coolants were also poured into standpipes or drained into trenches. Two oil retention ponds were eventually constructed to keep oil from leaking out of the trenches and seeping into surface streams. Oil accumulations from the surface of these ponds were spread on plots at the Oil Landfarm, sprayed on nearby trees infested with pine beetles, or transferred to a storage tank.

Other parts of the Burial Grounds were used for depleted uranium-metal and oxides. One area, known as the Walk-In Pits, was used for chemicals and uranium-metal saw fines. Parts of the Bear Creek Burial Grounds are in active use for low-level radioactive contaminated, nonhazardous wastes. This waste consists of low-level contaminated trash, depleted-uranium machine turnings, and bulk uranium solids. An agreement exists with the Environmental Protection Agency (EPA) and the Tennessee Department of Health and Environment (TDHE) for the continued use of these active disposal areas.

2.3 State/Federal Concerns

As part of the Y-12 pre-Survey site visit, a meeting was held at the Oak Ridge Operations Office with representatives of EPA Region IV and the Tennessee Department of Health and Environment (TDHE) on October 10, 1986. This meeting was held to advise these agencies of the scope and objectives of

the Environmental Survey. The agency personnel were asked to express their concerns regarding environmental matters of Y-12 so that these could be reviewed, as appropriate, during the DOE Survey. These concerns are summarized below:

- The goal at the Y-12 Plant should be to reduce air releases by at least 50 percent.
- Mercury sources in 9201-4 and 9201-5 (Alpha-4 and -5) could aggravate an existing environmental problem if these buildings were to be dismantled or decontaminated. Conversely, another concern was expressed on the eventual environmental impact of just letting these buildings stand without doing anything.
- The quality of the data for air emissions in previous DOE reports was questioned.
- There was concern as to whether the standards used in assessing an environmental problem would be DOE standards or the often more strict state or EPA standards. This is of particular concern in the radiological area because of the jurisdictional question (e.g., the DOE derived concentration guide for radium in drinking water is 100 pCi/l as compared to the EPA and TDHE limit of 5 pCi/l).
- Classified information contained in the Survey report would result in the report being unavailable to those with the most interest in it.
- Conditions of the groundwater and its effect on surface-water quality were matters of concern.
- The state has not been able to critique or advise on the Best Management Practices Plan because of security classification. This plan, required as part of the NPDES permit, is to prevent or minimize the potential for discharge of wastewater from those outfalls intended to transport only stormwater and/or cooling water to East Fork Poplar Creek. It required that each facility component or system shall be examined for its potential to cause a release of pollutants to the waters of the United States and for review of the steps that will be taken to prevent such a release.

In addition to the above concerns expressed at the meeting, the agencies are also concerned about the water and solid waste issues being addressed as a result of the Memorandum of Understanding (MOU) among EPA, TDHE, and DOE dated May 26, 1983; the Federal Facilities Compliance

Agreements between EPA and DOE dated April 10, 1982 and April 17, 1985; and the Complaints and Orders issued by TDHE, and subsequent Orders for Correction. These documents are attached to this report as Appendix D. The Federal Facilities Compliance Agreement dated April 10, 1982 (Appendix D.1), and the Notice of Complaint dated July 12, 1984 (Appendix D.2), dealt with noncompliance issues related to particulate and opacity emission violations at the Y-12 Steam Plant.

The MOU, dated May 26, 1983 (Appendix D.3), was developed as a result of concerns of the TDHE and EPA about environmental problems associated with past and present waste-disposal practices. These concerns were based on an analysis of information provided by DOE and that developed as a result of a Compliance Evaluation Inspection by TDHE on February 23, 1983. It prescribes a plan of action that details preliminary measures, and a schedule for completion, toward DOE's achieving full compliance with Federal and state pollution control laws.

A Complaint and Order was issued September 15, 1983 (Appendix D.4), by the TDHE as a result of information developed in response to the MOU. The Complaint and Order addresses waste disposal areas in the Upper East Fork Poplar Creek (UEFPC) watershed area and discharges of contaminated water into UEFPC and establishes more definite deadlines for pollution abatement and investigation.

Another Complaint and Order issued December 1, 1983 (Appendix D.5), and an Order for Correction issued December 6, 1984 (Appendix D.6), by the TDHE dealt with cessation of operations and closure/post-closure plans for waste disposal areas in the Bear Creek Valley.

A second Order for Correction issued December 6, 1984 (Appendix D.7), by the TDHE required compliance with interim status standards at all mixed waste facilities and submittal of Part B Hazardous Waste Permit Applications.

The Federal Facility Compliance Agreement dated April 17, 1985 (Appendix D.8), set forth details of actions required and established a schedule for compliance with the NPDES permit for wastewater discharges.

3.0 MEDIA-SPECIFIC SURVEY FINDINGS

The discussions in this section pertain to existing or potential environmental problems in the air, soil, surface water, and groundwater media. The discussions include a summary of the available background environmental information related to each medium, a description of the sources of pollution and their control techniques, a review of the environmental monitoring program specific to each medium, and a categorization and explanation of the environmental problems found by the Survey team related to each medium.

3.1 Air

3.1.1 Background Environmental Information

The air portion of the Y-12 Plant Environmental Survey is designed to address existing and potential environmental impacts associated with releases of contaminants to the atmosphere, and includes a critical evaluation of air pollution sources and controls, and compliance with air pollution regulations and Department of Energy (DOE) Orders. Adherence to established environmental procedures is evaluated from the standpoint of environmental problems or risks. Principal regulations and DOE orders relating to air emissions used as guidance during the Survey include

- The Clean Air Act (CAA) and amendments
- Federal regulations, including
 - National Ambient Air Quality Standards (NAAQS), 40 CFR 50
 - National Emissions Standards for Hazardous Air Pollutants (NESHAP), 40 CFR 61
- Rules of Tennessee Department of Health and Environment, Bureau of Environment, Division of Air Pollution Control, Chapter 1200-3

The release of radionuclides to the environment from a DOE facility is regulated by DOE Order 5480.1A. In 1985, DOE adopted, as an amendment to this Order, an interim radiation protection standard to be implemented in calendar year 1985 (DOE, 1985a). This interim standard incorporates guidance from the National Council on Radiation Protection and Measurement (NCRP), as well as the air emission standards of 40 CFR 61, Subpart H. Included in the interim standard is a revision of the dose limits for members of the public as well as tables of radiation dose conversion factors to be used for calculating dose from intakes of radioactive materials. The dose factors are based on International Commission on Radiological Protection (ICRP) Publication 30 methodology for radiation dosimetry. Effluent air derived concentration guides (DCG) were provided in a

memorandum from Robert J. Stern, dated February 28, 1986 (DOE, 1986a). The DCGs apply to inhalation of air by members of the general public.

The assessment of the environmental impacts of airborne radiological emissions from the Y-12 Plant considered the DOE interim standards referenced above; National Emissions Standards for Hazardous Air Pollutants (NESHAP), 40 CFR 61, Subpart H; and NRC limits for concentrations of radionuclides in air above natural background, 10 CFR 20, Appendix B. Although the NRC standards do not directly apply to DOE facilities, they provide a health-based reference for comparisons with site radionuclide releases.

The Y-12 Plant is located in Anderson County, Tennessee, which is part of the eastern Tennessee-Southwestern Virginia Interstate Air Quality Control Region. The air quality in Anderson County has been designated attainment (meets air-quality standards) for total suspended particulates and sulfur dioxides, non-attainment for ozone and nitrogen dioxide, and unclassifiable (insufficient data to make determination) or attainment for carbon monoxide (Environment Reporter, 1985).

A network of meteorological observation towers at the Oak Ridge Reservation (ORR) was completed in 1985 with the addition of two towers at the Y-12 Plant. The network consists of one 60-meter tower at the Oak Ridge Gaseous Diffusion Plant (ORGDP), three towers (one 100-meter and two 30-meter) at the Oak Ridge National Laboratory (ORNL), and two towers (one 100-meter and one 60-meter) at Y-12. The locations of the six towers are shown in Figure 3-1. Because the towers at Y-12 had not accumulated a full calendar year of data, wind roses have not been prepared. However, data are available from a nearby ORNL tower.

The wind rose for the 10-meter level at ORNL Tower No. 2 is shown in Figure 3-2. Examination of the annual wind rose reveals that the prevailing winds are split into two directions that are 180° apart: one prevailing direction is from the SW through W sectors, and the other prevailing direction is from the ENE sector. The winds are strongly aligned along these directions because of the channeling effect induced by the ridge-and-valley structure of the area. The ridges and valleys within the ORR are oriented along a WSW-ENE line (with respect to true north). This orientation causes the winds at the lower layers of the atmosphere to flow along the valleys without crossing the ridges.

The background radioactivity in the vicinity of the Y-12 Plant contains both natural and manmade components. The Y-12 Plant handles both depleted and enriched uranium. Enriched and depleted uranium contain different percentages of uranium-234, -235, and -238. Enriched uranium contains greater percentages of uranium-234 and uranium-235 and smaller percentages of uranium-238 than

FIGURE 3-1

LOCATIONS OF METEOROLOGICAL TOWERS ON THE OAK RIDGE RESERVATION
Y-12 PLANT, OAK RIDGE RESERVATION

FIGURE 3-2

1985 ANNUAL WIND ROSE AT 10-m LEVEL OF
ORR METEOROLOGICAL TOWER 2
Y-12 PLANT, OAK RIDGE RESERVATION

found in naturally-occurring uranium, whereas depleted uranium contains lower percentages of the two former isotopes than the natural abundance. The predominant radionuclides that may be present in airborne effluents from the Y-12 Plant are uranium-234, -235 and -238. These three naturally-occurring isotopes of uranium are found throughout the world in varying concentrations in geological deposits. Measurable concentrations of the uranium isotopes from natural sources and their decay products are found world-wide in the air, soil, surface water, and groundwater. Airborne particulates of uranium will result from the air-suspension of natural uranium-bearing surficial soils. Uranium-in-air concentrations will vary with time and location because of local meteorological conditions and concentrations of uranium in soils. To determine whether the Y-12 Plant is contributing to uranium concentrations in the air, it is necessary to have some knowledge of the uranium contributions from natural or other sources. Because of the many factors that may influence the uranium-in-air concentrations, it is not possible to exactly predict background levels in a given area. It is possible, however, to estimate background levels of a radionuclide. One approach to this is to determine the radionuclide concentrations at a location that is nearby, but sufficiently removed that the observed radionuclide levels would not be affected by the potential pollutant source. ORR personnel monitor radionuclide concentrations at seven remote stations located between approximately 40 km and 120 km from the Y-12 Plant. ORR personnel consider the data from the remote stations to be representative of background. Average uranium-in-air concentrations observed at the ORR remote stations are presented in Table 3-1. It may be assumed that background levels of uranium at Y-12 will be comparable to the Table 3-1 values. Observed uranium concentrations statistically greater than those in Table 3-1 may be indicative of a local contribution of uranium particulates to the atmosphere from facilities within the ORR.

3.1.2 General Description of Pollutant Sources/Controls

The Y-12 Plant has about 233 principal buildings with about 350 exhaust ventilation stacks that serve various operations having a potential to emit one or more pollutants to the atmosphere (MMES, 1986b; ORAU, 1985).

3.1.2.1 Radionuclide Sources and Controls

The number of stacks or vents with potential for radionuclide particulate emissions has varied over the years because of process changes and, to some extent, because of the criteria used to include a given stack in the count. The only radioactive material that has been processed at Y-12 within the last 15 years is uranium. The processing activities include chemical processing operations; incineration of contaminated scrap materials; metallurgical and machining operations; and product

TABLE 3-1

1985 AVERAGE CONCENTRATION OF PARTICULATE URANIUM
IN AIR AT REMOTE STATIONS
($\times 10^{-15} \mu\text{Ci/ml} \pm 2\text{S}$)
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE

Radionuclide	Maximum	Minimum	Average
Uranium-234	0.24	0.055	0.11
Uranium-235	0.023	0.0039	0.093
Uranium-238	0.056	0.026	0.037

Source: MMES, 1986a.

S = Sample Standard Deviation

cleaning, inspection, and assembly. In 1985, a review conducted by the Oak Ridge Associated Universities (ORAU, 1985) indicated that 111 stacks were considered to be potential uranium emitters, 60 for depleted uranium operations and 51 for enriched uranium operations. However, the annual report of environmental monitoring activities for CY-1985 counted five additional stacks serving depleted uranium sources for a total of 116 discharge points (Table 3-2), with 65 for depleted uranium and 51 for enriched uranium (MMES, 1986a). A recent study conducted in 1986 as part of the Stack Radiological Monitoring Project updated that count to 126 stacks or vents serving processes or operations where uranium was used, 86 of which have been designated to be equipped with new continuous real-time monitors and/or continuous samplers. Fifteen of the vents will be combined with other existing stacks, and the remaining 25 stacks are considered by Y-12 to not be potential sources of uranium emissions (DOE, 1986b). The 86 stacks or vents are located at various buildings at Y-12, as shown in Table 3-3.

Various techniques have been and are being used to minimize the emission of radionuclides to the atmosphere. These controls include filtration ranging from roughing filters and baghouses to combination systems, including high efficiency particulate air (HEPA) filters. On air streams vented from processes involving liquids, mist eliminators and scrubbers are used. Gaseous emissions such as hydrogen fluoride are controlled by scrubbers.

An additional source for the release of radioactive materials to the air is the burning of depleted uranium machine turnings (chips) in the Bear Creek Burial Grounds (BCBG). Beginning in 1960, depleted uranium chips were collected from the plant's machine shop and disposed in pits in the BCBG. Because uranium metal chips are pyrophoric, they present a fire hazard. Until 1971, the chips were intentionally burned at the burial grounds, prior to covering them with soil, to eliminate hazards to personnel from unplanned spontaneous ignitions. The chips were, during this period, often coated with a film of oil from the coolant used during machining operations. Because of the residual oil, the burning was accompanied by a plume of visible black smoke. The intentional burning was discontinued in 1971 because of concern about the visible air pollution.

Since 1971, depleted uranium machine turnings have been deposited in dumpsters containing approximately 200 gallons of water, transported to the BCBG, placed in burial pits, and covered with soil once the pit is filled. The water in the dumpsters reduces the likelihood of fires during storage in the plant and transport to the burial site. However, because of the pyrophoric nature of the uranium chips, spontaneous, unplanned chip fires continue to occur, both prior to and following the application of a soil cover.

TABLE 3-2

**SUMMARY OF 1985 AIR EMISSION POINTS
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**

Type of Emission	Number of Discharge Points for Each Type of Emission ¹
Enriched uranium	51
Depleted uranium	65
Particulates	92
Sulfur dioxide	5
Nitrogen oxide	77
Organic compounds	109
Carbon monoxide	6
Fluoride	9
Hazardous materials (Be, Hg, etc.) ²	14
Miscellaneous pollutants	45

Source: MMES, 1986a.

1. Many emission points emit more than one pollutant.
2. Be = Beryllium
Hg = Mercury

TABLE 3-3

**BUILDINGS WITH STACKS OR VENTS
HAVING POTENTIAL FOR URANIUM EMISSIONS,
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**

Building Number	Number of Stacks Serving Uranium Sources
9215	12
9206	7
9212	31
9998	5
9201-5N	1
9201-5E	3
9201-5	7
9204-4	12
9204-2E	2
9202	4
9203	1
9401-5	1
TOTAL	86

Source: DOE, 1986b.

Currently, the plant uses a water-soluble, biodegradable, machining coolant; therefore, there is no residual oil on the chips and the fires do not produce black smoke. Air sampling data collected during past chip fires have indicated (Table 3-4) that little particulate uranium oxide is released from either the covered or open pits during the fires. Dose assessments were made by Y-12 personnel for the fire on September 27, 1984. They indicated that a whole body dose of 0.1 mrem and a lung dose of 3 mrem would have been received by an individual standing at the fire site for the duration of the fire. At a distance of 330 feet, the estimated dose was 0.0001 mrem to the whole body and 0.003 mrem to the lung (Manuel and McDougald, 1986). For comparison, the NESHAP emission standard for radionuclides (40 CFR 61) restricts emissions to amounts that cause a dose equivalent of 25 mrem/yr to the whole body and 75 mrem/yr to any individual organ. At the distance of 330 feet from the fire, the doses to the whole body and the lungs (specific organ) were below the NESHAP standard by factors of 2.5×10^5 and 2.5×10^4 , respectively. These doses are only a small fraction of the NESHAP standard. At the nearest point along the site boundary, a distance of greater than 1 kilometer from the BCBG, the potential dose would be lower than at the 330-foot distance.

Despite the low emissions from the fires, there remained concern at the Y-12 Plant about potential air pollution (as well as deterioration of groundwater quality) from the BCBG fires. In response to these concerns, a program was initiated in 1983 to develop a process for the controlled oxidation of depleted uranium chips and subsequent storage of the oxide in concrete vaults. A production-scale chip-oxidation facility began operation in early 1985 but was temporarily shut down for modifications following a flash fire that occurred during startup operations on November 11, 1985. Operational startup of the facility will be delayed, pending facility modifications, until 1987.

Disposal of uranium chips at the BCBG and spontaneous chip fires will continue until the chip oxidizer is fully operational. However, Y-12 Plant personnel are considering a controlled oxidation technique at the BCBG as an alternative to the current burial practices until the chip oxidizer can be used. A test program for this alternative practice has been designed (Manuel and McDougald, 1986). As a part of the test, a monitoring program has been included to assess the impact of airborne emissions.

Another potential source of airborne radioactive emissions is through the accidental ignition of uranium chips or saw fines in non-process areas of uranium production buildings. Of primary concern are fires involving enriched uranium because of the higher specific activity and consequently greater health hazard of the enriched uranium as compared with that of depleted uranium.

TABLE 3-4

**AIRBORNE URANIUM CONCENTRATIONS DURING CHIP FIRES
IN BEAR CREEK BURIAL GROUNDS
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**

Date	Horizontal Distance from Fire (Feet)	Gross Alpha Activity Concentration ($\times 10^{-12}$ μ Ci/ml)
8/25/86	6	5.2
7/11/86	10	10.2
7/1/86	Unknown	4.3
2/3/86	2	5.0
	40	2.5
2/25/85	3	22.3
	12	85.1
	125	3.8
9/27/84	20	5.9
8/13/84	Unknown	73.5
	Unknown	42.1
8/3/84	*	1.6
	*	9.8

Source: Prepared by Environmental Survey Team, 1986
using data from MMES, 1986c.

* Sampled in the plume directly over the point of release.

Such a fire occurred in the chip washing area of Building 9212 on December 27, 1985. The fire occurred in a basket containing approximately 3.5 kilograms of enriched uranium chips, while the cleaning fluid was being drained. Loss of uranium to the room air was estimated to be 65 grams (Fee, 1986a). A portion of this was released from the room through a fume hood fitted with HEPA filtration. However, some material was released to the environment through a room ventilation duct that was not equipped with either emission controls or monitoring devices. An estimate of the release was made using room air samplers located near the area where the fire occurred. It was concluded that approximately 20 percent of the material released to the environment exited through the ventilation exhaust (Fee, 1986a). Elevated activity levels were observed at ambient air monitors A63, A64, and A65 (Figure 3-3), located in close proximity to Building 9212. The levels at these monitors, although above background, were much less than 1 percent of DOE's Derived Concentration Guide.

Room ventilation exhausts in production buildings are not equipped with either emission controls or monitors/samplers for radioactive emissions. Fires and other accidents in non-process areas present the potential for uncontrolled, unmonitored releases of radioactive materials to the atmosphere through the room-air exhausts.

A potential fugitive source of airborne particulate activity is the resuspension of soil contaminated with radionuclides. The extent of the radiological contamination of soils on-site is being assessed in a survey initiated by the Health and Safety Division of the Oak Ridge National Laboratory in 1985. The primary objective of the survey is to provide a characterization of the surface-soil contamination of the Y-12 Plant site. This effort is discussed in Section 3.2.3 of this report.

3.1.2.2 Beryllium Sources and Controls

Beryllium is processed at the Y-12 Plant both in the form of the metal and as an oxide powder. The beryllium metal is machined to form the desired shapes. Emission of beryllium dust is precluded by application of a continuous stream of machining lubricant/coolant. In addition, air at the machining workface is drawn through a flexible hose into a HEPA filter and baghouse prior to being exhausted. Beryllium oxide operations are conducted inside gloveboxes where the powder is formed, under heat and pressure, into desired shapes. The glovebox air is exhausted through prefilters and HEPA filters. The room air is exhausted without filtration. Beryllium oxide parts are finish machined under a continuous flow of mineral oil. Air exhausted from this operation passes through a demister and a HEPA filter. Potentially dusty operations in the beryllium oxide laboratory are conducted in enclosures, and all air is exhausted through HEPA filters.

SOURCE: MMES, 1986a

FIGURE 3-3

LOCATION MAP OF THE PERIMETER AIR MONITORING STATIONS
 AROUND THE Y-12 PLANT
 Y-12 PLANT, OAK RIDGE RESERVATION

Building 9766, an inactive cooling tower at the west end of the building, and a nearby underground storage tank (not in use) are contaminated with beryllium. The beryllium in Building 9766 is isolated inside old ventilation ducts that are sealed. These facilities may become sources of beryllium emissions to the atmosphere if these structures are disturbed or torn down (see Section 4.5.2.3 for further discussion).

3.1.2.3 Mercury Sources and Controls

Large quantities of mercury were involved in processes used to separate lithium isotopes during the 1950s and early 1960s. Those processes are described in greater detail in Section 2.2.2.1, Past Operations Involving Mercury. Although those processes are no longer practiced at Y-12, appreciable quantities of mercury remain in process equipment in Building 9201-4, and as a result of spills and leaks, in insulation, in brickwork, and in the ground beneath the building. Other buildings, including 9202, 9201-2, 9201-5, and 9204-4, were also used in development, pilot-plant, and production phases of lithium-enrichment processes involving mercury. Buildings 9202 and 9204-4 were stripped in the late 1950s. Buildings 9201-5 and 9201-2 were stripped in 1965-1966. Only Building 9201-4 remains to be stripped of mercury-containing equipment and mercury-contaminated insulation; however, both 9201-4 and 9201-5 may be dismantled.

Spilled mercury, especially finely divided droplets, exposes considerable surface area to the atmosphere, and because of its high vapor pressure, mercury can enter the atmosphere through evaporation. A Y-12 project description memorandum (PDM) has been prepared that discusses a preliminary action proposed to be taken prior to stripping Building 9201-4 to minimize air emissions (Fee, 1985a). The PDM indicates that the process equipment and piping contain about 220,000 pounds of mercury, and that about 70,000 pounds of that could be removed by draining the piping. By removing mercury from process piping, spillage during equipment and building decommissioning would be minimized.

The stripping of 9201-4 of process equipment and piping and the dismantling of 9201-4 and 9201-5 could result in airborne releases of mercury in excess of the 200 pound/year de minimus level prescribed in Prevention of Significant Deterioration (PSD) regulations (40 CFR 52.21). This is especially true if the mercury is to be recovered from scrap by distillation. A potential to emit in excess of the de minimus value would require an extensive PSD review prior to initiation of the stripping and dismantling activities.

A second Y-12 PDM has been prepared that discusses a proposed method for removing all asbestos insulation from Building 9201-4 (Fee, 1986b). About 5,000 cubic feet of asbestos insulation remain to be removed from process piping and on exhaust ductwork on the building exterior. In addition, about 1,650 cubic feet of roof gravel and material containing asbestos are present. These materials contain less than 75 parts per million (ppm) of mercury. However, about 12,000 cubic feet of asbestos insulation remains on process equipment in the building, with mercury concentrations in the hundreds of ppm. To minimize the potential for release of mercury to the atmosphere, the insulation outside the building and the roofing materials, with less than 75 ppm of mercury, will be double bagged and disposed of in an approved hazardous waste landfill. The insulation inside the building, with higher mercury concentrations, will be removed, appropriately packaged in double bags, and stored inside 9201-4 until an approved disposal method can be identified.

Other aspects of mercury contamination are discussed in Sections 3.2.3, 3.3.2, 3.3.3, 3.4.2, 3.4.3.2, 4.1.1.4, and 4.5.2.

3.1.2.4 Other Particulate Sources and Controls

Steam Plant

The steam generating facilities, located in Building 9401-3, provide steam for space heating and, to a lesser extent, for process use. The facility consists of four boilers, each with a rated heat input of about 297 million Btu per hour. Since 1975, the plant has used coal instead of natural gas as the boiler fuel. Electrostatic precipitators installed in 1966 to control particulate emissions had deteriorated to such an extent that they were ineffective, and were replaced in 1984 and 1985 with baghouses in response to a Federal Facilities Compliance Agreement (Appendix D.1) and a Notice of Complaint from the Tennessee Department of Health and Environment (Appendix D.2).

The compliance schedules attached to the Compliance Agreement and the Notice of Complaint set particulate emission limits of 0.17 pound per million Btu heat input, and a visible emission opacity limit of 20 percent.

Because the boilers provide steam largely for space heating purposes, the demand is a function of ambient temperature. To meet the demand, the boilers are subject to rather frequent shut-downs and startups and must be maintained hot during standby periods. During those periods of low-level operation, coal cannot be used, and fuel oil is used in its place. To avoid plugging of baghouse filters with oily residues, the baghouses are bypassed while fuel oil is fired, resulting in exceedances of both

the particulate mass emission and visible emission opacity limits. These exceedances will be discussed in greater detail in Section 3.1.3.1, Effluent Air Monitoring.

The emission problems during boiler shut-down, hot standby, and start-up phases are being resolved by replacing fuel-oil ignition systems with natural gas ignition and thus allowing the baghouses to remain on line. Temporary conversion of Boilers 1 and 2 has been completed. Boilers 3 and 4 are scheduled for conversion in 1988 as part of the Utilities Services Restoration Project. Until that time, Boilers 3 and 4 will be base loaded on coal with Boilers 1 and 2 placed on hot standby as required.

Coal received at Y-12 from several contractors for use at the steam plant is wet as a result of washing to lower ash and sulfur contents. The wet coal is placed on the coal pile, as received, in layers and is compacted by a bulldozer. Any dry coal is sprayed with water for density and moisture control. In addition, moisture helps to prevent particulate emissions from the coal pile and during transport and crushing operations. Coal is recovered from the pile and conveyed to a crusher station and then to one of four hoppers.

During the transfer of crushed coal by conveyor to one of four boiler-feed hoppers, coal-dust can be emitted into the room air as the coal drops from the conveyor into the open-top hopper. During hot, dry summer conditions especially, the coal is more dusty, and the ventilating fans in the area discharge air containing suspended particles to the outside atmosphere. These emissions can contribute to exceedances of the 24-hour total suspended particulate air quality standards.

Classified Waste Paper Disposal

Facilities are provided at Building 9811 for the destruction of materials containing classified information such as waste paper, reports, computer printouts, typewriter ribbons, film, microfiche, etc. Plant security personnel operate these facilities, which consist of a shredder for waste paper items and an incinerator for other items.

The paper shredder is covered by an operating permit (No. 012886P) from the Tennessee Air Pollution Control Board. Dry waste paper is fed to the shredder. An air stream carries the shredded material into a cyclone, which diverts the paper into a dumpster box. Although the shredder was not in operation during the on-site visit, it was apparent that appreciable dust is emitted from the dumpster box and the cyclone air outlet.

The incinerator is also covered by an operating permit (No. 022894I). It consists of a main chamber and a secondary afterburner, both of which are gas fired. The unit has a design charging rate of 435 pounds per hour with an average charging rate of 375 pounds per hour. Visible emissions were observed by the Survey team from the incinerator stack.

The shredded paper and the incinerator ash are disposed of at the sanitary landfill.

ORNL Development Incinerator at Y-12

A construction permit (No. 992777I) was obtained in 1982 for a gas-fired incinerator to burn liquid waste solvents. After construction of the incinerator was completed outside Building 9731, several test burns were conducted to demonstrate the feasibility of using the incinerator to routinely burn a highly combustible organic solvent. An application for an operating permit was submitted to the State on June 19, 1985, but no permit had been issued at the time of the Survey.

In addition to "liquid waste solvents," trial burns included waste paper, chlorinated liquids, and small animal carcasses, materials that were not covered by the operating permit application.

3.1.2.5 Sulfur Dioxide Sources and Controls

The four boilers at the steam plant represent the source of sulfur dioxide emissions at the Y-12 Plant. The boilers are normally fired on pulverized coal with natural gas or No. 6 fuel oil being used during periods of startup, hot standby, coal-feeder malfunction, and shutdown.

Sulfur dioxide emissions from the steam plant are limited by Tennessee regulations to 4.0 pounds of sulfur dioxide per million Btu of heat input (TDHE, 1984). Control of sulfur dioxide emissions is achieved through the use of low-sulfur coal. As discussed in Section 3.1.2.4, washed coal is purchased to ensure minimum sulfur content. The sulfur contents of coals received during FY86 averaged 1.49 percent with a maximum of 2.2 percent (Table 3-5). Estimated emissions based on these sulfur contents are 2.16 and 3.38 pounds of sulfur dioxide per million Btu, respectively. The effects of variations in the sulfur contents of coals are minimized by layering the coals while building the storage pile and by blending the layers during retrieval of the coal for use.

TABLE 3-5

**COAL SUMMARY FOR FY-86 AND ESTIMATED SULFUR DIOXIDE EMISSIONS
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**

Contractor	Tons Awarded	Delivered	Moisture, percent	Ash, percent	Sulfur, percent	BTU's as Received
A	25,750	26,638	4.05	8.35	1.31	13,114
B	25,750	26,025	4.29	6.65	1.58	13,689
C	22,000	22,053	4.04	10.48	1.24	12,899
D	7,500	7,540	4.98	9.64	1.15	12,840
E	15,000	9,412	4.89	11.98	2.16	12,386
F		5,936	6.29	10.92	2.20	12,381
G	6,500	6,500	4.12	6.53	1.58	13,354
TOTAL	102,500	104,104				
Weighted Average			4.38	8.83	1.49	13,099

Source: Coal Summary from Y-12 data sheet. Calculations of estimated sulfur dioxide emission rates by Survey team.

Estimated Sulfur Dioxide Emission Based on Maximum Sulfur Contents

$$(38 \times 2.2) \frac{\text{lb SO}_2}{\text{ton coal}} \times \frac{\text{ton}}{2000 \text{ lb}} \times \frac{\text{lb}}{12,381 \text{ Btu}} = \frac{83.6 \text{ lb SO}_2}{24.762 \times 10^6 \text{ Btu}} = \frac{3.38 \text{ lb SO}_2}{10^6 \text{ Btu}}$$

- * Factor from "Compilation of Air Pollutant Emission Factors Second Edition, Part A," Report No. AP-42, U.S. Environmental Protection Agency, Research Triangle Park, N.C, February 1976.

3.1.2.6 Nitrogen Oxides Sources and Controls

The steam plant is the major source of nitrogen oxides (a criteria pollutant). Based on 1978 test data, emissions of nitrogen oxides are estimated by Y-12 to be about 2,250 tons per year from the four boilers (Fee, 1986c). These emissions are uncontrolled. The operating permit application addresses emission limits for particulates and sulfur dioxide but not nitrogen oxides. Tennessee regulations do not include nitrogen oxides emission limits for existing boilers.

Other less significant sources of nitrogen oxides include chemical processing operations that involve the use of nitric acid in uranium recovery, in pickling of metal products, and in acid cleaning of equipment. Many of these sources are being retrofitted with scrubber devices to minimize the release of nitrogen oxides and nitric acid fumes, which would otherwise damage in-line HEPA filters.

3.1.2.7 Volatile Organic Compound Sources and Controls

Emissions of volatile organic compounds to the atmosphere are of concern because they react photochemically with nitrogen oxides to form ozone, which is a criteria pollutant and is harmful to health and welfare.

The Y-12 Plant has historically released volatile organic compounds into the atmosphere in the form of perchloroethylene (tetrachloroethene), used in degreasing operations. Projects are under way to evaluate Freon-113 (trichlorotrifluoroethane) for use as a degreasing solvent to replace perchloroethylene and other volatile organic compounds, such as trichloroethane, methylene chloride, and acetone.

In early 1986, the perchloroethylene used as machining coolant in the major enriched-uranium machine shop was replaced by a propylene glycol/water mixture. The result was elimination of the emissions of several hundred tons of perchloroethylene each year (MMES, 1985a).

An underground, 20,000-gallon tank for unleaded gasoline represents another source of volatile organic compounds. Each time the tank is refilled, the gasoline vapor displaced from the tank is emitted to the atmosphere through the tank vent pipe. During FY86, the Y-12 Plant received 435,831 gallons of gasoline. Because Y-12 is located in Anderson County (a rural county), the Tennessee Department of Health and Environment rules do not require that gasoline vapors be returned to the delivery truck; however, because of nationwide ozone nonattainment problems, the

EPA is requiring revisions to State Implementation Plans to provide more strict emission controls on sources of volatile organic compounds.

As a result of disposal of volatile organic compounds at the Bear Creek Valley Waste Disposal Area (see Section 4.5.2.1), volatile organic compounds are being emitted to the atmosphere (Jenkins, et al., 1986). As a result of preliminary sampling and analyses, air at the mouth of standpipes and vent pipes in the burial grounds contained the highest levels of volatile organics, including as much as 11 mg/m³ perchloroethylene and 8.5 mg/m³ trichloroethene. However, because there is no measured air flow from the pipes, these concentrations are not representative of ambient concentrations. These standpipes and vent pipes are located at large pits that were used to bury solid wastes, and into which organic solvents were poured. Although this disposal practice has stopped, the release of organics from the pits continues.

Other activities at the Y-12 Plant that release volatile organic compounds include

- Carbon foam production.
- Paint spray booths.
- Coating and curing operations.
- Adhesives preparation and application.

The volatiles from the carbon-foam baking furnaces are burned in gas-fired incinerators. No data are available for the latter three activities, which are impractical to quantify as a result of their diverse locations.

3.1.2.8 Hydrogen Fluoride Sources and Controls

Two sources of hydrogen fluoride that emit 14,000 to 22,000 kg per year exist at the Y-12 Plant. These sources are the result of chemical processing operations in two major production buildings (9206 and 9212). Hydrogen fluoride released in these operations is currently vented to the atmosphere. Projects are currently under way to reduce hydrogen fluoride emissions with new process controls and scrubber systems. A scrubber has been installed beside Building 9206. Another scrubber is in final construction stage at Building 9212 but will not operate until the fall of 1987.

A minor and occasional source of hydrogen fluoride emissions involves the tray dissolvers in Building 9212. A scrubber system installed in 1986 to remove nitric acid fumes and nitrogen oxides also removes hydrogen fluoride from exhaust gases.

A new source of hydrogen fluoride will begin operation in mid-1988 when modifications to upgrade equipment in the "dry chemistry" area of Building 9212 are complete. A potassium hydroxide scrubber will be installed as part of that project to minimize hydrogen fluoride emissions.

3.1.3 Environmental Monitoring Program

3.1.3.1 Effluent Air Monitoring

Airborne Uranium Emissions

Since 1956, estimates of uranium emissions (principally enriched uranium) have been made on the basis of measured emissions and/or data used for accountability of nuclear materials. In the early 1970s, constant-rate air sampling equipment was installed on 35 stacks deemed to have the greatest potential to emit enriched uranium on the basis of production activities and capacities (MMES, 1986d). Those samplers continue to operate. The equipment draws air samples continuously through multiport probes at a rate of 1 cubic foot per minute, capturing particulates on a 1-inch (25-mm) diameter Whatman 41 filter paper. Filters are replaced daily to three times per week, depending on the emissions history and filter loading.

A review of the stack monitoring program conducted in 1985 by Oak Ridge Associated Universities (ORAU, 1985) revealed a number of problems, some of the more significant of which are listed below:

- Probe locations do not and cannot meet minimum requirements because of stack configuration.
- The selection of stacks for sampling was done more than 10 years ago. Activities are likely to have changed.
- Variations in the design of sampling equipment.
- Vacuum systems are incapable of achieving required flow at all locations.
- Long sampling lines between probe and filter on some stacks.
- No capability for real-time warnings of control system failure on most stacks.

Stack sampling at Y-12 for uranium emissions is currently undergoing major revisions (Fee, 1985b). Some stack flows are being combined to reduce the number of stacks requiring sampling. Other stacks are being modified so that sampling can be conducted in accord with EPA isokinetic stack

sampling criteria (40 CFR 60.344), which would provide emissions data required by NESHAP for dose assessment.

Existing stack samplers are being replaced by 35 real-time monitors that will automatically alarm if an emission excursion beyond a preset limit is detected (in the event, for example, of a control device failure). These monitors will also collect a continuous filter record of the emissions for analysis and quantification. Other stacks with potential for uranium emissions are being equipped with improved continuous samplers (MMES, 1986d).

Beryllium

Ventilation exhaust stacks serving areas where beryllium metal or beryllium oxide is handled are sampled continuously for beryllium emissions. No emissions data were available during the on-site Survey. However, because of emission-control procedures and devices described in Section 3.1.2.2, emissions of beryllium do not approach the 10-gram-per-24-hour-day limit set by NESHAP (40 CFR 61.32).

Steam Plant Compliance Testing

Y-12 has installed baghouses to replace old electrostatic precipitators. Compliance with particulate mass emissions and visual emission opacity limitations has been demonstrated at all four baghouses while burning coal. Compliance test results are shown in Table 3-6. However, when fuel oil is fired (during startup, hot standby, coal-feeder malfunctions, and shutdown), the baghouse is bypassed, and neither the particulate mass emission nor visual opacity requirement is met, as demonstrated by stack testing (Spence, 1986).

Steam Plant Visual-Emission Opacity Monitoring

The two exhaust stacks serving the four boilers are equipped with continuous monitors for visual-emission opacity. These instruments constantly observe the stack exhaust and record the opacity. Quarterly reports of opacity exceedances are submitted to the Tennessee Department of Health and Environment for review. Each quarter since the first quarter of 1985, the TDHE has issued Notices of Violation for almost daily exceedances of the visual emissions opacity standard, which occur during startup, hot standby, coal-feeder malfunctions, and shutdown periods.

TABLE 3-6

COMPLIANCE TEST RESULTS ON BOILER BAGHOUSES*
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE

Boiler I.D.	Sulfur Dioxide (lb/10 ⁶ Btu)		Particulate (lb/10 ⁶ Btu)		Average Opacity (percent)	
	Actual	Allowable	Actual	Allowable	Actual	Allowable
No. 1	3.6	4.0	0.03	0.17	0	20
No. 2	3.1	4.0	0.02	0.17	0	20
No. 3	3.6	4.0	0.01	0.17	0	20
No. 4	2.8	4.0	0.01	0.17	0	20

Source: Stewart, 1985.
 Stephens, 1986.

* Compliance tests were conducted while firing coal and while the exhaust gases were being vented through the baghouses.

3.1.3.2 Ambient Monitoring

Radionuclides

Monitoring for radionuclides in ambient air for the Y-12 Plant is provided by three monitoring systems: (1) stations around the perimeter of the Y-12 Plant; (2) stations throughout the Oak Ridge Reservation; and (3) stations at remote locations, at distances ranging from 19 to 121 kilometers from the Oak Ridge Reservation. In addition to these systems, an additional monitoring station was established in 1986, to the north on Pine Ridge near the location of the closest residence to the Y-12 Plant.

The Y-12 radionuclide monitoring system consists of eleven monitoring stations located around the plant at or near the plant boundary. Monitor locations are shown on Figure 3-3, with identification numbers A61 through A71. Samples are collected continuously on 5-inch square Whatman 41 filter paper at a nominal sampler flow rate of 4.5 ft³/min. The air flow is not regulated to assure a constant flow, nor is there a timer to record the operating time of the system. The flow rate is assumed to have been constant and the sampler is assumed to have operated without interruptions during the sample collection period. Filters are collected weekly, composited quarterly, and analyzed quarterly for gross alpha, gross beta, and isotopic uranium concentrations.

Table 3-7 presents the concentrations of long-lived gross alpha and gross beta activities in air for the Y-12 perimeter monitors, for 1985. The activity concentrations observed for the individual stations ranged from 4.2 to 35 x 10⁻¹⁵ μ Ci/ml for gross alpha and from 16 to 44 x 10⁻¹⁵ μ Ci/ml for gross beta.

The Y-12 ambient air monitors were sited to provide coverage surrounding the plant and for convenience of access. No site-specific modeling was conducted to verify the adequacy of their placement. In 1985, Y-12 installed two meteorological towers to provide site-specific meteorological data to be used as input to Y-12 dose assessments. Y-12 plans to utilize data from these towers to reassess the monitor placement. 1986 will present the first full year's meteorological dataset. It is anticipated that a siting assessment will be conducted in 1987.

Because of the use of radioactive materials at other facilities within the Oak Ridge Reservation (ORR), in addition to Y-12 (Oak Ridge National Laboratory [ORNL] and Oak Ridge Gaseous Diffusion Plant [ORGDP]), any ambient air samples collected within or near the ORR will have contributions to the total activity from all three major facilities. Consequently, it is not possible to positively identify the source of any observed gross activity (i.e., gross alpha and gross beta). Radionuclide-specific data

TABLE 3-7

PLANT PERIMETER 1985 AIR MONITORING DATA:
 LONG-LIVED GROSS ALPHA AND BETA ACTIVITY IN AIR
 (QUARTERLY COMPOSITE SAMPLES)
 Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE
 Concentration (10^{-15} μ Ci/ml)

Location*	Gross Alpha			Gross Beta		
	Maximum	Minimum	Average	Maximum	Minimum	Average
A61	9.9	5.5	6.9	22	17	19
A62	9.8	6.3	8.2	25	17	20
A63	20	10	16	29	19	24
A64	31	14	26	44	23	32
A65	22	10	16	30	21	25
A66	16	8.0	11	27	18	21
A67	14	7.6	9.9	29	19	23
A68	21	8.3	13	29	17	22
A69	35	9.8	17	26	16	20
A70	14	6.0	8.6	25	17	20
A71	18	4.2	8.9	23	17	19

Source: MMES, 1986a.

* See Figure 3-3.

may be used to identify the major source of activity. The only radionuclides that are emitted by Y-12 in quantities sufficient to allow detection in the ambient air are uranium isotopes. In the summer of 1985, the uranium enrichment capabilities at ORGDP were placed in "ready standby" and consequently can no longer emit uranium particulates to the environment unless the plant is placed back into operation. In 1985, the majority of the uranium discharged to the environment came from the Y-12 Plant (MMES, 1986a). For the purposes of this discussion, it may be assumed that the Y-12 Plant is the source of uranium observed in the ambient air at both the Y-12 perimeter stations and the ORR stations.

The ORR monitoring system consists of 11 stations, numbered A31 through A41, that are inside the ORR boundary but outside the Y-12, ORNL, and ORGDP facility boundaries. The locations of the ORR air monitoring stations are shown in Figure 3-4. These monitors serve to detect any releases that might occur from the ORR facilities to the immediate environment. Filters from the monitors are collected and analyzed weekly for gross alpha and beta activities. Samples from 8 of the 11 stations are composited quarterly into a single sample for specific radionuclide analysis. The filters from stations A36, A40, and A41 have sufficient activity that they are analyzed quarterly for the individual stations. Compositing is necessary because activities are so low that all analyses on the individual samples would have results less than the detection limits for the method.

For the ORR stations, none of the air filters for 1985 exhibited any gross alpha activity above the analytical detection limits, which ranged from 3.3 to $16 \times 10^{-15} \mu\text{Ci/ml}$. The ORR gross beta activities in air ranged from below the detection limit of $3.3 \times 10^{-15} \mu\text{Ci/ml}$ to a maximum of $27 \times 10^{-15} \mu\text{Ci/ml}$. The ORR data are presented in Table 3-8.

Seven air monitoring stations, numbered A51 through A57, are designated as remote air monitors. The monitors are located outside the ORR at distances of 19 to 121 km. The locations of these monitors are shown on Figure 3-5. The monitors are at distances at which they are considered to be unaffected by emissions from the ORR facilities and are representative of background levels. The remote stations provide data for evaluating local conditions. Filters from these monitors are collected and analyzed weekly for gross alpha and gross beta activities and are composited quarterly, for the system, for radionuclide-specific analysis.

Similar to the ORR stations, none of the remote stations exhibited any gross alpha activity in excess of the analytical detection limits in 1985. Detection limits for the analysis ranged from 3.5 to $12 \times 10^{-15} \mu\text{Ci/ml}$. The 1985 air monitoring data for the remote stations is shown in Table 3-9.

FIGURE 3-4

LOCATION MAP OF THE OAK RIDGE RESERVATION AIR MONITORING STATIONS
Y-12 PLANT, OAK RIDGE RESERVATION

TABLE 3-8

**1985 AIR MONITORING DATA FROM OAK RIDGE RESERVATION STATIONS:
LONG-LIVED GROSS ALPHA AND BETA ACTIVITY
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE
Concentration (10^{-15} μ Ci/ml)**

Location ^a	Number of Samples	Gross Alpha		Number of Samples	Gross Beta	
		Maximum	Minimum		Maximum	Minimum
A31	52	< 16 ^b	< 8.5	52	16	< 8.5
A32	52	< 5.2	< 4.5	52	16	< 4.5
A33	52	< 5.1	< 4.1	52	10	< 4.1
A34	52	< 4.9	< 4.1	52	27	< 4.1
A35	52	< 4.1	< 3.3	52	17	< 3.3
A36	52	< 4.1	< 3.8	52	13	< 3.8
A37	52	< 7.4	< 3.5	52	18	< 3.5
A38	52	< 4.1	< 3.3	52	18	< 3.3
A39	51	< 4.4	< 3.8	51	13	< 3.8
A40	49	< 13	< 9.1	49	20	< 9.1
A41	37	< 1.1	< 9.8	37	21	< 9.8
Network Summary	553	< 16	< 3.3	553	27	< 3.3

Source: MMES, 1986a.

a. See Figure 3-4.

b. The symbol "<" indicates that the analytical results were less than the detection limit of the method.

ORNL-DWG 86-9187

SOURCE: MMES, 1986a

FIGURE 3-5

LOCATION MAP OF THE REMOTE AIR MONITORING STATIONS Y-12 PLANT, OAK RIDGE RESERVATION

TABLE 3-9

**1985 AIR MONITORING DATA FROM REMOTE STATIONS:
LONG-LIVED GROSS ALPHA AND BETA ACTIVITY
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE
Concentration (10^{-15} μ Ci/ml)**

Location ^a	Number of Samples	Gross Alpha		Number of Samples	Gross Beta	
		Maximum	Minimum		Maximum	Minimum
A51	13	<7.2 ^b	<5.5	13	11	<5.4
A52	42	<9.1	<4.2	42	24	<4.2
A53	28	<6.0	<4.8	28	34	<4.8
A54	47	<6.1	<5.1	47	17	<5.1
A55	48	<4.9	<4.1	48	28	<4.1
A56	48	<12.0	<3.5	48	21	<3.5
A57	32	<4.1	<4.1	32	36	<4.1
Network Summary	258	<12	<3.5	258	36	<3.5

Source: MMES, 1986a.

a See Figure 3-5.

b The symbol "<" indicates that the analytical results were less than the detection limit of the method.

The data from the Y-12 perimeter monitors exhibit activities elevated above background. Since the data are for gross activities, the releases cannot be directly compared with DOE's Derived Concentration Guidelines (DCG), which apply only to specific radionuclides. It is therefore necessary to consider nuclide-specific data. Table 3-10 presents uranium-in-air data for 1985 for both the ORR monitors and the remote monitors. Table 3-11 presents uranium-in-air data for ORR stations A36, A40, and A41. The data from these three stations were not included in the composite data of Table 3-10; these monitors exhibit higher uranium activities than other ORR monitors because of their proximity to the Y-12 Plant and prevailing wind directions. Table 3-12 presents the 1985 uranium-in-air data for Y-12 perimeter monitors.

The ORR composites (Table 3-10) exhibit activity higher than those of the remote stations. This activity elevation is greatest for U-234. The average observed U-234 concentration for the ORR stations (excluding A36, A40, and A41) was $0.22 \times 10^{-15} \mu\text{Ci/ml}$, while for the remote stations it was $0.11 \times 10^{-15} \mu\text{Ci/ml}$. If the remote value is considered to be background uranium, the elevated activity concentration is $0.11 \times 10^{-15} \mu\text{Ci/ml}$ above background. This is 0.4 percent of DOE's DCG ($90 \times 10^{-15} \mu\text{Ci/ml}$) for U-234.

The highest U-234 concentration observed in 1985 was $22 \times 10^{-15} \mu\text{Ci/ml}$ for the monitors in Y-12 perimeter system (Table 3-12) and the ORR monitors A36, A40, and A41 (Table 3-11). This is 24 percent of the DCG for U-234. The radiation dose assessment to members of the general public, as a consequence of airborne releases, is discussed in detail in Section 4.3. The calculated whole body dose equivalent is 0.000016 millirem and the critical organ (lung) dose is 8.3 millirem. These doses are 6.4×10^{-5} percent and 1.1 percent, respectively, of the NESHAP limits for exposure through the air pathway of 25 millirem/yr whole-body dose and 75 millirem/yr critical organ dose.

Total Suspended Particulates

The Y-12 Plant monitors total suspended particulates (TSP) in ambient air at two locations, one at the east end (A72) and one at the west end (A68) of the Plant (Figure 3-3). Sampling for TSP consists of drawing air through a preweighed Whatman 41 filter paper for 24 hours every 6th day. Before it is weighed, each clean filter paper is allowed to equilibrate to existing laboratory temperature and humidity conditions. (The Reference Method for TSP [40 CFR 50, Appendix B] specifies controlled temperature and humidity conditions.) At the end of the 24-hour sampling period, the filter papers are again allowed to equilibrate for one hour (Reference Method specifies 24 hours) to laboratory conditions before they are reweighed. From the weight differential due to particle accumulation,

TABLE 3-10

**1985 CONTINUOUS AIR MONITORING DATA FOR URANIUM RADIONUCLIDES
(QUARTERLY COMPOSITE SAMPLES)
Y-2 PLANT, OAK RIDGE RESERVATION, TENNESSEE
Concentration (10^{-15} $\mu\text{Ci}/\text{ml}$)**

Radionuclide	Oak Ridge Reservation Stations ^{a,b}			Oak Ridge Remote Stations ^c			DOE Derived Concentration Guide
	Maximum	Minimum	Average	Maximum	Minimum	Average	
²³⁴ U	0.32	0.12	0.22	0.24	0.055	0.11	90
²³⁵ U	0.029	0.0076	0.018	0.023	0.0039	0.093	100
²³⁸ U	0.092	0.033	0.068	0.056	0.026	0.037	100

Source: MMES, 1986a.

a Does not include data from A36, A40, and A41.

b See Figure 3-4.

c See Figure 3-5.

TABLE 3-11

1985 CONTINUOUS AIR MONITORING DATA FOR
OAK RIDGE RESERVATION STATIONS A36, A40, A41: URANIUM
(QUARTERLY COMPOSITE SAMPLES)
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE

Location*	Concentration (10 ⁻¹⁵ μ Ci/ml)			
		234U	235U	238U
A36	Maximum	0.75	0.10	0.38
	Minimum	0.35	0.02	0.18
	Average	0.51	0.06	0.24
A40	Maximum	3.5	0.26	0.96
	Minimum	0.77	0.07	0.20
	Average	1.9	0.14	0.47
A41	Maximum	1.3	0.18	0.32
	Minimum	0.84	0.04	0.22
	Average	0.97	0.11	0.25
DOE DCG		90	100	100

Source: MMES, 1986a.

* See Figure 3-4.

TABLE 3-12

1985 AIR MONITORING DATA FOR THE Y-12 PERIMETER: 234U, 235U, AND 238U
(COMPOSITE SAMPLES)
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE
Concentration (10⁻¹⁵ μ Ci/ml)

Location ^a	234U				235U				238U			
	Maximum	Minimum	Average	Maximum	Minimum	Average	Maximum	Minimum	Maximum	Minimum	Average	
A61	5.2	3.2	4.5	0.19	0.14	0.16	0.34	0.15	0.34	0.15	0.24	
A62	5.6	3.2	4.6	0.22	0.16	0.19	0.41	0.26	0.41	0.26	0.33	
A63	12	6.4	11	0.75	0.17	0.48	0.77	0.19	0.77	0.19	0.51	
A64	22	12.0	19	1.1	0.55	0.87	1.69	0.10	1.69	0.10	0.73	
A65	16	6.9	11	0.44	0.35	0.40	0.86	0.34	0.86	0.34	0.69	
A66	9.2	4.0	6.3	0.33	0.13	0.21	0.77	0.34	0.77	0.34	0.49	
A67	7.1	5.1	6.0	0.27	0.10	0.20	0.81	0.32	0.81	0.32	0.55	
A68	14	4.1	7.3	0.59	0.10	0.31	1.17	0.28	1.17	0.28	0.83	
A69	25	7.2	12	0.85	0.06	0.39	0.44	0.22	0.44	0.22	0.35	
A70	7.8	2.8	4.7	0.35	0.10	0.22	0.47	0.30	0.47	0.30	0.38	
A71	10	1.7	5.0	0.39	0.11	0.21	0.25	0.11	0.25	0.11	0.23	
DOEDCG		90			100			100				

Source: MMES, 1986a.

sampling time, and total air volume sampled, the TSP concentration (expressed in micrograms per cubic meter [$\mu\text{g}/\text{m}^3$]) can be calculated.

The Y-12 Plant data for TSP for 1984 and 1985 are summarized in Table 3-13 and are compared to the Tennessee primary and secondary air-quality standards. In 1984, the primary and secondary annual and 24-hour standards were exceeded at the east-end sampler (A72); while at the west-end sampler (A68), the primary standards were met. Air quality with respect to TSP improved generally in 1985, as reflected by the substantially lower annual geometric mean values. However, on five occasions at both monitors, TSP values exceeded either the primary or secondary 24-hour standard. The improvement in the annual geometric mean TSP in 1985 is largely attributed to the fact that one of the two baghouses at the steam plant came on line in late 1984 and was operational during 1985.

During 1985, a review of the locations of the Y-12 Plant TSP monitors was conducted. Because of the close proximity of the west monitor (A68) to the fire-training center, dirt roads, and devegetated hillsides, it was determined that this location was inappropriate for monitoring ambient air. A new site meeting EPA monitoring guidelines was located, and the west TSP monitor was moved in late 1986.

Sulfur Dioxide

Sulfur dioxide (SO_2) monitoring is conducted continuously at two stations (A62 and A68) at the Y-12 Plant (see Figure 3-3). These two stations are identical except for their location. Ambient air is pumped into pulsed ultraviolet fluorescence analyzers that are connected to recording units housed in temperature-controlled shelters. They are calibrated weekly to ensure that they remain within the ± 15 percent drift allowed by the state. The TDHE conducts a quarterly audit of each system.

Concentrations of SO_2 are recorded hourly. Three-hour and twenty-four-hour averages are calculated and compared with the 3-hour and 24-hour ambient air standards. Table 3-14 lists the maximum 3-hour, maximum 24-hour, and monthly and annual averages (mg/l) for both stations at Y-12. Typically, the highest values are recorded during the winter heating season. The maximum 3-hour values were less than 20 percent of the standard; the maximum 24-hour values were less than 35 percent of the standard; and the annual averages were less than 30 percent of the standard.

TABLE 3-13

**TOTAL SUSPENDED PARTICULATES IN AIR
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**

Sampler ^a	1984	1985	Tennessee Air Quality Standards ^b	
			Primary	Secondary
A68 (West End)				
Number of Samples	44	53		
Annual Geometric Mean, $\mu\text{g}/\text{m}^3$	62	35	75	60
Maximum 24-hour TSP, $\mu\text{g}/\text{m}^3$	160	510	260	150
A72 (East End)				
Number of Samples	47	52		
Annual Geometric Mean, $\mu\text{g}/\text{m}^3$	76	57	75	60
Maximum 24-hour TSP, $\mu\text{g}/\text{m}^3$	400	487	260	150

Source: MMES, 1985b.
MMES, 1986a.

- a See Figure 3-3 for location.
b Primary standards are health based.
Secondary standards are welfare based.

TABLE 3-14

**1985 SULFUR DIOXIDE^a IN AIR
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE
(Concentration, mg/l)**

Month	Maximum 3-hour Average		Maximum 24-hour Average		Monthly Average	
	A62 ^b	A68 ^b	A62	A68	A62	A68
January	0.096	0.029	0.049	0.013	0.015	0.005
February	0.085	0.067	0.033	0.028	0.010	0.006
March	0.078	0.052	0.031	0.026	0.012	0.006
April	0.038	0.009	0.018	0.005	0.007	0.003
May	0.041	0.008	0.011	0.004	0.005	0.002
June	0.015	0.008	0.011	0.006	0.004	0.002
July	0.048	0.008	0.014	0.006	0.006	0.002
August	0.046	0.009	0.016	0.005	0.006	0.003
September	0.039	0.015	0.014	0.008	0.006	0.004
October	0.021	0.034	0.012	0.022	0.006	0.004
November	0.063	0.036	0.028	0.015	0.010	0.006
December	0.082	0.021	0.038	0.009	0.017	0.005
Annual Arithmetic Average					0.009	0.004

Source: MMES, 1986a.

a Tennessee ambient air standards are 0.5 mg/l for the maximum 3-hr average, 0.14 mg/l for the maximum 24-hr average, and 0.03 mg/l for the annual arithmetic average.

b See Figure 3-3.

Fluoride

Sampling for ambient concentrations of fluorides is conducted at 11 sites around the Y-12 Plant (see Figure 3-3). In 1985, these perimeter monitoring stations operated continuously for one 7 day period each month. In 1986, sampling was continuous, with filters being changed every 7 days. Atmospheric fluoride is sampled by drawing 2 cubic feet of air per minute through filters pretreated with potassium carbonate. This method measures gaseous fluorides and water-soluble particulate fluorides in the atmosphere. The lower detection limit is 5 μg per sample (MMES, 1986a).

The weekly samples are analyzed for soluble fluorides using a method of testing for fluoride ions in water (ASTM D 1179-72, Method B). The filter (after exposure) is placed in a vial of distilled water overnight to leach out any soluble fluoride. A 20-ml portion of the solution is combined with 20 ml of a reagent solution and then tested on a pH/activity meter. The pH-meter reading is converted by means of a calibration curve to fluoride concentration in $\mu\text{g/l}$, which is multiplied by a factor of 40 to obtain the total mass of fluoride ion recovered from the filter. That mass is then divided by the total volume of air sampled to obtain the ambient concentration in $\mu\text{g/m}^3$.

The 1985 fluoride data show that the ambient fluoride concentrations around the Y-12 Plant for the 7-day averaging period are less than 0.1 $\mu\text{g/m}^3$ as compared to the Tennessee standard of 1.6 $\mu\text{g/m}^3$. Because of the 7-day sampling schedule in 1985, no data are available for comparison with the State's 12-hour, 24-hour, and 30-day standards.

Mercury

Because a potential exists for release of mercury into the atmosphere during the stripping of Building 9201-4 (see Section 3.1.2.3), Y-12 undertook, in early 1986, the development and testing of a method to sample and analyze for airborne mercury. Four mercury samplers have been deployed, two at the east and west side of Building 9201-4, one at site A62 at the eastern end of the plant, and the fourth at site A68 at the western end of the plant. These samplers draw about 800 ml of air per minute through a filter to trap particulates and a charcoal-filled tube to capture mercury vapor. The filters are changed monthly and the charcoal tubes are changed weekly. The air-flow rate is checked weekly and the rotometer is checked semiannually. No data were available from the developmental procedure at the time of the on-site Survey.

3.1.3.3 Meteorology

To provide meteorological data, two meteorological towers were installed late in 1985 at the Y-12 Plant that have automated data collection and solid-state telemetry data transfer to a computer. A 100-m tower located near the east boundary of the plant has instrumentation at the 10-, 30-, and 100-m levels (Tower 5, Figure 3-1). A 60-m tower just west of the plant has monitors at the 10- and 60-m levels (Tower 6, Figure 3-1). Meteorological parameters will be monitored to provide data on the stability class of the atmosphere as well as wind speed and direction data essential for reliable dispersion modeling. As data from the meteorological towers and various process stacks are obtained, the Y-12 Plant, in conjunction with ORNL, will examine the development of an atmospheric dispersion modeling program for Bear Creek Valley. The meteorological data will be used with the dispersion model to evaluate the potential impact of Y-12 Plant atmospheric emissions on the surrounding community and to assess the appropriateness of existing ambient-air monitoring sites.

The first full year of data acquisition was completed at the end of 1986.

3.1.4 Findings and Observations

3.1.4.1 Category I

None.

3.1.4.2 Category II

None.

3.1.4.3 Category III

1. Accidental Airborne Releases of Uranium. Unmonitored, uncontrolled releases of uranium to the environment can occur in the event of accident.

In the uranium processing buildings, both enriched and depleted uranium are handled and transported in nonprocess areas that are not equipped with either emission control devices or radiological air monitors. If an accident, such as a uranium chip fire or criticality, were to occur in such an area, radioactive materials could be released to the environment. One such

accident occurred in the enriched-uranium chip washing area of Building 9212 on December 27, 1985. In that accident, a fire was spontaneously ignited in a basket containing approximately 3.5 kilograms of enriched-uranium machining chips. It was estimated (Fee, 1986a) that approximately 65 grams of uranium were released to the immediate environment. A portion of the room air contaminated with uranium was exhausted through a laboratory hood fitted with a HEPA filter. However, an estimated 20 percent of the material released to the environment was exhausted through an unmonitored, uncontrolled room ventilation exhaust. Only samples from ambient-air monitors located in close proximity to Building 9212 (sample stations A63, A64, and A65) exhibited activity levels in excess of background. The maximum uranium levels observed were less than 1 percent of the DOE Derived Concentration Guideline of 100×10^{-15} microcurie/ml.

2. Quantification of Airborne Radionuclide Emissions. Releases of radionuclides to the atmosphere are not being properly monitored and thus potential impacts to the environment are not accurately evaluated.

Reliable and defensible estimates of radionuclide emissions cannot be made because the current stacks preclude the proper location of samplers in accordance with recognized guidelines. Many of the existing stacks have one or more of the following deficiencies:

- Stack too short.
- Stack diameter too small.
- Lack proper separation from flow disturbances (e.g., bend, expansion, or contraction).
- Lack of access for sampling.

A stack radiological monitoring project is under way to combine and modify stacks to permit proper sampler location and to provide for accurate continuous sampling for radionuclides and periodic stack flow-rate measurement. Real-time monitors will also be provided on certain stacks to indicate control device failure.

3. Hydrogen Fluoride Emissions. Hydrogen fluoride emissions are not properly controlled, resulting in releases to the atmosphere.

Uranium processing operations at Y-12 release hydrogen fluoride to the atmosphere. These releases have the potential to cause increased health and environmental impacts through respiratory tract irritations, vegetation damage, and subsequent food pathway accumulation.

During the period of 1981 through 1985, emissions ranged between 14,000 and 22,000 kg per year. A hydrogen fluoride scrubber has been installed at Building 9206 and is expected to begin operation during the 1st quarter of 1987. Additional scrubbers are under construction at Building 9212.

4. Steam Plant Opacity Exceedances. Continued uncontrolled releases of particulate matter can be expected at Boilers 3 and 4 (east stack) until those boilers can be converted from fuel-oil ignition to natural-gas ignition.

During periods of start-up, hot standby, shutdown, and malfunction, while fuel-oil is fired, the baghouse is bypassed and emissions exceed both opacity and particulate mass emission limitations. The excessive emissions can cause or contribute to exceedances of the 24-hour national and state ambient-air-quality standards for total suspended particulates. This will be of particular concern during the summer of 1988, when Boilers 1 and 2 will be down simultaneously for upgrade, and either Boiler 3 or 4 could be on bypass during hot standby operation while firing fuel oil.

5. Volatile Organic Compounds from Waste Disposal Areas. Volatile organic compounds are being emitted to the atmosphere through standpipes and vents at the Bear Creek Valley Waste Disposal Area.

Preliminary sampling at the mouth of standpipes and vents detected as much as 11 mg/m³ perchloroethylene and 8.5 mg/m³ trichloroethane. These emissions may contribute to the pervasive ozone non-attainment problem. A sampling and characterization program is being conducted by ORNL.

6. Coal-Dust Emissions. Uncontrolled, unquantified emissions of coal dust to the atmosphere can occur when crushed coal is dropped from the conveyor into open-top hoppers at the steam plant. Such emissions potentially contribute to exceedances of the 24-hour total suspended particulate air quality standards.

During hot, dry, summer conditions especially, the ventilating fans in the surrounding structure would move air containing suspended particles to the outside. Y-12 has plans to cover the hoppers to minimize dust emission.

7. Gasoline Vapors. Gasoline vapors vented from the underground storage tank at the Y-12 gas station contribute to the ozone non-attainment problem in Anderson County.

The Y-12 Plant is located in Anderson County, which has been designated rural by the TDHE. Consequently, gasoline tanks are not required to return tank vapor to the delivery truck during refills. However, an equivalent volume of vapor is emitted each time the tank is filled. During 1986, 435,000 gallons of gasoline were purchased. Such emissions are likely to come under increased scrutiny by air pollution control agencies as EPA moves to achieve attainment of the ozone air-quality standards.

8. Classified Waste Paper Disposal. The incinerator and shredder at Building 9811 both emit particulate matter to the atmosphere and thus add to the total-suspended-particulate load in the ambient air.

The two-chamber incinerator is not equipped with emission controls. Visible emissions, which may be in violation of state regulations, were observed by the Survey team. The shredder has a cyclone separator; however, small particles escape from the dumpster box that receives the shredded paper.

9. Potential for Mercury Emissions. Removal of process equipment and piping containing mercury from Building 9201-4 and dismantling of Buildings 9201-4 and 9201-5 could result in airborne emissions of mercury in excess of the 200-pound-per-year Prevention of Significant Deterioration de minimus value.

Y-12 has indicated that about 70,000 pounds of mercury could be recovered by draining process piping in 9201-4. Additional quantities (perhaps as much as 150,000 pounds) are estimated to be contained in process equipment and should be recoverable with minimal losses to the atmosphere. However, if residual mercury remaining in and on scrap materials (including dismantled process equipment and piping, mercury-contaminated building components, and mercury-contaminated soil) is recovered by a distillation process (mercury roaster), airborne emissions of mercury vapor could occur, possibly in excess of 200 pounds per year.

3.1.4.4 Category IV

1. Development Incinerator. The incinerator at Building 9731 has been used in trial runs to burn solids, liquids (some chlorinated), and animal carcasses; however, the permit application indicates that only "liquid waste solvent" will be incinerated.
2. Total Suspended Particulates Monitoring. Data obtained in ambient air sampling for total suspended particulates (TSP) may not be accurate and defensible because of siting and quality assurance deficiencies.
 - The west monitor (A68) is located too close to possible interferences from a fire training station, an unvegetated hillside, and busy plant roads. Relocation of the west monitor is currently under way.
 - The Whatman 41 filter paper being used does not meet the minimum 99 percent capture efficiency requirement of the Federal Reference Method (40 CFR 50, Appendix B) for TSP on 0.3 μm dioctylphthalate particles at the face velocity commonly used in high-volume (hi-vol) samplers. Thus, the particulate mass captured may be biased low.
 - Individual filters are preconditioned on a laboratory bench for 1 hour at room conditions prior to weighing. The Reference Method requires 24-hour equilibration at carefully controlled temperature and humidity conditions.
 - The sampling activity lacks a collocated sampler for quality assurance purposes.
 - Concentrations are calculated on the basis of actual temperature and barometric pressure conditions. EPA requires (40 CFR 50.3) correction to reference temperature (25°C) and reference pressure (760mm Hg).
3. Unpermitted Degreasers. Two small (15-gallon) degreasers in Building 9201-1 are not covered under a current air permit.
4. Perchloroethylene Degreasers. Perchloroethylene is being used in several degreasers at Y-12. Perchloroethylene has been listed as a potential air pollutant under the NESHAP system, having direct health-related effects and potential contribution to ozone formation.

3.2 Soil

3.2.1 Background Environmental Information

The Y-12 Plant, as well as the Oak Ridge Reservation (ORR) in general, is underlain by residual soils formed by in-place decomposition of rock. Alluvium (water-deposited soil) also occurs in floodplains along streambeds.

Decomposition of rock occurs as a result of physical weathering and chemical action. The nature of a residual soil depends on the type of source rock, solubility of the source rock components, degree of weathering, climate, vegetation, and drainage. Soils also exhibit different characteristics after being disturbed by excavation and recompaction.

The typical residual soil (residuum) in this area is a reddish-brown clay. The residuum overlies a zone of weathered (or weathering) bedrock that is partially decomposed. Under this zone is unweathered bedrock.

Soluble materials such as calcium carbonate tend to leach out of the residuum. Even in soils formed from limestone or dolomite, there is very little carbonate above the weathering bedrock zone. Where the rock is predominantly shale, the residuum may retain the appearance of the original rock except for removal of calcium carbonate.

The Knox dolomite (magnesium-rich carbonate), which forms Chestnut Ridge, contains abundant chert, a variety of quartz which occurs as nodules or lenses. This material is resistant to weathering and remains on the surface. As a result of the presence of this cherty surface armor, erosion of the clay residuum is retarded. The presence of chert thus accounts for both the existence of a ridge despite the solubility of dolomite and for the depth of the residuum (up to 90 feet) that can be formed on the Knox. The surface of the bedrock beneath this soil mantle is very irregular; outcrops generally represent the tops of pinnacles of bedrock projecting through the soil. Caverns are common in the Knox, and sinkholes are a frequently observed topographic feature.

Valley soils, such as those developed on the Conasauga Group in Bear Creek Valley and the Chickamauga Limestone in Bethel Valley (see Section 3.4.1), are generally much shallower than those developed on carbonate ridges. Valley soils are a mixture of clays, silts, and weathered shale fragments. The Rome Formation on Pine Ridge, which is predominantly sandstone, weathers to form a shallow soil full of rock chips.

Soils are important both because of their role as a supporting medium and source of nutrition for plants, and because of their physical and chemical properties in retarding contaminant migration. For example, substances such as mercury, PCBs, and certain hydrocarbons tend to remain bound to soil and are unlikely to be leached into groundwater. The primary concern, historically, with regard to soils at the Oak Ridge Reservation has been the deposition onto surface soil of airborne radionuclides. Radionuclides present in soil can be ingested by humans through consumption of food grown in that soil, since they can be incorporated metabolically into plants through root uptake. Radionuclides or other contaminants deposited on leaf surfaces can be taken up by the plant, or can be transferred directly to animals that consume contaminated foliage. Deposition on leaf surfaces can occur through wind resuspension of contaminated soils, through splattering of soil on the plant during rains, and through direct contact between the soil surface and plant surfaces.

Uranium and thorium isotopes are present in soils in the vicinity of the Y-12 Plant as a consequence of past releases of these materials from Y-12 operations and their natural occurrence in soils. The concentration ranges of naturally occurring, or, background, thorium and uranium in soils throughout Tennessee have been measured to be 0.66 to 1.5 pCi of thorium-232 per gram of soil and 0.72 to 1.3 pCi of uranium-238 per gram of soil (Myrick, et al., 1983). Throughout the United States, the uranium-in-soil concentrations range between 0.12 and 3.8 pCi/g (U-238), and the thorium-in-soil concentrations range between 0.10 and 3.4 pCi/g (Th-232). Soils in the vicinity of the Y-12 Plant would be expected to have background concentrations of thorium and uranium within the ranges observed throughout Tennessee. Thus, uranium or thorium concentrations greater than the background levels may be indicative of a local contamination source.

There are no regulations that limit the concentrations of uranium or thorium in soils. However, there is some guidance available from both the U.S. Nuclear Regulatory Commission (NRC) and the Department of Energy (DOE). The NRC, in a memorandum pertaining to a Branch Technical Position on the disposal or on-site storage of residual thorium or uranium, establishes derived concentration limits for various disposal options (NRC, 1981). One of these options applies to wastes with sufficiently low concentrations of uranium or thorium that they would present no health risk and may be disposed of in any manner. The acceptable concentrations for this disposal option were derived by the NRC using radiation dose guidelines recommended by the Environmental Protection Agency (EPA, 1977) for protection against transuranium elements present in the environment. The derived concentration limits are natural thorium, 10 pCi/g; depleted uranium, 35 pCi/g; enriched uranium, 30 pCi/g; and natural uranium, 10 pCi/g. The concentration limits for natural thorium and natural uranium assume that all the daughter products of these elements are present in secular

equilibrium. The radium isotopes are the daughter products that are used to establish the limits. No thorium has been processed at the Y-12 Plant for approximately 15 years (Kamp, 1986). Consequently, it has been at least 15 years since the thorium was separated from its daughter products, and present concentration of the daughters is greater than 80 percent of equilibrium concentration. The derived concentration limit for natural thorium would be appropriate for the Y-12 Plant, although it will be somewhat conservative. The limits for depleted and enriched uranium are appropriate for the Y-12 Plant because even at a time as long as 1,000 years after separation, the radium concentration will be less than 10⁻⁸ percent of the equilibrium concentration.

DOE has established guidelines for residual radioactivity at Formerly Utilized Sites Remedial Action Program (FUSRAP) and Remote Surplus Facilities Management Program (SFMP) sites (DOE, 1985b; 1985c). The guidelines specify concentrations for thorium-232, thorium-230, radium-228, and radium-226 of 5 pCi/g averaged over the first 15 cm of soil below the surface and 15 pCi/g averaged over 15-cm-thick layers of soil more than 15 cm below the surface. These guidelines take into account the in-growth of the daughters and assume secular equilibrium. For other radionuclides or mixtures, the soil concentration guidelines must be derived, on a site-specific basis, from a basic dose limit of 100 mrem/yr to an individual, from all pathways.

3.2.2 General Description of Pollution Sources/Controls

Y-12 has contributed to the concentrations of uranium in both off-site and on-site soils through deposition associated with normal operational airborne releases and airborne releases from accidents such as uranium chip fires, spills of uranium-bearing materials during storage, and washing of uranium from contaminated material or equipment during storage outdoors. In addition, Y-12 processed thorium in the past, and although there is no longer any thorium processed or stored at the plant, there may be areas with some thorium contamination.

There is not sufficient information to estimate the extent of soil contamination on the basis of release and spill data. A total curie quantity of airborne uranium released from Y-12 to the environment during the plant's operating history from 1944 through 1985 is 13.46 Ci. This corresponds to approximately 5,850 kg of uranium. There is no estimate of the total thorium releases, nor are there any records to allow an estimation of quantities of uranium or thorium that might have been released through spills or contamination. An on-going radiological survey of the plant, which will characterize the extent of the radionuclide contamination, is discussed in Section 3.2.3.

The ongoing plant survey is also concerned with mercury contamination in soil. As discussed in Section 2.2.2, an estimated 428,000 pounds of mercury were lost to the ground beneath the Y-12 Plant during past operations. An earlier study of mercury in soil is described in Section 3.2.3.

Soil analyses for contaminants other than uranium and mercury have been performed as part of site characterization projects, but there is no routine monitoring program for such contaminants. Sites for which soil analyses have been performed include the S-2 Pond, part of the Interim drum storage yard, the UNC site, the "line yard," the Oak Ridge Sewage Sludge Land Farming site, and the Oil/Solvent Drum Storage Area. These sites are described in Sections 3.4.2, 4.1.1, 4.2.1, and 4.5.2. Soil analytical data are discussed in Section 3.2.3 for the Oil/Solvent Drum Storage Area and the Oak Ridge Sewage Sludge Land Farming site; soil data for the other sites are unavailable. A program of subsurface soil analyses from borings adjacent to underground storage tanks is also in progress at the Y-12 Plant, but analyses are incomplete.

Burial sites produce soil contamination only if migration from the site occurs. The burial sites in the Bear Creek Valley Waste Disposal Area have clearly produced contaminated soil, since contaminants have moved through the unsaturated zone to reach the groundwater. This is also true of the Oil Landfarm area and the S-3 Pond. The only other site suspected of causing soil contamination is the Z-Oil system, discussed in Section 4.5.2. Survey-related sampling and analysis is planned for this site.

3.2.3 Environmental Monitoring Program

Samples of soil and vegetation are collected from several locations in the vicinity of the ORR and in remote areas as a part of the routine environmental monitoring program. The remote areas are at locations believed to be at sufficient distances from the ORR that they may be considered to be unaffected by releases from the ORR activities. Samples of soils and grasses are collected semiannually from one-meter plots at the ORR vicinity locations (Figures 3-6 and 3-7) and annually at the remote locations (Figures 3-8 and 3-9). Samples are analyzed for a variety of radionuclides, of which only U-234, U-235, and U-238 may be associated with Y-12. It must be emphasized that the source of uranium contamination observed near the ORR cannot be clearly identified, as both Y-12 and ORGDP have historically released uranium. The following discussion will consider the results of radiological environmental monitoring data without attempting to define its source as either Y-12 or ORGDP.

FIGURE 3-6

LOCATION MAP OF THE OAK RIDGE RESERVATION SOIL SAMPLING AREAS
Y-12 PLANT, OAK RIDGE RESERVATION

SOURCE: MMES, 1986a

FIGURE 3-7

MAP OF OAK RIDGE RESERVATION GRASS SAMPLING LOCATIONS Y-12 PLANT, OAK RIDGE RESERVATION

FIGURE 3-8

LOCATIONS OF REMOTE SOIL SAMPLING AREAS Y-12 PLANT, OAK RIDGE RESERVATION

ORNL DWG 88-9187R

SOURCE: MMES, 1986a

FIGURE 3-9

LOCATIONS OF REMOTE GRASS SAMPLING AREAS Y-12 PLANT, OAK RIDGE RESERVATION

Table 3-15 presents the uranium-in-soil data for 1985. Table 3-16 summarizes the data for the period 1981 through 1985. The highest uranium-in-soil concentrations observed for ORR during 1985 were at sample location S9, the location nearest the Y-12 Plant. Because of the relative concentrations of the three isotopes, it is apparent that the uranium contamination at the S9 location is enriched rather than depleted or natural uranium. Only the sample from location S9 exhibits uranium concentrations greater than background levels observed elsewhere in Tennessee (Myrick, et al., 1983). The uranium concentration of the S9 sample is about 28 percent of the NRC limit for disposal in any manner. Excluding sample location S9 for 1985, the average concentrations of Uranium-234 at the ORR locations ranged from a high of 0.52 pCi/g dry wt (1985) to a low of 0.48 pCi/g dry wt (1982). The average concentrations of Uranium-235 at the ORR locations ranged from a high of 0.11 pCi/g dry wt (1983) to a low of 0.03 pCi/g dry wt (1981). The average concentrations of Uranium-238 at the ORR locations ranged from a high of 0.46 pCi/g dry wt (1983) to a low of 0.33 pCi/g dry wt (1980). With the exception of S9, none of the ORR or remote samples exhibited uranium-in-soil concentrations greater than have been observed in background soils throughout the State of Tennessee (Myrick, et al., 1983). Y-12 personnel have offered no explanation for the elevated uranium at location S-9; the observed concentration of uranium (total of 10.7 pCi/g dry wt.) is below any guidance that may be applied for uranium-in-soil contamination (Section 3.2.1).

The concentrations of uranium found in grasses during 1985 at the ORR and remote stations are presented in Table 3-17. Table 3-18 tabulates the average uranium concentrations for the period 1981 through 1985. Uranium concentrations were elevated, with respect to remote locations, for samples collected during 1985 at sample locations V14, V22, and V23. These data suggest that vegetation in locations near the ORR may have received some uranium contamination. There are no limits for radionuclides in vegetation. The grasses collected are not used as foodstuffs, so they will not present a direct exposure risk to individuals. Contamination of edible vegetation is modeled through the AIRDOS-EPA computer code that calculates the effective radiation dose received through the air pathway from ingestion of foodstuffs.

The Health and Safety Research Division of the Oak Ridge National Laboratory initiated a radiological survey of the Y-12 Plant site in 1985. This survey was conducted as a part of the Radiological Survey Activities Program. The primary objective of the survey was to provide a characterization of the surface environment of the Y-12 site. The characterization included identifying the locations of areas of concern, preparation of reports summarizing the results of the survey, and the development of a data base that may be accessed by management to obtain existing environmental data or add new information as it becomes available.

TABLE 3-15

**1985 RADIOACTIVITY IN SOIL SAMPLES FROM
OAK RIDGE RESERVATION AND
REMOTE MONITORING STATIONS
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**

Location	Concentration (pCi/g dry wt)		
	²³⁴ U	²³⁵ U	²³⁸ U
ORRa,b			
S1	0.81	0.086	1.0
S2	0.39	0.035	0.28
S3	0.34	0.022	0.23
S4	0.57	0.057	0.43
S5	0.46	0.051	0.34
S6	0.39	0.036	0.29
S7	0.27	0.021	0.23
S8	0.93	0.061	0.58
S9	8.0	0.37	2.3
S10	0.54	0.055	0.39
Average ^c	0.52	0.047	0.42
Remoted,e.			
S11	0.41	0.027	0.27
S12	0.49	0.043	0.43
S13	0.78	0.035	0.62
S14	0.38	0.016	0.32
S15	0.35	0.023	0.27
S16	0.41	0.015	0.32
S17	0.51	0.035	0.46
Average	0.47	0.028	0.39

Source: MMES, 1986a.

- a Figure 3-6.
- b Average of two samples.
- c Average excludes location S9.
- d Figure 3-8.
- e One sample.

TABLE 3-16

**CONCENTRATION OF RADIONUCLIDES IN SOIL SAMPLES FROM
OAK RIDGE RESERVATION AND REMOTE STATIONS
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**

Year/Location	Concentration (pCi/g dry wt)		
	²³⁴ U	²³⁵ U	²³⁸ U
1981			
ORR Stations ^{a,b}	0.60	0.030	0.40
Remote Stations ^{c,d}	0.03	0.50	0.004
1982			
ORR Stations	0.48	0.074	0.34
Remote Stations	0.45	0.063	0.41
1983			
ORR Stations	0.87	0.11	0.46
Remote Stations	0.55	0.065	0.45
1984			
ORR Stations	0.62	0.060	0.33
Remote Stations	0.40	0.058	0.34
1985			
ORR Stations ^e	0.52	0.047	0.42
Remote Stations	0.47	0.028	0.39

Source: MMES, 1986a.

- a Figure 3-6.
- b Average of two samples.
- c Figure 3-8.
- d Single sample.
- e Sample location S9 not included.

TABLE 3-17

**1985 RADIOACTIVITY IN GRASS SAMPLES
FROM OAK RIDGE RESERVATION
AND REMOTE MONITORING STATIONS
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**

Location	Concentration (pCi/g dry wt)		
	²³⁴ U	²³⁵ U	²³⁸ U
ORRa,b			
V14	0.11	0.0078	0.049
V15	0.032	0.0027	0.015
V16	0.039	0.0043	0.015
V17	0.030	0.0025	0.016
V18	0.042	0.0034	0.035
V19	0.024	0.0017	0.018
V20	0.033	0.0019	0.014
V21	0.049	0.0023	0.028
V22	0.33	0.015	0.043
V23	0.23	0.0085	0.032
Average	0.092	0.0050	0.027
Remote:c,d			
V24	0.073	0.025	0.018
V25	0.041	0.0019	0.027
V26	0.023	0.003	0.0076
V27	0.051	0.0022	0.024
V28	0.051	0.0041	0.0086
V29	0.023	0.0021	0.014
V30	0.092	0.007	0.054
Average	0.051	0.0065	0.022

Source: MMES, 1986a.

- a Figure 3-7.
- b Average of two samples.
- c Figure 3-9.
- d One sample.

TABLE 3-18

**AVERAGE CONCENTRATIONS OF RADIONUCLIDES IN GRASS
SAMPLES FROM OAK RIDGE RESERVATION AND REMOTE
MONITORING STATIONS^a
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**

Year/Location ^a	Concentration (pCi/g dry wt)		
	²³⁴ U	²³⁵ U	²³⁸ U
1981			
ORR Stations ^b	0.16	0.02	0.08
Remote Stations ^c	0.07	0.02	0.04
1982			
ORR Stations	0.08	0.008	0.074
Remote Stations	0.025	0.007	0.011
1983			
ORR Stations	0.12	0.012	0.45
Remote Stations	0.031	0.0035	0.014
1984			
ORR Stations	0.11	0.0074	0.019
Remote Stations	0.015	<0.0007	0.006
1985			
ORR Stations	0.092	0.005	0.027
Remote Stations	0.051	0.0065	0.022

Source: MMES, 1986a.

- a Figures 3-7 and 3-9.
b Average of two samples.
c Single sample.

The overall survey included a gamma radiation survey of the entire Y-12 site, collection of surface soil samples, and analysis of the samples for mercury, uranium, and other radionuclides. For purposes of the survey, the Y-12 site was divided into grid blocks of no larger than 400-foot squares. These large blocks were used primarily for open areas where little contamination was suspected. Areas suspected of extensive contamination were surveyed on a 100-foot square. The gamma survey covered the entire site. Systematic soil samples were collected at the intersection of grid lines and the center of each grid block, and bias soil samples were collected at locations identified by the gamma survey as having elevated activity. More than 3,000 samples were collected during the radiological survey.

The gamma survey and sample collection were completed during 1986; at the time of the on-site portion of the Environmental Survey, sample analysis was incomplete, as was the development of the survey data base. It is anticipated that the data base will be completed during 1987; the Environmental Survey team will incorporate the results of the survey in the Y-12 Interim Report.

Each grid block will be assigned a rating number that will indicate how extensive contamination is in that block. There will be three sets of rating criteria:

1. Gamma Survey.
2. Soil Sample - Radionuclides (uranium).
3. Soil Sample - Mercury.

From these data, a map of the plant can be computer generated that will indicate the status of each block for each criterion, or a single map that will show blocks having anomalies for any or all three criteria. The ratings of the blocks will be based on the extent of remediation needed for each block. There will be four rating categories:

1. No further work required - background levels.
2. Separate and distinct small spots (2 ft²).
3. Will need additional in-depth evaluation - will require some higher level of effort for cleanup.
4. Will need extensive evaluation - will require considerable effort for remedial action.

The Environmental Survey team has requested that it be provided access to the data base once it is completed. This information will be used to assess the environmental implications of the site contamination. Although the analysis phase is incomplete, several areas have been identified as

having uranium contamination in excess of the NRC-accepted level of 35 pCi/g for disposal of contaminated soil in any manner. This contamination is localized in small areas and is not considered an immediate hazard, but these areas will likely require remediation. Areas with possible thorium and cesium-137 contamination were also identified. Examples of these areas are as follows:

- Scrap yard - Uranium contamination levels as high as 437 pCi/g were identified.
- Area near 9201-5 - A 40-square-foot area was identified with uranium contamination of approximately 3,500 pCi/g. A small spot with a radiation level of 70 mR/hr was located in this area; this is believed to be thorium contamination and is being investigated by Y-12 operational health physics personnel.
- CSX railroad siding - Cesium-137 contamination is present at locations along the CSX railroad sidings within the boundaries of the Y-12 Plant and outside the plant boundaries north of Scarboro Road. The contamination was discovered by the ORNL survey team and is being further characterized by ORAU. Dose rates at the soil surface have been observed in several locations to be of the order of 1 mR/hr. Members of the DOE Environmental Survey team observed one location with a dose of 3.6 mR/hr. This area is discussed further in Section 4.5.2.

The ORNL survey of the Y-12 Plant is concerned only with surface soil. An earlier investigation of mercury in soil was conducted by Rothschild, et al. (1984a). In this study, subsurface soil samples were taken from boreholes drilled for monitoring well installation. Mercury analyses of soils and fill indicated that high concentrations (up to 1 percent by weight) of mercury occur in the shallow soil and fill at several sites within the plant. However, the estimated total quantity located (approximately 7,000 pounds) represents only about 2 percent of the amount estimated to have been lost to the ground (428,000 pounds).

In the Rothschild study, the highest mercury concentrations found as dissolved mercury in groundwater were only about 1 µg/l. The occurrence of elevated mercury levels, mainly in shallow (≤ 10 feet) soil and fill, and of mainly background levels in groundwater indicate that the metal has been generally immobilized or retained in upper earth materials. Thus, subsurface mercury at the Y-12 Plant is a soil contamination problem and not a groundwater problem. The major environmental impact of mercury-contaminated soil is its buildup in surface water and sediments as a result of surface runoff.

Soil sampling and analysis at the Oil/Solvent Drum Storage Area in the Y-12 Salvage Yard was conducted as part of the RCRA closure of the western part of the area. The closure plan, which was approved by the TDHE, specified the maximum allowable limits for nine organics and eight metals in soil (Table 3-19). Preliminary action levels for metals were also developed. These preliminary action levels (Table 3-20) are the soil concentrations in mg/kg that would produce the maximum allowable concentration (in mg/l) in the EP toxicity test if the metal were completely leached from the soil.

Lead and mercury were detected in some samples at concentrations above the preliminary action levels. Samples that exceeded these action levels were submitted for EP toxicity testing. The highest mercury concentration in the extract from the EP toxicity test was 0.027 mg/l, and the highest lead concentration was 1.60 mg/l. The maximum allowable limits are 0.2 mg/l for mercury and 5.0 mg/l for lead. Thus, these contaminants do not leach from the soil in significant amounts.

Mercury concentrations were highest in samples taken near the surface. These concentrations declined rapidly with depth, suggesting that mercury from spills and leaks remains bound to soil and does not migrate downward. High concentrations of mercury did not correlate with detectable concentrations of organics associated with oils and solvents. Organics were found near drainage channels where spilled solvents would be washed by rainfall runoff.

The highest observed contaminant concentrations from Phase I (eight soil borings) and Phase II (24 soil borings) are shown on Table 3-21. No contaminants exceeded the maximum allowable limits.

Because drums of wastes were stored on the facility for 2 to 3 months after the Phase I and II soil sampling was completed, a final round of verification sampling was performed after waste removal. This surface sampling confirmed that no further contamination had occurred. Thus, the completed soil investigation demonstrated that the western portion of the Oil/Solvent Drum Storage Area could be closed without site decontamination or soil excavation.

The Oak Ridge Sewage Sludge Land Farming Site is an area west of Rogers Quarry, which has been used for disposal of sludge from the City of Oak Ridge sewage treatment plant. As part of a study conducted by Oak Ridge National Laboratory, soil samples were collected from a control location and from top, bottom, and side slopes of three ridges at the site. Several 15-cm core samples were composited at three stations within each area of each ridge. The sampling and statistical methodologies are described in Daniels, 1986a.

TABLE 3-19

**MAXIMUM ALLOWABLE LIMITS FOR CONTAMINANTS IN SOIL IN
THE Y-12 SALVAGE YARD OIL/SOLVENT DRUM STORAGE AREA
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**

Compound	Maximum Limit
Perchloroethene (Tetrachloroethene)	8.5 mg/kg ^a
Methylene chloride	15.0 mg/kg ^a
1,1,1-Trichloroethane	100.0 mg/kg ^a
Trichloroethene	26.0 mg/kg ^a
Benzene	2.5 mg/kg ^a
Toluene	1,430.0 mg/kg ^a
2-Butanone	75.0 mg/kg ^a
PCBs	25.0 mg/kg ^b
Freon-113	40.0 mg/kg ^c
Arsenic	5.0 mg/l ^d
Barium	100.0 mg/l ^d
Cadmium	1.0 mg/l ^d
Chromium	5.0 mg/l ^d
Lead	5.0 mg/l ^d
Mercury	0.2 mg/l ^d
Selenium	1.0 mg/l ^d
Silver	5.0 mg/l ^d

Source: Welch, 1986.

- a Maximum allowable limits for these constituents are based on the Hazardous Waste Guidelines, TDHE.
- b Proposed cleanup limit.
- c Maximum allowable limit for Freon-113 based on back-calculation from proposed Toxicity Characteristic Leaching Procedure level.
- d Maximum allowable limits for these constituents based on the characteristic of EP Toxicity, 40 CFR 261.24, Table 1, in mg/l of the extract from soil samples.

TABLE 3-20

**PRELIMINARY ACTION LEVELS FOR METALS
SPECIFIED FOR ANALYSIS IN THE CLOSURE PLAN FOR THE Y-12
SALVAGE YARD OIL/SOLVENT DRUM STORAGE AREA
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**

Metal	Maximum Allowable Limit (mg/l) ⁽¹⁾	Preliminary Action Level (mg/kg) ⁽²⁾
Arsenic	5.0	100.
Barium	100.0	2,000.
Cadmium	1.0	20.
Chromium	5.0	100.
Lead	5.0	100.
Mercury	0.2	4.0
Selenium	1.0	20.
Silver	5.0	100.

Source: Herbes and Turner, 1986.

- (1) Concentrations in soil sample extracts, as presented in the Closure Plan.
- (2) Soil concentration that would yield maximum allowable limit in EP toxicity test if metal were entirely leachable from the soil sample, e.g.:

$$\text{Arsenic: } 5 \text{ mg/l} \times \frac{2 \text{ l extract}}{100 \text{ g sample}} = 100 \text{ mg/kg}$$

TABLE 3-21

HIGHEST OBSERVED CONTAMINANT CONCENTRATIONS
 PHASE I AND PHASE II SOIL SAMPLES
 OIL/SOLVENT DRUM STORAGE AREA
 Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE

Material	Maximum Allowable Limit (mg/kg)	Highest Concentration in Phase I Samples (mg/kg)	Highest Concentration in Phase II Samples (mg/kg)
Tetrachloroethene	8.5	0.740	1.600
Methylene chloride	15	0.019	0.013
1,1,1-trichloroethane	100	1.8	0.008
Trichloroethene	26	0.014	0.002
Benzene	2.5	ND	ND
Toluene	1,430	0.029	0.051
Methyl ethyl ketone	75	ND (2)	ND
PCB	25	ND	0.100
Freon 113	40	ND	0.150
Arsenic	100 (1)	4.8	17
Barium	2,000 (3)	1,300	760
Cadmium	20 (1)	3.3	4.1
Chromium	100 (1)	48	57
Lead	100 (1)	95	290 (3)
Mercury	4 (1)	202 (3)	306 (3)
Selenium	20 (1)	0.6	0.6
Silver	100 (1)	0.7	5.4

Source: Shelton and Willoughby, 1986.

(1) Preliminary action value for inorganics that triggers EP Toxicity Test.

(2) ND = Not Detected

(3) EP Toxicity Tests were performed on the soil samples with lead and mercury concentrations greater than the preliminary action values. The lead and mercury concentrations from the EP Toxicity Tests did not exceed the maximum allowable limits.

Samples were analyzed for 44 parameters, including metals, organics, and radionuclides. Radioactivity in sewage sludge is of some concern; however, total uranium was not specifically included among the parameters. Nine parameters were not detected in any sample. There were no statistically significant differences among the samples for 5 parameters, including gross alpha and gross beta. The finding, of "no statistically significant differences" may mean that there is too much variability within the samples composited for each area to detect differences among stations.

The remaining parameters for which significant differences between some stations could be detected included aluminum, barium, beryllium, cobalt, chromium, copper, iron, mercury, nickel, nitrate, phosphorus, lead, silicon, sulfate, zinc, cobalt-60, cesium-137, total Kjeldahl nitrogen, and Bray phosphorus. In general, higher values were found at the ridge bottoms, a factor which suggests that material washes down the slopes.

Mean values for each area were compared by the Oak Ridge National Laboratory to the "Hazardous Substance Guidelines" currently being used by the TDHE as guidelines (but not absolute requirements) for clean closure considerations. Chemical concentrations in soil that exceeded these guidelines include mercury at all locations except the control areas (ridges never used for sludge deposition), and lead and chromium in all areas. The maximum levels found were mercury, 0.70 mg/kg; lead, 36 mg/kg; and chromium, 49 mg/kg. All levels are too low and too variable to be traced to either the presence of sewage sludge or some other possible source.

3.2.4 Findings and Observations

3.2.4.1 Category I

None.

3.2.4.2 Category II

None.

3.2.4.3 Category III

1. On-site Uranium Contamination of Soils. Areas within the Y-12 Plant boundaries exhibit surficial soil uranium contamination in excess of the NRC-accepted level of 35 pCi/g for disposal of contaminated soil in any manner.

The contamination is localized in small areas and is not considered an immediate health hazard by Y-12 personnel. Since the contamination is in a controlled area, it does not present a risk of exposure to members of the public. However, the existence of the contamination requires that DOE maintain access control to these areas for an indefinite period, or that DOE decontaminate the soils to below acceptable levels. The surficial contamination was identified by the recently completed survey of the facility by an ORNL survey team. The Environmental Survey team will request a copy of the ORNL Radiology Survey data base upon completion. This data will be used to define levels of contamination for the Survey purposes, and will be incorporated into the Interim Report.

2. Z-Oil Contaminated Area. A Category III finding regarding possible soil contamination from this system appears in Section 4.5.3.
3. Transport of Contaminated Soil. A Category III finding on transport of mercury-contaminated soil into surface streams by means of groundwater infiltration into basements and drains is found in Section 3.4.4.3.

3.2.4.4 Category IV

None.

3.3 Surface Water

3.3.1 Background Environmental Information

Natural surface-water bodies in the immediate vicinity of the Y-12 Plant are shown in Figure 3-10. Bear Creek and East Fork Poplar Creek (EFPC) are the streams most affected by the plant. These two streams have their headwaters within the operating area of the Y-12 Plant. Bear Creek originates on the western side of the Y-12 operating area near the S-3 Ponds and flows southwestward through Bear Creek Valley before turning to the northwest to join East Fork Poplar Creek at mile point 1.5 (2.4 km). East Fork Poplar Creek originates east of the S-3 Ponds and flows northeastward to New Hope Pond. After exiting New Hope Pond, EFPC flows northwestward and then southwest through the City of Oak Ridge and eventually combines with Bear Creek prior to converging with Poplar Creek at mile point 5.5 (8.8 km). Poplar Creek then discharges to the Clinch River at mile point 12.0 (19.3 km), downstream from the Melton Hill Dam, which is located at mile point 23.1

FIGURE 3-10

**SURFACE WATER STREAMS NEAR THE Y-12 PLANT
Y-12 PLANT, OAK RIDGE RESERVATION**

(37.2 km) on the Clinch River. McCoy Branch, which enters the Clinch River through an embayment on Melton Hill Lake at mile point 37.5 (60.3 km), and Kerr Hollow Branch, entering through another embayment at mile point 41.1 (66.1 km), are the other streams in the area affected by direct discharges from Y-12 operations. The Clinch River joins the Tennessee River near the City of Kingston, Tennessee (Figure 2-1). The other streams shown on Figure 3-10, White Oak Creek, Scarboro Creek, and Walker Branch, do not receive direct discharges from Y-12 operations, nor are they known to be contaminated indirectly (i.e., through groundwater recharge) by the plant. However, members of the U.S. Geological Survey (USGS) staff believe that unpublished data may show that it is possible for Y-12 groundwater to cross the surface-water divide and get into Scarboro Creek (see Section 3.4.1.2).

The water supply for the Y-12 Plant is drawn from the Clinch River by a pumping station located at mile point 41.6 (66.9 km). This location is 0.5 miles (0.8 km) upstream of the embayment that receives the discharge from Kerr Hollow Branch. Water for both process and potable usage is obtained from this source. This is also the source of water for ORNL and the City of Oak Ridge. The City of Kingston withdraws approximately 9 percent of its average daily supply from the Tennessee River about 0.4 miles (0.6 km) upstream from the confluence with the Clinch River (MMES, 1986a). These are the closest two public water supplies. They would only be likely to receive contamination from surface-water discharges at Y-12 during periods of backflow in the rivers.

The USGS has operated a sampling station on the Clinch River at Melton Hill Dam since 1973. Excerpts of data for the Water Year 1985 (October 1984 to September 1985) obtained at this station are listed in Table 3-22 and are presented as being typical of surface-water quality in the area (USGS, 1986). Stream flow data from the same publication are presented in Table 3-23 to give the reader a sense of the variations and relative volumes of flows in the streams affected by discharges from Y-12 (i.e., Bear Creek, East Fork Poplar Creek, Poplar Creek, and the Clinch River).

The radionuclides that are processed at the Y-12 Plant are uranium-234, -235, and -238. Background levels of uranium are present in the environment, primarily in natural geological deposits. Consequently, there will be background levels of uranium in surface waters.

To determine whether activities at the Y-12 Plant are resulting in uranium contamination of surface water, it is necessary to have some knowledge of the levels of uranium that would be present if there were no Y-12 contributions. Because concentrations of uranium vary widely in geological formations, the concentrations found in surface waters are also expected to vary. Therefore, it is not possible to accurately define uranium backgrounds. However, it is possible to estimate background

TABLE 3-22

USGS DATA FOR WATER YEAR 1985
CLINCH RIVER AT MELTON HILL DAM, TENNESSEE
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE

	Average	Maximum	Minimum
Flow (CFS)	8,200	19,200	200
Conductivity (μ mhos/cm)	245	255	235
pH (S.U.)	---	8.3	7.2
Temperature ($^{\circ}$ C)	14.5	20.0	8.0
Turbidity (NTU)	1.4	2.0	0.9
Dissolved oxygen (mg/l)	8.6	12.3	5.6
Hardness (as CaCO_3) (mg/l)	123	130	120
Calcium (mg/l)	33	35	32
Magnesium (mg/l)	9.5	10	8.7
Sodium (mg/l)	4.3	4.9	2.9
Potassium (mg/l)	1.5	1.6	1.4
Alkalinity (mg/l as CaCO_3)	109	115	100
Carbon dioxide (mg/l as CO_2)	4.2	13	1.1
Sulfate (mg/l)	22	24	18
Chloride (mg/l)	4.2	4.7	2.8
Fluoride (mg/l)	0.1	0.1	<0.1
Silica (mg/l)	2.8	5.1	1.6
Dissolved solids (mg/l)	151	173	142
Nitrogen $\text{NO}_2 + \text{NO}_3$ (mg/l as N)	0.32	0.45	0.21
Nitrogen, ammonia (mg/l as N)	0.073	0.15	<0.01
Nitrogen, ammonia & organic (mg/l as N)	0.3	0.6	0.1
Phosphorus, total (mg/l as P)	0.014	0.02	<0.01
Phosphorus, ortho (mg/l as P)	0.012	0.02	<0.01
Suspended sediment (mg/l)	6	9	3
Aluminum (μ g/l)	15	30	<10
Arsenic (μ g/l)	<1	<1	<1
Barium (μ g/l)	33	36	30

TABLE 3-22
 USGS DATA FOR WATER YEAR 1985
 CLINCH RIVER AT MELTON HILL DAM, TENNESSEE
 Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE
 PAGE TWO

	Average	Maximum	Minimum
Beryllium (µg/l)	0.6	0.9	<0.5
Cadmium (µg/l)	<1	<1	<1
Chromium (µg/l)	2	5	<1
Cobalt (µg/l)	<3	<3	<3
Copper (µg/l)	2	3	1
Iron (µg/l)	4	6	<3
Lead (µg/l)	1.5	2	1
Lithium (µg/l)	8.5	14	<4
Manganese (µg/l)	1.8	3	<1
Mercury (µg/l)	<0.1	<0.1	<0.1
Molybdenum (µg/l)	<10	<10	<10
Nickel (µg/l)	1	1	<1
Selenium (µg/l)	<1	<1	<1
Silver (µg/l)	1	1	<1
Strontium (µg/l)	88	95	79
Vanadium (µg/l)	<6	<6	<6
Zinc (µg/l)	5	6	4

Source: USGS, 1986

TABLE 3-23

**MEAN DISCHARGE FLOWS IN STREAMS IN THE VICINITY OF THE Y-12 PLANT
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**

	Clinch River ⁽¹⁾	Poplar Creek	East Fork Poplar Creek ⁽²⁾	Bear Creek
Gage Location (MP) ⁽³⁾	23.1	13.8	3.3	2.8
Drainage Area (mi ²)	3,345	82.5	19.5	4.26
Period of Record (yrs)	36 ⁽⁴⁾	25 ⁽⁵⁾	25 ⁽⁵⁾	⁽⁶⁾
Average Discharge (ft ³ /s)	4,647	173	51.4	⁽⁷⁾
Maximum Discharge (ft ³ /s)	39,600	11,400	4,100	233
Minimum Discharge (ft ³ /s)	0	4	12	0.40
Current Year				
Average Discharge (ft ³ /s)	3,308	108	40.7	⁽⁷⁾
Maximum Discharge (ft ³ /s)	12,200	1,490	476	79
Minimum Discharge (ft ³ /s)	0	5.5	17	0.43

Source: USGS, 1986.

1. Downstream of the Melton Hill Dam.
2. Remarks include the following statement: "Flow includes the effect of operations of the Department of Energy's Y-12 Plant, which may add up to 20 ft³/s, and the west end sewage treatment plant of the City of Oak Ridge, which may add up to 10 ft³/s."
3. MP = mile point = distance in miles upstream from mouth of stream.
4. 1936-1964, 1967-1968, and 1978-1985.
5. August 1960 to current year.
6. April 1959 to June 1964 and March to September 1985.
7. Data not reported.

levels of uranium for an area. One approach to this is to measure the radionuclide concentrations at a location, or several locations, nearby, but sufficiently removed from a potential pollution source that there will be no contributions from that source. The radionuclides at such locations are considered to be at background levels. As a part of the ORR environmental monitoring program, samples are collected from the Clinch River at the Melton Hill Dam. This sample location is upstream of the Y-12 discharge points (East Fork Poplar Creek and Bear Creek) that are likely to contain uranium and may be considered to be free of Y-12 contributions and therefore representative of background. These data are shown in Table 3-24.

The release of waterborne radionuclides to the environment from a Department of Energy (DOE) facility is regulated by DOE Order 5480.1A. In 1985, the DOE adopted, as an amendment to this order, an interim radiation protection standard to be implemented in calendar year 1985 (DOE, 1985a). This interim standard incorporates guidance from the National Council on Radiation and Measurement (NCRP). Included in the interim standard is a revision of the dose limits for members of the public and tables of radiation dose conversion factors to be used for calculating dose from intakes of radioactive materials. The dose factors are based on an International Commission for Radiation Protection (ICRP) Publication 30 methodology for radiation dosimetry. Effluent water derived concentration guides (DCG) were provided in a memorandum from Robert J. Stern, dated February 28, 1986 (DOE, 1986a). The DCGs apply to ingestion of drinking water by members of the general public. The assessment of the environmental impacts of waterborne radiological releases from the Y-12 Plant considered the DOE interim standards referenced above; National Primary Drinking Water Standards, Radionuclides, 40 CFR 141; and Nuclear Regulatory Commission (NRC) limits for concentration of radionuclides in water above natural background, 10 CFR 20, Appendix B. Although the NRC standards do not directly apply to DOE facilities, they provide a health-based reference for comparison with site radionuclide releases. A discussion of waterborne releases, both radioactive and nonradioactive, is presented in Sections 3.3.2 and 3.3.3.

3.3.2 General Description of Pollution Sources/Controls

Pollution of surface waters at the Y-12 Plant is caused by both present operations and past practices. The present operations discussed in Section 2.2.1 produce a variety of wastewaters containing metals, oils, machining coolants, solvents, acids, alkalis, detergents, and suspended solids. Additionally, support services (e.g., steam plant and cooling towers) also contribute to the sources of pollution. Past practices such as those described in Section 2.2.2 contribute to present surface-water pollution through groundwater transport of the contaminants to the surface water, as described in Section 3.4.2.

TABLE 3-24

1985 CONCENTRATIONS OF URANIUM ISOTOPES IN WATER FOR
THE CLINCH RIVER AT MELTON HILL DAM, TENNESSEE (pCi/l)
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE

	Average	Maximum	Minimum
Uranium-234	0.12	0.18	0.051
Uranium-235	3.8×10^{-3}	5.4×10^{-3}	1.7×10^{-3}
Uranium-238	0.082	0.093	0.074

Source: MMES, 1986a.

These pollution sources, relating to surface water contamination, are recognized by DOE, EPA, and TDHE, and have been addressed in the following documents: (1) the Memorandum of Understanding (MOU) dated May 26, 1983; (2) the Complaint and Order related to East Fork Poplar Creek (C&O-EFPC) issued by TDHE on September 15, 1983; (3) the Complaint and Order related to Bear Creek (C&O-BC) issued by TDHE on December 1, 1983; (4) the Federal Facilities Compliance Agreement (FFCA) dated April 17, 1985; and (5) the National Pollutant Discharge Elimination System (NPDES) Permit No. TN 0002968 issued on May 24, 1985.

In the MOU, as it relates to surface waters, DOE agreed to identify discharges to EFPC, report on interim treatment and control measures (including the elimination of discharges), apply for a permit for all remaining discharges to EFPC, take steps to eliminate New Hope Pond (NHP) as an NPDES discharge point, cease waste discharges to the S-3 Ponds and eliminate them as a source of contamination of the surface waters, submit a plan for the rehabilitation of Upper Bear Creek, apply for a permit for the Burial Ground Oil Pond discharge to Bear Creek, and to establish, with representatives of TDHE (with the Division of Water Management, TDHE, as lead), TVA, EPA, and DOE, a Task Force to study contamination in EFPC and Bear Creek and formulate plans for remediation if the EPA, DOE, and TDHE determine that it is necessary. The C&O-EFPC specifically mentions the discharges from the laundry, steam plant, and cooling towers at Y-12. It contains more definitive schedules for pollution abatement actions and investigations in the EFPC watershed, based on information submitted in response to the MOU. Similarly, the C&O-BC contains definitive schedules for actions and investigations as they pertain to the Bear Creek Watershed. The FFCA further defined the development of abatement activities in that it specified waters that would not be treated, those that would be treated, the facilities that would provide treatment for the discharges, as well as establishing schedules for the planning, construction, and achievement of compliance with the effluent limitations for these facilities. These dates were made a part of the NPDES permit when it was issued on May 24, 1985.

The pollution abatement program at Y-12 is dynamic. New treatment facilities are being constructed, new or additional sources of contaminants are being delivered to facilities already operating, and some other facilities are either being shut down or used for purposes other than which they were originally built. The goal of all this activity is to eliminate, or at least reduce to a minimum, the discharge of pollutants to surface waters from Y-12. The following sections contain descriptions of the existing and planned surface-water pollution control facilities and other measures being taken to achieve this goal. Past operations such as the S-3 Ponds are discussed where it is believed that such a discussion will help the reader to understand the present situation. The facilities are grouped together in order of the surface-water stream to which they discharge (i.e.,

Kerr Hollow Branch, McCoy Branch, Bear Creek, and East Fork Poplar Creek). The operation of the water treatment plant is also discussed in this section.

3.3.2.1 Water Treatment Plant

The water treatment plant at the Y-12 Plant is operated by Rust Engineering. In addition to serving the needs of Y-12, it supplies water to the ORNL X-10 facility and the City of Oak Ridge. Water is pumped from the Clinch River at mile point 41.6, upstream of any discharge from the Oak Ridge Reservation. Potassium permanganate and chlorine are added at the river pump house for initial disinfection and taste and odor control. A portion of this water is used, without further treatment, by the Y-12 Plant for sluicing ash at the boilerhouse.

The water treatment plant uses an organic polymer and clay in its two traditional horizontal-flow clarifiers, which were installed when Y-12 was built in 1943. An organic polymer and alum are used in its two upflow-style clarifiers, which were installed in the mid 1950s. These chemicals are added to help in the removal of turbidity (suspended particulate matter) from the raw water. The clarified water is filtered prior to the addition of sodium fluorosilicate (to prevent tooth decay), chlorine (for disinfection), and zinc phosphate (for corrosion control). The settled sludge from the clarifiers and the backwash from the filters are treated in a thickener to concentrate the solids. The liquid that overflows from the thickener is returned to the influent to the clarifier. The underflow sludge is dried on drying beds. The dried sludge is then put into a diked area adjacent to the water treatment plant for disposal. Because the polymer-alum treatment does not generate as large a volume of solids as the polymer-clay treatment, this process is to be extended for use in the entire water plant. Use of this process will extend the useful life of this disposal area.

A variance was obtained for the zinc discharge requirements in the NPDES permit because of the zinc content of the treated water. Zinc phosphate is added to the clear well at the water treatment plant to provide corrosion protection to the water distribution system.

All process, potable, and fire protection water at the Y-12 Plant (except for the ash sluicing water) comes from the treated water system. Backflow preventers are used to keep possible flows from the process water users from contaminating the potable water portion of the system if pressure is lost in the main water line.

3.3.2.2 Kerr Hollow Quarry

The Kerr Hollow Quarry is the only discharge from Y-12 Plant to Kerr Hollow Branch. Although this discharge has been assigned an NPDES outfall number (301), flow only occurs (once or twice a year) when there has been sufficient rain in the area to raise the groundwater table at the quarry so that it overflows. There is no liquid discharge into the quarry from the Y-12 Plant; however, it has been used to dispose of reactive metals since 1950. Containers of these materials are thrown into the quarry and are punctured by rifle fire by members of the security force. The reactive metals (sodium, lithium, potassium) disposed of in the quarry combine with the water to form soluble metal hydroxides and hydrogen gas, which escapes to the atmosphere. Disposal only takes place when the water level in the quarry is low so that discharge is unlikely until maximum dilution of the contaminants occurs. Samples are taken after each disposal operation in accordance with the terms of the NPDES permit, as discussed in Section 3.3.3.1.

3.3.2.3 Ash Impoundment and Rogers Quarry

The fly ash and bottom ash, which are the residue from burning coal in the boilers, are sluiced from the steam plant with untreated river water. This slurry is pumped to the top of Chestnut Ridge, where it flows by gravity to an impoundment that was constructed in the headwaters of McCoy Branch. This impoundment has become filled so that the water/ash mixture overflows and continues down McCoy Branch to Rogers Quarry. Rogers Quarry is of sufficient size to provide the settling capacity needed for the removal of the suspended matter. However, TDHE is concerned about the use of McCoy Branch, which it considers to be waters of the state, as a conduit for the ash from the impoundment to the quarry. The water flow from Rogers Quarry is monitored weekly as NPDES Outfall 302.

3.3.2.4 City of Oak Ridge Sanitary Sewage Sludge Land Farm

Another possible source of pollution of McCoy Branch at the Y-12 Plant is the waste sludge from the City of Oak Ridge West End Sewage Treatment Plant. The sludge could become contaminated from inadvertent discharges of radionuclides to the sanitary sewers that convey sewage from the Y-12 Plant to the city's treatment plant (Section 3.3.2.20). Preliminary monitoring of the treatment plant sludge shows accumulation of uranium at or above background levels (MMES, 1985a). This sludge has been deposited in an area west of Rogers Quarry. A new area for disposal of these sludges is being developed east of the quarry.

ORNL has made a study of the surface-water runoff from both these areas and has found no downstream contamination as the result of surface-water runoff from the existing landfarm area (Daniels, 1986b). After the new landfarm area becomes operational, data from the first series of analyses from that area will be provided to the Survey team (Kitchings, 1986). The effects of the existing site on soils and groundwater are described in Sections 3.2.3 and 3.4.3.2, respectively.

3.3.2.5 Bear Creek Valley Waste Disposal Area

Contamination of the surface water in Bear Creek (as measured at its effluent from Y-12 through NPDES Outfall 304) is the result of leachate and contaminated groundwater transporting pollutants from the disposal areas to the surface waters. As discussed briefly in Section 2.2.2.2 and in more detail in Section 3.4.2.2 and 4.5.2.1, the wastes disposed in the facilities in Bear Creek Valley (i.e., S-3 Ponds, Burial Grounds, Oil Landfarm, etc.) contained oils, polychlorinated biphenyls (PCBs), solvents, heavy metals (including uranium), and nitrates. The burial-ground oil-retention ponds and the S-3 Ponds are discussed in this section because the direct discharges from oil retention ponds to Bear Creek are NPDES outfalls and leachate from the S-3 Ponds has been a source of nitrate contamination of this creek. However, the effluents from the facilities installed to eliminate discharges to the S-3 Ponds pass through NPDES monitoring points that discharge to EFPC; therefore, these facilities are discussed in later sections.

Oil Retention Ponds 1 and 2

Burial Ground A (Figure 3-11) was opened for use in 1955 for the disposal of solid wastes. Liquid wastes began to be disposed there in 1959. Through the years, a variety of liquids (mop waters, oils, coolants, and solvents, some of which contained PCB) were put into the burial trenches in this area. Oil-retention Pond No. 1 was constructed in 1971 to collect and contain the oils observed seeping into a surface stream along the west side of Burial Ground A (Figure 3-11). A diversion ditch was also constructed to prevent overflow from the pond due to excess drainage entering into the pond. A year later (1972) another, smaller pond (No. 2) was built to the east of Burial Ground A to collect oils seen seeping out of the ground in that area. Both ponds were constructed with an inverted siphon (Figure 3-12) to remove water from below the surface of the oil for discharge to the adjacent streams. Oils removed from the surface of the ponds since 1979 have been stored for eventual disposal in the incinerator at ORGDP when it is permitted (Section 4.2.1.3). Less than 50 gallons per year is now recovered from these ponds. The water effluents from the ponds are monitored monthly as NPDES Outfalls 305 (Pond 1) and 306 (Pond 2).

FIGURE 3-11

OIL RETENTION PONDS 1 & 2 IN BEAR CREEK VALLEY BURIAL GROUNDS Y-12 PLANT, OAK RIDGE RESERVATION

SOURCE: UCND, 1984a.

FIGURE 3-12

OIL RETENTION POND 1 Y-12 PLANT, OAK RIDGE RESERVATION

S-3 Ponds

The S-3 Ponds were built in 1951 to receive wastes that, prior to that time, had been placed in the S-2 Pond (Section 4.5.2.3). The function of the ponds was to evaporate these wastes or allow them to percolate into the ground. This was effective for the control of radionuclide discharges since they were absorbed in the soil immediately adjacent to the pond. However, the nitrates and any other nonabsorbable contaminant present in the water are passed on into the groundwater or leached out of the ponds directly into the headwaters of Bear Creek and East Fork Poplar Creek. Through the years, until disposal in the S-3 Ponds was discontinued in 1984, various materials were disposed here. These included uranyl nitrate solutions, dilute and concentrated acid solutions, caustic solutions, mop waters, raffinates from uranium recovery processes, machine coolants, and even some empty spray cans and propane cylinders.

Although use of the ponds was not discontinued until March 1984, remediation efforts began in 1983 with the neutralization and biodenitrification of the ponds. All four ponds were neutralized, and pond aerators were used to stir up the sludge to increase the rate of denitrification. Nutrients were added to maintain this reaction. The nitrate levels in the ponds were reduced to less than 50 ppm. The ponds were then dewatered through the S-3 Ponds Liquid Treatment Facility, which discharged to EFPC. This facility is described in one of the following sections (Section 3.3.2.8) that relate to the treatment of those discharges from Y-12 to EFPC. Some of these facilities, which were initially used for treatment and dewatering of the S-3 Ponds, may continue to be used by being incorporated into the treatment process at the West End Treatment Facility (WETF). In the meantime, they are available (if needed) to treat rainwater that may accumulate in the S-3 Ponds before closure under RCRA (Section 4.1.2.1) is complete.

3.3.2.6 Aluminum Nitrate and Nitric Acid Recovery

These processes reduce the volume of waste that must be treated for discharge. The nitric acid recovery system began operation in February 1977 and reduced the amount of material being discharged to the S-3 Ponds at that time. The aluminum nitrate recovery system began operations in December 1976. Aluminum nitrate is added to the uranium extraction processes in Buildings 9206 and 9212 to improve the extraction of the uranium and to complex fluoride. The raffinate (solution from which the uranium has been extracted) containing the aluminum nitrate is treated in an evaporator to concentrate the solution. This solution is then put through a crystallization process that recovers about 60 percent of the aluminum nitrate waste. The recovered aluminum nitrate is returned to the uranium extraction process for reuse. The mother liquor (saturated solution from

which the aluminum nitrate has been crystallized) is sent to the biodenitrification reactors in Building 9818 for treatment. The condensate from the evaporation step is combined with other process condensates that contain nitric acid for further processing to recover the acid. This recovery involves the fractional distillation of the dilute nitric acid (HNO_3) solutions to obtain a 30 percent solution of HNO_3 for recycle to the process. The water, from which the still has removed the nitric acid, is discharged to EFPC through a Category IV outfall (Section 3.3.3.1). There are two biodenitrification reactors in Building 9818. These 25,000-gallon units, which were first operated in 1976-1977, utilize bacteria to convert nitrates in the wastewater to nitrogen gas. The slurry produced by this treatment contains about 10 percent solids. The solids are approximately 50 percent calcium carbonate and 50 percent aluminum hydroxide with a small amount of biomass (Taylor, 1982). This slurry is now sent to the West Tank Farm (Section 3.3.2.10) for storage for further treatment. Prior to this, the slurry was being used to neutralize the S-3 Ponds.

3.3.2.7 Building 9201-5N Cyanide Treatment Facility (CTF)

The CTF treats cyanide wastes that have been generated in the Metal Preparation Division Plating Shop and the Precious Metals Recovery Operation (PMRO). One of the Metal Preparation Division's plating shops is located across the hall from the CTF, and the PMRO and the CTF share the same basement room in Building 9201-5N.

Cyanide wastes are treated (destroyed) by a process known as alkaline chlorination. To begin chlorination, the pH of the cyanide wastes is increased to approximately 11.0 by the addition of sodium hydroxide (NaOH). At this elevated pH, hypochlorite is slowly added, and the oxidation of cyanide (CN) to cyanate (CNO) begins. When most of the cyanide has been oxidized, the pH of the solution is reduced to 8.0 to 8.5 by the careful addition of sulfuric acid. In this pH range the residual hypochlorite will oxidize the cyanate to carbon dioxide and nitrogen with the evolution of gas from the solution. The treated waste is then transferred to portable tanks for transport to the West End Treatment Facility (WETF).

At present, the manual treatment process takes place in the same 55-gallon drums used for storage of the raw waste. Drums of waste are placed under one of the cyanide treatment hoods, a mechanical agitator is placed into the waste, and the treatment begins. This system is to be replaced by a package unit. The package unit will contain two 150-gallon tanks so that the two steps of the process can take place in separate reaction vessels. It will also contain the necessary pumps, piping, chemical tanks, and electrical controls for semi-automatic operation of the system. In addition to

this facility, other, larger, cyanide-destruction facilities are included in the Plating Rinsewater Treatment Facility (Section 3.3.2.13) and the West End Treatment Facility (Section 3.3.2.11).

3.3.2.8 S-3 Ponds Liquid Treatment Facility (LTF)/CPCF-II Decant Treatment Facility (DTF)

The use of different names for this facility is confusing to those not familiar with the Y-12 Plant. The only difference between the two is in the source of liquid to be treated and the disposition of the sludges generated. The treatment process and equipment are the same.

Initially, in the spring of 1985, this facility received the denitrified water from the S-3 Ponds. A floating suction device in the Southwest Pond was the source of the water to be treated. Water was pumped from the other three ponds to this pond as required. The sludge generated in the treatment process was returned to the S-3 Ponds. When the dewatering of the S-3 Ponds was completed in 1986, this facility was available to treat the West Tank Farm (WTF) (Section 3.3.2.10) decant liquid until the West End Treatment Facility (WETF) is built. The sludge generated from this use is pumped to either the CPCF-II Rotary Drum Vacuum Filter (RDVF) for dewatering or to the WTF for interim storage.

The LTF/DTF consists of two parallel trains, each capable of treating 50 gpm of wastewater. Water is pumped from the WTF to one of two equalization basins. From here, it is pumped to a reactor vessel where sulfuric acid is added to adjust the pH. See Figure 3-13 for a block flow diagram of this process. Flow is then by gravity to another reaction tank where ferric sulfate is added, then to a retention tank for additional reaction time. If needed, sodium hypochlorite can be added as the waste water enters the retention tank. Gravity flow continues through three more residence time reactors after lime has been added to precipitate the heavy metals. Then, powdered activated carbon is added as the water enters another reactor. The carbon is used to adsorb organics from the wastewater. A polymer, which aids the flocculation and settling of the solids, is added as the water enters the clarifier. The sludge that settles out in the clarifiers goes to a basin from which it is pumped to either the Rotary Drum Vacuum Filter or the West Tank Farm. The clarified overflow is pumped through a 10-micron cartridge filter and then through two parallel 1-micron cartridge filters into a holding tank. A portion of this water is recycled for use as spray water to minimize the foam that forms in the first two reactors as a result of the release of carbon dioxide when the wastewater is first neutralized with sulfuric acid. The remaining water overflows to the CPCF-II chlorine contact chamber and is sampled as NPDES Outfall 507 before being discharged to EFPC. Because this facility is only housed in a shed and has no protection from cold weather, operation is

CPCF-II DECANT TREATMENT FACILITY
Y-12 PLANT, OAK RIDGE RESERVATION

only possible during the warmer months of the year. This facility is located in Building 9616-6 north of the S-3 Ponds (Figure 3-14).

3.3.2.9 Central Pollution Control Facility-II (CPCF-II)/Rotary Drum Vacuum Filter (RDVF)

This facility, which is located in Building 9616-8 (Figure 3-14) west of the tank farms, began operating in 1986. It is being used to dewater sludges from the DTF (Section 3.3.2.8) or the Biotenitrification Reactors at the WTF (Section 3.3.2.10). A simplified process flow diagram is presented in Figure 3-15).

In the operation of this facility, a coating of diatomaceous earth (DE) is first applied to the cloth covering the filter drum. This is done by recirculating a mixture of DE and water from the precoat mix tank through the rotary drum vacuum filter (RDVF) and back to the mix tanks until a coat of DE of the desired thickness is built up on the filter drum. Then the sludge to be dewatered is mixed with polymer in the sludge conditioning tank before being fed to the RDVF. The water from the sludge is drawn through the coat of DE while the solids remain on the surface. The filtrate (water) is sent to the DTF for treatment prior to discharge. The solid sludge, along with some of the DE, is scraped off the filter drum by a knife edge blade into a sludge blender. The sludge is blended with untreated slurry to obtain the proper consistency for pumping and storage for future disposal. When construction of the WETF is completed, that facility will have another RDVF, and this one will be used as a backup.

3.3.2.10 West Tank Farm (WTF)

This facility, located west of the S-3 Ponds, consists of three tank farms, each of which contains three 500,000-gallon tanks (Figure 3-14). A fourth tank farm with four additional tanks is scheduled to be completed in the Spring of 1989. The tanks in Tank Farms 1 and 2 (Tanks F-1 through F-6) are to be used as biotreatment facilities, whereas the others are to be used as sludge storage facilities.

Until the West End Treatment Facility (WETF) is in operation, the nitrate wastes from Y-12 are being trucked to the Oak Ridge Gaseous Diffusion Plant (ORGDP) K-25 for treatment. At K-25, the nitrate wastes are neutralized and nutrients (phosphoric and acetic acids) are added before the wastes are returned to Y-12 for biotreatment. The wastes in the biotreatment reactors are recirculated under anaerobic conditions (oxygen is kept out of the tank) until the nitrate content is reduced to less than 10 mg/l by the action of the denitrifying bacteria. Then the recirculating pumps are made

SOURCE: MMES, 1986f.

FIGURE 3 - 14

CPCF-II, WETF, WEST TANK FARM SITE PLAN
Y-12 PLANT, OAK RIDGE RESERVATION

FIGURE 3 - 15

CPCF-II EQUIPMENT / PROCESS FLOW DIAGRAM
Y-12 PLANT, OAK RIDGE RESERVATION

SOURCE: MMES, 1986f.

to discharge through jet eductors that draw air into the reactors. This introduction of oxygen from the air results in the bacteria consuming the residual organic carbon by bio-oxidation. When this process is completed, the clear liquid from the top of the reactor is treated in the DTF (Section 3.3.2.8) and the sludge from the bottom of the reactor is dewatered in the RDVF (Section 3.3.2.9). The dewatered sludge is put into one of the tanks at Tank Farm 3 for storage until it can be disposed of as a mixed waste (Section 4.1.2.2).

3.3.2.11 West End Treatment Facility (WETF)

Upon completion of this unit in early 1987, Y-12 nitrate wastes will not have to be taken to K-25 in tanker trucks for neutralization prior to being treated in the biodenitrification reactors at the WTF and the decant liquid from the WTF will be able to be treated year round. This facility, which is to be housed in Building 9616-7 west of the Tank Farm, is to include head-end facilities for cyanide destruction, heavy metals precipitation, neutralization, and biological nutrient addition. Polishing facilities to treat the decant liquid from the biodenitrification reactors and sludge dewatering facilities will also be housed in this heated building. A process flow diagram of the head-end treatment at WETF is shown in Figure 3-16.

The acidic nitrate wastes will be received from tankers that transport them from the generation points at Y-12 (9212, 9206, 9204-4, etc.). The wastes are to be offloaded into 6,000-gallon storage tanks according to the analysis of the waste. Oily wastes will be delivered to a tank for treatment to remove oil before the waste is combined with other wastes. Cyanide wastes will also be treated to destroy the cyanide prior to further treatment. The wastes will be pumped from the initial receiving facilities to a neutralization reactor. Here lime or sulfuric acid will be added as needed to adjust the pH of the solution. Phosphoric and acetic acids that are used to supply nutrients to the bacteria in the biological reactors are also to be added here. Sodium sulfide and/or ferrous sulfate may also be added if it is determined that they are needed to assist with the removal of heavy metals from the waste. The neutralized slurry will then be pumped to the WTF biodenitrification reactors for further treatment.

SOURCE: Battelle, 1985a.

FIGURE 3-16

WETF HEAD-END TREATMENT SYSTEM PROCESS FLOW DIAGRAM
Y-12 PLANT, OAK RIDGE RESERVATION

When the bionitrification at WTF (Section 3.3.2.10) is complete, the clear liquid from the top of the reactor and the sludge from the bottom will be returned to the WETF for treatment rather than being sent to the DTF (Section 3.3.2.8) and the CPCF-II RDVF (Section 3.3.2.9). The processes utilized will be the same as at these other facilities. The polishing step, however, will be able to use different chemicals to improve the precipitation of heavy metals and will have granular activated carbon beds instead of powdered carbon for organic removal.

3.3.2.12 Central Pollution Control Facility I (CPCF-I)

This facility, which began operation in late 1985, receives wastewaters that do not contain nitrate from other Y-12 process operations. It is capable of handling 2×10^6 gallons per year of wastewater, although at the time of the Survey, wastes were only being processed at the rate of $0.8\text{--}1.0 \times 10^6$ gallons per year. The wastes to be treated at this facility are collected in the plant areas where they are generated and are trucked to CPCF-I. Here they are transferred to storage tanks in accordance with their chemical content. Described in Section 4.1.2 are the responsibilities of the individual waste generators, as well as those of Waste Treatment Operations (WTO) and Waste Transportation, Storage, and Disposal (WTS&D), in characterizing, segregating, containerizing, analyzing, and transferring the wastes.

Sixteen tanks (ten 3,000-gallon tanks and six 2,000-gallon tanks) are used at CPCF-I to store the wastes for treatment. In addition, a 14,000-gallon skim tank is used to receive the mop water, the most abundant (~75 percent of the total wastes treated) of the wastes to be processed here. Mop waters are the wastes from floor cleaning and other similar cleaning operations. They frequently contain detergents and oils in addition to suspended solids. The other wastes treated are concentrated acids and bases from Buildings 9401-2, 9998, and 9204-2; floor wastes (dilute acids and bases) from Buildings 9737, 9731, 9204-4, 9201-2, 9201, and 9204-5; spent scrubber solution from the scrubbers used to remove hydrogen fluoride from stack gasses; and the liquid effluent from the Waste Coolant Processing Facility (Section 3.3.2.14).

Figure 3-17 is a block flow diagram of CPCF-I. When a treatment scheme, based on the composition of the wastes, has been determined, wastes from one or more of the storage tanks is transferred to one of the two 4,000-gallon process reactors. Here the initial chemical reaction, usually neutralization, takes place. Effluent from these tanks goes to one of four open-top reactor settlers where additional chemicals can be mixed with the wastes. Solids are then allowed to settle in these tanks, and the underflow sludge is sent to either a rotary vacuum filter or a pressure leaf filter for dewatering. The dewatered sludge is transported to a sludge disposal or storage facility (Section 4.1.2). The water removed from the sludge is passed through polishing filters to remove any residual suspended matter before it enters the carbon absorption columns for the removal of organic contaminants. The liquid effluent from the reactor settlers is sent to the 14,000-gallon reactor clarifier feed tank. If hexavalent chromium (Cr^{+6}) is present in the wastewater, it can be sent to the electrolytic chromium reduction unit for conversion to the less toxic trivalent chromium (Cr^{+3}). In this unit an electric current causes a consumable iron electrode to produce ferrous ions (Fe^{+2}), which reduce the Cr^{+6} to Cr^{+3} while oxidizing to ferric ions (Fe^{+3}) themselves. The hydrogen formed by the electrolysis of the water is vented to the atmosphere. The hydroxyl ions that are formed react with the metal ions that are present to form metal hydroxides. These hydroxides are settled out when the water is returned to the reactor settlers.

The water in the mop-water skim tank can be treated with sulfuric acid, aerated and/or heated to aid in the separation of oils from the water. After the oil separation has been effected, the oils are put into drums for disposal (Section 4.1.2) and the water is transferred to the reactor clarifier feed tank, where it is combined with the effluents from the reactor settlers.

The previously described operations at CPCF-I are performed batchwise (i.e., the waste is treated in distinct units). A given volume is put into the process reactors. When that step is completed, the entire contents of the reactor are transferred at one time to the reactor settlers. Subsequently, the contents are removed from the reactor settlers for further treatment before more waste is introduced.) The processing steps at CPCF-I, as described in the following paragraph, are continuous (i.e., the water to be treated enters the processing unit at the same time and at the same flow rate as the treated water leaves the unit.).

The effluent from the reactor clarifier feed tank is pumped at a rate of 5-20 gpm (50 gpm maximum) to the reactor clarifier. Organic polymers can be added to aid in the separation of solids from the water in this unit. The settled solids are returned to the reactor settlers for processing, whereas the

SOURCE: MMES, 1985b.

FIGURE 3 - 17

CPCF-I BLOCK FLOW DIAGRAM
Y-12 PLANT, OAK RIDGE RESERVATION

clarified liquid is passed through a sand filter to remove any residual solids before it is sent to the organic removal unit.

The organic removal unit consists of two tanks of granular activated carbon connected in series (i.e., the water passes through one before passing through the next). This unit receives flow from the sand filter, sludge dewatering polishing filters, and the Plating Rinsewater Treatment Facility (Section 3.3.2.13). The activated carbon adsorbs the organic material from the water as it passes through the unit. The effluent is discharged to one of two effluent basins before being discharged to EFPC through NPDES Outfall 501. Sufficient piping and pumping capacity are provided so that recycle of effluent from one treatment step to a previous treatment step or the bypassing of a subsequent treatment step is possible in order to obtain optimum treatment results.

3.3.2.13 Plating Rinsewater Treatment Facility (PRTF)

This facility, scheduled for completion in early 1987, has been designed to treat approximately 8×10^6 gallons/year of rinsewaters from the plating shops at Y-12. The PRTF is located at CPCF-I (Building 9623). The initial treatment facilities are contained in a diked area (formerly the basin of cooling tower 9409-11) west of Building 9623, and the remaining facilities of the PRTF are housed in the southeast corner of the third floor of this building. Approximately 95 percent of the rinsewaters to be treated originate in the main plating shop located in Building 9401-2 across the street, south of CPCF-I. All cyanide-containing wastes and the rinsewaters from other plating shops are to be trucked to the PRTF, whereas rinsewaters from the main plating shop are to be pumped. Figure 3-18 is a block flow diagram of this treatment process. The non-cyanide-containing rinsewaters from the main plating shop are to be pumped from a sump in Building 9401-2 to a 1,000-gallon neutralization tank, for pH adjustment, prior to being discharged in the 30,000-gallon equalization tank. The non-cyanide-containing rinse waters, which are trucked to PRTF from other areas, are similarly neutralized in another 1,000-gallon tank before going to the equalization tank. The cyanide-containing wastes received at the PRTF are to be held in a 7,500-gallon holding tank. They are then transferred in 800-gallon batches to the alkaline chlorination cyanide destruction system prior to being put into the equalization tank. This is the only batchwise operation at the PRTF.

The neutralization tanks, holding tanks, cyanide destruction system, and the equalization tanks are located within the diked area west of the CPCF-I. The following facilities of the PRTF are located within the CPCF-I building.

PRTF BLOCK FLOW DIAGRAM
Y-12 PLANT, OAK RIDGE RESERVATION

The wastes are pumped continuously from the equalization tank to the Heavy Metal Removal System (HMRS). This is an electrolytic unit similar to the chromium reduction unit, previously described in Section 3.3.2.12. The effluent from this unit goes to the combination clarifier/filter unit consisting of a flash mixer, flocculator, tube settler, and sand filter for the removal of the metal hydroxides from the waste stream. The sludges containing the solids are discharged to the settling tanks at CPCF-I for handling, as described in Section 3.3.2.12. The liquid effluent passes through a pH adjustment station and is monitored as NPDES Outfall 504 before being discharged to a 1,000-gallon sump tank, located on the second floor of CPCF-I. The effluent from this sump can be discharged directly to EFPC or sent to the carbon adsorption portion of CPCF-I, if needed, for removal of organic material.

3.3.2.14 Waste Coolant Processing Facility (WCPF)

Water-soluble waste machine coolants are collected in 55-gallon drums, 610-gallon polytanks, and 400- to 600-gallon dumpsters at locations throughout the Y-12 Plant. These coolants are trucked to the WCPF and dumped into a sump for transfer into storage tanks. Figure 3-19 is a block flow diagram of the treatment system.

The treatment system consists of extended aeration, clarification, waste sludge holding, and dewatering. This facility, which began operation late in 1985, takes the waste coolant from the storage tanks to a feed tank, from which it is pumped to the 30,000-gallon extended-aeration tank at a maximum rate of 1,000-gallons per day. This allows for a hydraulic retention time of approximately 30-days in the reactor in which the aerobic bacteria can biodegrade the coolant. The treated coolant overflows into an upflow clarifier, which separates it into three streams. The floating-oily-solids stream is fed to a blender-dryer for dewatering before being put into 55-gallon drums for storage. The intermediate clarified liquid effluent stream is pumped to an effluent holding tank prior to being discharged to EFPC. The settleable solids are pumped to an aerated sludge holding tank before being sent to the blender-dryer for dewatering so that they can also be drummed for storage. The clarified, treated effluent is presently discharged to EFPC and is covered by the existing NPDES permit as outfall 510. As soon as the new West End Treatment Facility is put into operation, this discharge will be stopped, and the effluent will be taken to WETF for polishing to remove additional suspended solids and eventual discharge to EFPC through outfall 502. The drummed dewatered sludge is being held at ORGDP for incineration in the new incinerator at that site.

SOURCE: MMES, 1986h.

FIGURE 3 - 19

WCPF BLOCK FLOW DIAGRAM
Y-12 PLANT, OAK RIDGE RESERVATION

A similar operation, known as the Waste Machine Coolant Biodegradation Facility, used a former cooling-tower basin as an aeration tank and discharged to a tile drain field. This facility is being closed under RCRA (Section 4.1.2.1).

3.3.2.15 Steam Plant Wastewater Treatment Facility (SPWTF)

Water used as make-up water for the boilers, which produce the steam used at the Y-12 Plant, is treated with demineralizers. These are ion exchange resins, which remove the cations and anions found in the water. The waste sulphuric acid and sodium hydroxide, used to regenerate these demineralizers are neutralized and discharged to EFPC. The boiler blowdown water (water drained from the boiler to limit the build-up of minerals in the boiler water) and coal-pile runoff water are discharged directly to EFPC.

A steam-plant wastewater-treatment facility is being constructed and is scheduled for completion by September 30, 1987. This facility will collect and treat the above waters and other steam-plant drains presently discharging to EFPC. These waters will first flow into a sedimentation basin, where the coarse, heavy, suspended solids can settle. The water will then be pumped to neutralization tanks where lime or sulphuric acid can be added to adjust the pH. Air is also to be injected into the neutralization tanks to oxidize ferrous iron, which is usually found in coal-pile runoff waters, to the more easily removed ferric state. The neutralized water is then to be pumped to a clarifier-thickener to remove the fine, light, suspended solids and precipitates formed in the neutralization step. The pH of the liquid overflow from the clarifier will be adjusted to meet effluent limitations prior to being discharged to EFPC through NPDES Outfall 503. The underflow sludge from the thickener will be dewatered on a rotary vacuum filter and sent to the sanitary landfill for disposal.

3.3.2.16 Mobile Wastewater Treatment Facility

An experimental wastewater treatment system was developed and mounted in several trailers so that it could be moved to the source of the wastewater to be treated. While the unit processes could be utilized to treat different types of wastes, they were used primarily for treatment of mercury-contaminated water. The wastewater to be treated is first filtered; then it is clarified in a reactor clarifier using ferrous sulfate, ferric sulfate, lime and an organic polymer. The sludge from the clarifier is drummed and taken by WTSD for disposal. The clarified liquid is filtered and passed through ion exchange columns for the removal of mercury. The columns contain anionic resin that has been treated with ferrous sulfide. The effluent is filtered again before being discharged to EFPC through NPDES Outfall 508.

Recently, the equipment was removed from the trailers and permanently mounted in the basement of Building 9201-4. The building housed a lithium isotope separation process that used mercury. The system will be used to treat any mercury-contaminated water resulting from the planned decommissioning of this building. Other mercury-contaminated wastewaters will be collected and brought to this building for treatment prior to discharge of the water.

3.3.2.17 ORNL Biology Division Waste Treatment

The Biology Division of ORNL, which is located within the confines of the Y-12 Plant, conducts research on the effects of various radiological and nonradiological factors on animal populations. This requires keeping a population of animals, mostly laboratory mice, on hand. Wastewater from this complex comes from the washing of cages, glassware, and other items used to care for and perform tests on the animals. This water is presently discharged untreated to EFPC through the storm sewer system along with water from roof drains, cooling water from the Biology Division complex, and other flows from Y-12. The NPDES permit contains discharge limits and monitoring requirements for the effluent from an ORNL-Biology Wastewater Treatment Facility to be designated as Outfall 505. The compliance schedule contained in the permit requires commencement of construction of this facility by February 28, 1987; completion by October 30, 1988; and attainment of compliance by March 30, 1989. Installation of a sewer system to collect these wastes from the sink and floor drains for treatment is already in progress. The cooling-water discharges and water from roof drains are being segregated for discharge to the storm sewer.

Because the cleanup and washing operations are not continuous throughout the day, both flows and contaminant loading in these waste streams are variable. A study of the individual water discharges has been made (Peretz, 1986). The study report contains a table showing the calculated concentration of the expected composite flow from this area as well as the maximum concentration of contaminants found at any one discharge point. These data indicate that although phenol and chloroform are present at individual discharge points in excess of the maximum allowable limits designated in the NPDES permit, the calculated composite flow values are below the NPDES average limits. Therefore, it is probable that the wastewater may meet the discharge limits without treatment. TDHE and Y-12 have discussed the possibility of delaying construction of the treatment facility until a determination is made as to whether or not treatment is actually needed to meet the discharge limits. A treatment consisting of pH adjustment, settling, filtration, and granular activated carbon adsorption has been designed for these wastewaters if they actually need it. The dewatered

sludge will go to the sanitary landfill. Mop waters are sent to the Y-12 CPCF-I for treatment and discharge to EFPC.

3.3.2.18 ORNL Building 9204-3 Sump Pump Oil Separator

Water collected in the sump in the isotope separation facility operated by ORNL in Building 9204-3 often contains oil from leaks and spills that get into the floor drains. A coalescer-type oil separator, which uses the difference in specific gravity between the water and oil to effect the separation, has been installed to remove the oil from this water. The separated oil is taken by ORNL (X-10) waste management for disposal. The water is discharged to EFPC through NPDES Outfall 506 at Y-12.

3.3.2.19 Cooling Water Treatment

The Y-12 Plant has approximately 30 cooling towers, which are used to provide cooling water for various plant operations. The water in these cooling systems is treated with chemicals to minimize the possibility of scaling and/or corrosion within the systems. The systems lose some water either through planned blowdown (to decrease the dissolved solids concentration), or through unplanned leakage at pumps, valves, etc. This lost water is discharged to EFPC through Category II outfalls, as defined in the NPDES permit.

The chemicals used to treat the cooling water may exhibit toxic properties toward the aquatic life present in a stream. For example, the present cooling-water corrosion inhibitor (a molybdenum phosphonate compound) was selected to replace an inhibitor that contained hexavalent chromium, which is a toxic chemical. However, the pH of the water being discharged with this treatment is usually in the range of 8.5-8.8, which exceeds the NPDES limit of 8.5. Y-12 is in the process of evaluating new formulations of treatment chemicals to ensure that any water lost through blowdown or leakage will not cause a fish toxicity problem due to either pH or chemical composition. This evaluation includes bioassay studies using fathead minnows and ceriodaphnia as test species.

3.3.2.20 Sanitary Wastewater Treatment

The sanitary waste from the Y-12 Plant is collected by a series of gravity sewers/force main and is conveyed to the City of Oak Ridge West End Sewage Treatment Plant. The discharge from the treatment plant enters EFPC just upstream of the Roane-Anderson County line at mile point 8.3. The

waste sludge from the treatment plant is transported back to the Y-12 Plant for disposal by land farming (Section 3.3.2.4).

Y-12 has received City of Oak Ridge Sanitary Sewer Permit 001 (Section 3.3.3.3). This is a draft that remains in effect for one year (February 27, 1986-February 27, 1987), at which time a final permit will be issued. Because of concern regarding the volume (20 percent of the flow to the city's plant) and possible contamination of the sanitary waste water stream, a study has been undertaken by Y-12 to determine if it is feasible to install a sanitary wastewater treatment facility on site. This ongoing study will include the possible return of glove cleaning and laundry operations to Y-12. These operations are now carried out at ORGDP.

3.3.2.21 Storm Sewer System

A storm sewer system covers the entire production area of the Y-12 Plant east of the Bear Creek-East Fork Poplar Creek divide. It gathers rainfall from the hillsides, parking lots, building roof drains, and sump pumps, which collect seepages of groundwater at the basement levels of the buildings. This water is all conducted to East Fork Poplar Creek (Figure 3-20). Most of the system is underground, including East Fork Poplar Creek itself west of Building 9204-1. This area of the creek was enclosed and paved over to utilize the area more effectively.

In addition to collecting storm waters, the system will also collect any spilled material that can flow into the collection system. Steps are being taken to eliminate the possibility that spills may reach EFPC via the storm sewer system. Approximately 10 spill-prevention/isolation facilities have already been provided, with still others being installed or in the planning stage (Section 3.3.2.22).

Some process waste streams (for which treatment systems are described in previous sections) discharged to EFPC through this system in the past, and will continue to do so until planned treatment and/or collection systems are completed. These discharges are permitted as the 16 Category III discharge in the NPDES Permit (Section 3.3.3.1). In addition, there are also 20 Category IV discharges (mostly dye penetrant and x-ray film developing rinse waters) in the NPDES permit that will continue to discharge untreated to EFPC through this drain system. In the past, dilute wastes flowed unrestricted to EFPC. Therefore, Y-12 is conducting a study to ensure that all areas requiring correction have been identified. The study is to be completed during 1987.

2

SOURCE: Y-12 Engineering Mechanics / Tennessee Valley Authority.

- 100 YEAR FLOOD PLAIN
- 500 YEAR FLOOD PLAIN
- MAXIMUM PROBABLE FLOOD
- FACILITIES WITHIN 100 YEAR FLOOD PLAIN
- STORM DRAINAGE SYSTEM (18" DIA. OR LARGER)
- SURFACE FLOW

NOTE: FOR COMPLETE DISTRIBUTION (LESS THAN 18" DIA.) OF STORM SEWER SYSTEM, SEE Y-12 ENGINEERING BLOCK PLANS.

FIGURE 3-

Y-12 STORM SEWERS
INT, OAK RIDGE RESERVATION

The storm sewer system can also collect and discharge groundwater to EFPC. Groundwater enters the system through infiltration of leaky drains and through springs flowing into basement sumps. Some of this groundwater can pick up contaminants prior to being discharged to EFPC. For example, Buildings 9201-2, 9201-4, and 9201-5 at one time (1950-1966) contained processes which utilized mercury. Even though these lithium isotope separation processes have not operated since 1966, there is still a discharge of mercury-contaminated water from the building basement sumps. Plans are under way to attempt to clean up these buildings to prevent ongoing contamination or to divert the springs around the buildings. EFPC does convey mercury to New Hope Pond, where an average 50 percent removal takes place. The concentration of mercury in the water and the removal efficiency of NHP is affected by storm intensity, which has a direct effect on the flow rate, and by remedial action activities, which disturb soils or drain pipes containing mercury. A Y-12 study on sources of mercury contamination showed that 63.2 kg entered NHP in the period of July 1983 through June 1984 and that 30.2 kg was released (Turner, et al., 1985). The water that is discharged off-site from NHP contains mercury and is thus causing contamination of the creek and the flood plain downstream from Y-12. This is the subject of another study, which is being performed by the Oak Ridge Interagency Task Force (TVA, 1985-1986). The objective of this study, which is described in Section 4.5.2.5, is to investigate the contamination of the water, soils, flood plain, and fish.

3.3.2.22 Spill Prevention

At certain locations throughout the Y-12 Plant, various types of wastes (e.g., acid, cyanide, etc.), as previously described, are collected, held, and/or transferred for transport to a treatment facility. In other areas, liquid raw materials (oils, sodium hydroxide, nitric acid, etc.) are handled. Leakage and/or spillage from these operations due to either equipment failure or human error is always a possibility. Spills in the vicinity of either storm sewer catch basins or East Fork Poplar Creek would result in contamination of the creek.

The Y-12 Plant is in the process of installing new containment facilities, consisting of dikes and catchment sumps, at the locations where collection of liquid waste occurs. These facilities have been sized to enable collection and containment of the contents of the largest vessel (tanker, carboy, tank, dumpster) handled at each location (Williams, 1985). In areas where new dikes and catchments have not yet been installed, sand bags are available to block off the flow to storm catch basins until measures can be taken to clean up the spill. Additionally, steps have been taken to ensure that an adequate number of tanks are available to collect and transport these liquids so that excess waste does not accumulate at either the collection point or in the processing area. The containment facility

construction program is on-going, and plans have been made to provide protection in all major collection areas.

In addition to the above, Y-12 has included a Spill Prevention Control, Countermeasure and Contingency Plan (SPCCC) as part of the Best Management Practices Plan required by the NPDES permit. A part of this plan designates responsibilities, outlines actions to be taken, and identifies equipment available to contain contaminants in the event of a spill anywhere in the plant. This plan, prepared in 1985, must be reviewed once every 3 years at minimum and must be amended whenever new facilities at the site change the potential for a spill. New Hope Pond (Section 3.3.2.23) can also be used to prevent spilled material from leaving the Y-12 Plant site.

3.3.2.23 New Hope Pond (NHP)

This pond was built in 1963 to serve as an equalization basin. It also serves as the last line of defense to keep Y-12 pollutants from exiting the site through EFPC. NHP covers an area of 5 acres and had an original capacity of 10×10^6 gallons of water. Its effectiveness is demonstrated by the fact that 19,000 yd³ of sediment had to be removed from the pond in 1972-73. Additional material has accumulated since then to such an extent that Y-12 has proposed additional dredging. However, a regulatory difference of opinion between TDHE and EPA has delayed this project (Section 4.1.2.1). Further evidence of the pond's effectiveness was provided through a study of mercury discharges at Y-12 (Turner, et al., 1985). The study determined that NHP, on the average, removes 50 percent of the mercury in the influent.

Figure 3-21 is a schematic of NHP. A floating boom in EFPC diverts oil and other floating debris to an oil removal pond adjacent to NHP. Water, which is diverted into the oil pond along with the debris, is delivered into NHP through a subsurface outlet pipe. The flow of EFPC is diverted from its original channel to a distribution ditch from which the flow into New Hope Pond is evenly distributed through inlet pipes, as shown in the sketch. Water exits the pond through a weir in the northwest corner of the pond. Continuous on-line analyzers monitor the inlet and the effluent for nitrate, hexavalent chromium, dissolved oxygen, pH, and conductivity (a measure of the dissolved solids).

In the event of a spill getting into EFPC upstream of NHP, the spilled material can be contained in the pond by closing off the effluent. After testing had shown that all the spilled material was contained in the pond, the flow would be diverted around NHP into EFPC through a by-pass at the end of the distribution ditch. The pond contents could then be treated, or removed for treatment at another

FIGURE 3 - 21

SCHEMATIC OF NEW HOPE POND
Y-12 PLANT, OAK RIDGE RESERVATION

location, depending on the type of contaminants present. The effluent from NHP is NPDES Outfall 303.

3.3.3 Environmental Monitoring Program

3.3.3.1 NPDES Monitoring

NPDES Permit Number TN0002968 for the Y-12 Plant was renewed by EPA (and certified by TDHE) effective May 24, 1985. This permit greatly increased the monitoring requirements for the surface water medium at Y-12. Under the terms of the expired NPDES permit, only four discharge points (Kerr Hollow Quarry, Rogers Quarry, New Hope Pond, and Bear Creek) were required to be sampled and analyzed on a regular basis. The renewed permit required sampling and analysis (monitoring) at 16 serial-numbered outfalls, approximately 195 categorized outfalls, and approximately 30 miscellaneous discharges. The type of sample, frequency of sampling, and parameters to be measured are shown in Table 3-25.

The serial-numbered outfalls are distinct point sources and consist of six discharges from surface water bodies (Outfalls 301-306), 9 discharges from treatment facilities (Outfalls 501-508, 510) and one discharge to an impoundment (Outfall 623). The samples for analysis are taken at the point source.

The categorized outfalls are identifiable conduits leading to EFPC. However, the water in the conduit may come from more than one building within the Y-12 Plant, or conversely, one building may be served by more than one of these outfalls. Two reports (Characterization of Y-12 Storm Drain System and Effluents Intersecting into East Fork Poplar Creek, YSE-44, September 1983, and Program for Elimination of Process Waste Discharges into East Fork Poplar Creek, Y/SE-52, February 1984) prepared by Y-12 and included with the NPDES permit renewal application describe the source, flows, chemical content, and proposed remedial action for these discharges. These reports are available in the Y-12 Environmental Survey Library for review if necessary. Four categories were established and described in the NPDES permit as follows:

- Category I - Precipitation Runoff and Small Amounts of Groundwater
- Category II - Cooling Water; Condensate; Precipitation Runoff; and Building, Roof and Foundation Drains
- Category III - Process Wastewaters
- Category IV - Untreated Process Waste Streams

TABLE 3-25

**NPDES MONITORING REQUIREMENTS
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**

Outfall	Type and Frequency of Sampling	Parameter
301, Kerr Hollow Quarry	Grab, following each disposal operation Instantaneous, following each disposal operation	pH, total suspended solids, temperature, lithium, zirconium, potassium, sodium, arsenic, cadmium, chromium, copper, iron, nickel, selenium, zinc, lead, mercury. Flow
302, Rodgers Quarry	Grab, weekly Instantaneous, weekly	pH, total suspended solids, settleable solids, chemical oxygen demand, sulfate, turbidity, temperature, oil and grease, arsenic, cadmium, chromium, copper, iron, nickel, selenium, zinc, lead, mercury. Flow
303, New Hope Pond	Grab, monthly Composite Sample, weekly Grab, weekly Grab, daily Continuous, daily	Settleable solids Ammonia, chromium, fluoride, lithium, surfactants, dissolved solids, total suspended solids, zinc, total nitrogen, cadmium, lead, copper, mercury, BOD, COD, nickel, beryllium Oil and grease, pH, total chlorine residual, temperature, perchloroethylene. Dissolved oxygen Flow
304, Bear Creek, where it crosses Highway 95	Composite sample, weekly Grab sample weekly Continuous, daily	BOD, COD, dissolved solids, nitrate, suspended solids. pH, oil and grease, conductivity, dissolved oxygen, turbidity. Flow
305, Oil Pond #1	Grab sample, monthly Instantaneous, daily	pH, oil and grease, total suspended solids, beryllium, cadmium, lead, mercury, silver. Flow
306, Oil Pond #2	Grab sample, monthly Instantaneous, daily	pH, oil and grease, total suspended solids, cadmium, nickel, lead, mercury, silver. Flow

TABLE 3-25
NPDES MONITORING REQUIREMENTS
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE
PAGE TWO

Outfall	Type and Frequency of Sampling	Parameter
623, Y-12 Steam Plant Fly Ash Sluice Water	Grab sample, weekly	pH
	Instantaneous, weekly	Flow
501, CPCF-1	Composite sample, daily	Chromium, copper, lead, nickel, cadmium, zinc, total suspended solids, silver, color, sodium, nitrate, sulfate, fluoride, aluminum, iron, mercury, surfactants, beryllium, phosphorus, chloride.
	Grab sample, daily	Oil and grease, cyanide, pH, phenols, temperature.
	Continuous, daily	Flow
	Representative Composite per 30,000 gallons discharged	Total toxic organics
502, CPCF-II	Composite, weekly	Total toxic organics
	Continuous, daily	Flow
	Composite, daily	Cadmium, chromium, copper, lead, nickel, silver, zinc, total suspended solids, barium, nitrate, phosphorus, sulfate, fluoride, aluminum, arsenic, beryllium, iron, mercury, calcium, cobalt, magnesium, manganese, molybdenum, sodium, chloride, potassium.
	Grab, daily	Temperature, cyanide, oil and grease, pH, total residual chlorine.
503, Y-12 Steam Plant Wastewater Treatment Plant (when operational)	Composite sample, 3 times a week	Chromium, copper, iron, zinc, total suspended solids, chloride, phosphorus, sulfate, sulfide, fluoride, aluminum, arsenic, cadmium, lead, nickel, mercury, selenium, barium, cobalt, magnesium, manganese, potassium, calcium, sodium, titanium.
	Grab sample, 3 times a week	Oil and grease, pH, temperature, phenols.
	Continuous, daily	Flow

TABLE 3-25
NPDES MONITORING REQUIREMENTS
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE
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Outfall	Type and Frequency of Sampling	Parameter
504, Y-12 Plating Rinse Water Treatment Facility (when operational)	Composite, weekly	Total toxic organics
	Composite sample, 3 times a week	Cadmium, chromium, copper, lead, nickel, silver, zinc, total suspended solids, potassium, nitrate, phosphorus, sulfate, beryllium, fluoride, aluminum, iron, mercury, chloride, sodium.
	Grab sample, 3 times a week	Cyanide, oil and grease, pH, temperature.
	Continuous, daily	Flow
505, ORNL-Biology Wastewater Treatment Facility (when operational)	Composite sample, 3 times a week	Cadmium, chromium, copper, lead, mercury, nickel, silver, zinc, barium, iron, selenium, boron, magnesium, manganese, titanium, fluoride, phosphorus, sulfite, aluminum, molybdenum, antimony, arsenic, beryllium, calcium, copper.
	Grab sample, 3 times a week	pH, total residual chlorine, oil and grease, phenol, cyanide, total toxic organic, chloroform, dibromochloromethane, bromoform, temperature, bromodichloromethane.
	Continuous, daily	Flow
506, ORNL-Building 9204-3 Sump Pump Oil Separator	Grab sample, weekly	Oil and grease, pH, temperature.
	Instantaneous, weekly	Flow
507, Y-12 Decant Treatment Facility	Composite, weekly	Total Toxic organics
	Composite sample, daily	Silver, cadmium, chromium, copper, nickel, lead, zinc, total suspended solids, arsenic, aluminum, mercury, beryllium, sulfate barium, nitrate, fluoride, calcium.
	Grab sample, daily	Cyanide, oil and grease, pH, total residual chlorine, temperature.
	Continuous, daily	Flow

TABLE 3-25
NPDES MONITORING REQUIREMENTS
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE
PAGE FOUR

Outfall	Type and Frequency of Sampling	Parameter
508, Experimental Mobile Wastewater Treatment Facility	Grab sample, weekly	pH
	Composite sample, daily	Mercury, total suspended solids, sulfate, sulfide, fluoride, aluminum, arsenic, beryllium, cadmium, chromium, copper, iron, lead, nickel, silver, sodium, zinc.
	Grab sample, daily	Color, oil and grease, cyanide, chlorinated organic compounds.
	Continuous, daily	Flow.
510, Waste Coolant Processing Facility	Grab sample, weekly	Oil and grease, total suspended solids, BOD, pH, temperature.
Category I - Precipitation Runoff and Small Amounts of Groundwater	Grab, yearly	pH
	Instantaneous, yearly	Flow
Category II - Cooling Water, Condensate, Precipitation Runoff, and Building, Roof, and Foundation Drains	Instantaneous, quarterly	Flow
	Grab, quarterly	Temperature, pH.
Category III - Process Waters	Instantaneous, quarterly	Flow
	Grab, quarterly	pH
Category IV - Untreated Process Streams	Instantaneous, yearly	Flow
	Grab, weekly	pH
	As required	Bioassay
Miscellaneous Discharges (Potable and industrial water treatment facilities including filters, softeners, and demineralizers)	Composite, weekly	Total suspended solids
	daily	Flow, pH.

TABLE 3-25
NPDES MONITORING REQUIREMENTS
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE
PAGE FIVE

Outfall	Type and Frequency of Sampling	Parameter
Miscellaneous discharges (Recirculating cooling water, cooling tower blowdown, and cleaning wastes originating at space-cooling facilities)	Quarterly Grab sample, quarterly	Flow Chromium, zinc, copper, temperature, free available chlorine, pH.
Miscellaneous discharges (Boiler blowdown originating at space-heating facilities)	Quarterly Grab, quarterly	Flow Temperature, pH.
Miscellaneous discharges (Vehicle and equipment cleaning facilities)	Grab, monthly Daily	Oil and grease, total suspended solids, phenols, BOD, fecal coliform bacteria, pH. Flow, pH.
Miscellaneous discharges (Vehicle and equipment maintenance areas)	Grab, quarterly	Oil and grease
Miscellaneous discharges (Firefighter training areas)	Upon occurrence Grab, quarterly	Flow pH, BOD, oil and grease, total suspended solids.

Source: EPA, 1985

The difference between Category I and II is that Category II discharges contain cooling water and steam or air-conditioning condensate in addition to precipitation runoff and groundwater. Categories III and IV differ in that the 20 Category IV process discharges are specifically identified and will continue to go untreated into EFPC, (Section 3.3.2.21) whereas the Category III process discharges are to be eliminated or collected and treated at one of the facilities described elsewhere in Section 3.3.2. There are 77 Category I, 82 Category II, 16 Category III, and 20 Category IV, for a total of 195 categorized discharges listed in the NPDES permit. Some of these Category III discharges have already been eliminated while the others are scheduled for elimination under the terms of the FFCA. The samples collected from the Category outfalls for analysis are taken at the effluent from the conduit that leads to EFPC.

The permitted miscellaneous source discharges identified in Part III-12 of the NPDES permit are discharges from

- Potable and industrial water-treatment facilities, including filters, softeners, and demineralizers.
- Recirculating cooling water, cooling tower blowdown, and cleaning wastes originating at space-cooling facilities.
- Boiler blowdown originating at space-heating facilities.
- Vehicle and Equipment Cleaning Facilities.
- Vehicle and Equipment Maintenance Areas.
- Firefighter Training Areas.

The effluents from these discharges may be carried to EFPC through one of the Category outfall lines. However samples for analysis of these permitted discharges are taken at the source of the discharge (i.e., boiler blowdown line, cooling tower blowdown line).

Figure 3-22 depicts the locations of the surface water outfalls (301-306). The locations of the treatment facility outfalls (501-508, 510) and discharge to an impoundment outfall (623) are shown in Figure 3-23. Because of the large number of locations, the Category I-IV and miscellaneous-source discharge points are not identified in a figure.

In addition to the monitoring for parameters listed in Table 3-25, Y-12 must also conduct bioassay studies under the terms of the NPDES permit. These studies are being, or will be, performed on the discharges from the Cooling Towers, the Central Pollution Control Facility-CPCF-I, the Central Pollution Control Facility-CPCF-II, the Plating Rinse Water Treatment Facility, the S-3 Ponds Liquid Treatment Facility, the Category IV Discharges, and the Biology Wastewater Treatment Facility to determine if there is a need to develop a toxicity control and monitoring program. If review of the data by TDHE and EPA indicates that such a plan is needed, it will be developed by Y-12. The purpose of these studies and the plan, if required, is to bring East Fork Poplar Creek and Bear Creek in compliance with the water quality standards for the fish and aquatic life designation given to them by the TDHE. The data being collected as a result of the NPDES monitoring program (including those parameters listed in Table 3-25 for which there are no limits listed in Table 3-26) is being obtained for the same purpose; that is, to determine whether the discharges will meet state water quality criteria, or whether other measures will have to be taken to meet them.

The TDHE has requested that data on radionuclides also be included in the NPDES monitoring reports. DOE has declined to include such data in the past because of security reasons and provisions of the Atomic Energy Act. However, a plan has been submitted to the EPA and TDHE for collection and reporting of radiological data. Y-12 is awaiting approval of the plan before initiating action to obtain the data.

Table 3-26 is a summary of the 1985 NPDES compliance at Y-12 for those parameters for which limits have been set. Sixty percent of these parameters were in compliance 100 percent of the time. Y-12's ongoing environmental program is aimed at improving this performance.

3.3.3.2 Surface-Water Monitoring

The water quality of the Clinch River at the Melton Hill Dam is monitored by the USGS as part of its nationwide program of collecting hydrologic data for use by the public and other government agencies. Additionally, the Tennessee Department of Public Health maintains a monitoring station on the Clinch River downstream of the mouth of Poplar Creek. The USGS data for 1985 is shown in Table 3-22 in Section 3.3.1.

FIGURE 3-22

LOCATION MAP - NPDES 301 THROUGH 306
Y-12 PLANT, OAK RIDGE RESERVATION

FIGURE 3 - 23

LOCATION MAP - TREATMENT FACILITIES, OUTFALLS, AND IMPOUNDMENT INFLUENT OUTFALL Y-12 PLANT, OAK RIDGE RESERVATION

TABLE 3-26

**1985 NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) COMPLIANCE
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**

Discharge Point	Effluent Parameter	Effluent Limits					Percent of Compliance
		Daily Average (kg/day)	Daily Maximum (kg/day)	Daily Average (mg/l)	Daily Maximum (mg/l)	Range	
301 (Kerr Hollow Quarry)	Lithium				5.0		100
	pH Units					6.5-8.5	100
	Total Suspended Solids			30.0	50.0		100
	Temperature, °C				30.5		100
	Zirconium				3.0		100
302 (Rogers Quarry)	Oil and Grease			10.0	15.0		96
	pH Units					6.5-8.5	91
	Settleable Solids, ml/l				0.5		96
	Total Suspended Solids			30.0	50.0 ^a		98
	Temperature, °C				30.5		100
303 (New Hope Pond)	Ammonia (as N)				1.6		97
	Cadmium, Total			0.0025	0.0035		94
	Chromium, Total			0.05	0.08		100
	Copper, Total			0.015	0.022		94
	Dissolved Oxygen			5.0 ^b			97
	Dissolved Solids				2,000		100
	Fluoride			1.5	2.0		100
	Lead, Total			0.012	0.17		100
	Lithium, Total				5.0		100
	Mercury, Total			0.0035	0.0080		91
	Nitrogen, Total (as N)				20.0		94
	Oil and Grease			10.0	15.0		94
	pH Units					6.5-10.0	96
	Settleable Solids (ml/l)				0.05		96
	Surfactants (as MBAS)			5.0	8.0		98
	Total Suspended Solids				20.0 ^c		100
	Temperature, °C				30.5		100
	Zinc, total			0.20	0.30		100

TABLE 3-26
1985 NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) COMPLIANCE
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE
PAGE TWO

Discharge Point	Effluent Parameter	Effluent Limits					Percent of Compliance
		Daily Average (kg/day)	Daily Maximum (kg/day)	Daily Average (mg/l)	Daily Maximum (mg/l)	Range	
304 (Bear Creek)	Oil and Grease			10.0	15.0		100
	pH Units					6.5-8.5	100
305 (Leaking Burial Grounds and Wet Weather Springs-- Oil Pond No. 1)	Oil and Grease			10.0	15.0		100
	pH Units					6.5-8.5	87
	Total Suspended Solids			30.0	50.0		100
306 (Seepage from Burial Pit and Surface Water Runoff-- Oil Pond No. 2)	Oil and Grease			10.0	15.0		87
	pH Units					6.5-8.5	100
	Total Suspended Solids			30.0	50.0		87
623 (Steam Plant Fly Ash Sluice Water)	pH Units					6.5-8.5	100
507 (S-3 Ponds Liquid Treatment Facility)	Cadmium, Total	0.14	0.38	0.26	0.69		100
	Chromium, Total	0.93	1.5	1.7	2.77		100
	Copper, Total	1.13	1.84	2.07	3.38		100
	Cyanide, Total	0.35	0.65	0.65	1.20		99
	Lead, Total	0.23	0.38	0.43	0.69		100
	Nickel, Total	1.30	2.17	2.38	3.98		100
	Oil and Grease	14.2	28.4	26.0	52.0		100
	pH Units					6.0-9.0	100
	Silver, Total	0.13	0.23	0.24	0.43		100
	Temperature, °C				30.5		100
	Total Suspended Solids	16.9	32.7	31.0	60.0		99
	Total Toxic Organics		1.16		2.13		100
	Zinc, Total	0.81	1.42	1.48	2.61		100

TABLE 3-26
1985 NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) COMPLIANCE
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE
PAGE THREE

Discharge Point	Effluent Parameter	Effluent Limits					Percent of Compliance
		Daily Average (kg/day)	Daily Maximum (kg/day)	Daily Average (mg/l)	Daily Maximum (mg/l)	Range	
508 (Experimental Mobile Wastewater Treatment Facility)	Mercury, Total			0.002	0.004		50
	pH Units					6.5-9.0	100
	Total Suspended Solids			30.0	45.0		100
510 (Waste Coolant Processing Facility)	Biochemical Oxygen Demand	1.93	2.65				75
	Oil and Grease			15.0	20.0		33
	pH Units					6.5-9.0	100
	Temperature, °C				30.5		100
	Total Suspended Solids				100.0		100
Category I Outfalls (Precipitation Runoff and Small Amounts of Groundwater)	pH Units					6.5-8.5	100
Category II Outfalls (Cooling Waters, Condensate, Precipitation Runoff, and Building, Roof, and Foundation Drains)	pH Units					6.5-8.5	98
	Temperature ^d						100
Category III Outfalls (Process Wastewaters)	pH Units					6.5-8.5	90
Category IV Outfalls (Untreated Process Wastewaters)	pH Units					6.5-8.5	97

TABLE 3-26
1985 NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) COMPLIANCE
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE
PAGE FOUR

Discharge Point	Effluent Parameter	Effluent Limits					Percent of Compliance
		Daily Average (kg/day)	Daily Maximum (kg/day)	Daily Average (mg/l)	Daily Maximum (mg/l)	Range	
Miscellaneous Discharges (Cooling Tower Blowdown)	Chromium, Total				1.0		100
	Copper, Total			0.5	1.0		100
	Free Available Chlorine			0.2	0.5		100
	pH Units					6.5-8.5	58
	Temperature, °C			35	38		100
	Zinc, Total			0.5	1.0		100
Miscellaneous Discharges (Demineralizers)	pH Units					6.5-8.5	0
	Total Suspended Solids			30	50		0

Source: MMES, 1986a.

- Limit not applicable during periods of increased surface runoff resulting from precipitation.
- Daily minimum.
- If discharge volume exceeds 8.0×10^6 gallons/day as a result of precipitation, daily maximum is 100 mg/l.
- Temperature shall be controlled such that the stream temperature standards delineated in the General Water Quality Criteria for the Definition and Control of Pollution in the Waters of Tennessee, as amended, are not violated as a result of this discharge.

The NPDES outfalls 303 and 304 reported in Table 3-26 are actually surface water samples. 303 is the discharge from New Hope Pond, which in actuality is EFPC, while point 304 is Bear Creek as it crosses Route 95. Data for water-quality parameters of Bear Creek and East Fork Poplar Creek downstream from the NPDES outfalls, near their confluence, are included as Tables 3-27 and 3-28.

The Tennessee Stream standards for the protection of domestic water supplies, fish and aquatic life, and recreational use classifications of state waters are given in Table 3-29. This information may be helpful in giving the reader a perspective as to what the data in the other tables mean. However, the reader is also cautioned to observe that some of the Tennessee limits (i.e., mercury, cadmium, lead) are lower than the limits of detection used in obtaining the data for Tables 3-27 and 3-28.

The data presented in Table 3-30, 1985 Monitoring for Upper Bear Creek, especially the total dissolved solids and nitrate as nitrogen concentration, show the effect of groundwater contamination on this stream. This data was collected in the headwaters of Bear Creek, where groundwater seeps and springs are the only source of flow other than storm-water runoff.

Liquid discharges from the Y-12 Plant ultimately reach the Clinch River (Section 3.3.1). The only nearby drinking water supply, downstream of the Y-12 Plant, is at the city of Kingston. The intake to the Kingston Water Filtration Plant is located on the Tennessee River, which does not directly receive any Y-12 discharges. However, under backflow conditions, Clinch River water may move upstream in the Tennessee River and be used as the source of water at the Kingston Plant. During 1985, water samples were collected by Oak Ridge Reservation (ORP) personnel on a daily basis and composited for a quarterly analysis for uranium fission products and transuranics. Since the samples are collected daily and composited, the analyses would represent any backflow conditions that may have occurred during 1985. The concentrations of the uranium isotopes that were observed in Kingston water samples are presented in Table 3-31. These concentrations are equivalent to background levels of uranium observed at the Melton Hill Dam (Section 3.3.1.)

3.3.3.3 Sanitary Sewer Monitoring

The discharge to the Publicly Owned Treatment Works (POTW) is covered by the City of Oak Ridge Sanitary Sewer Permit 001 issued to Y-12. This "draft" permit, which became effective February 27, 1986, for a 1-year period, sets the following limits for the monthly average concentration at the influent to the POTW:

TABLE 3-27

**1985 CHEMICAL WATER QUALITY DATA FOR BEAR CREEK
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**

Parameter	Symbol	Maximum (mg/l)	Minimum (mg/l)	Average (mg/l)
Mercury	Hg	0.0034	<0.00050	<0.001
Total Suspended Solids	TSS	63	<2.0	<20
Total Dissolved Solids	TDS	280	190	231
Chloride	Cl	22	9.0	14
Cyanide	CN	0.007	<0.002	<0.003
Fluoride	F	1.5	0.1	0.3
Surfactants	MBAS	<0.05	<0.05	<0.05
Kjeldahl Nitrogen	TKN	0.54	<0.2	<0.4
Nitrate Nitrogen	NO ₃ (N)	24	6.6	12
Sulfate	SO ₄	36	13	22
Turbidity (NTU)		44	3.2	12
Silver	Ag	0.04	<0.01	<0.01
Aluminum	Al	3.0	0.12	0.74
Arsenic	As	<0.06	<0.06	<0.06
Boron	B	0.39	0.19	0.27
Barium	Ba	<0.2	<0.2	<0.2
Beryllium	Be	<0.0005	<0.0005	<0.0005
Calcium	Ca	64	35	47
Cadmium	Cd	<0.002	<0.002	<0.002
Cesium	Ce	<0.03	<0.03	<0.03
Cobalt	Co	<0.002	<0.002	<0.002
Chromium	Cr	<0.01	<0.01	<0.01
Copper	Cu	0.13	<0.004	<0.031
Iron	Fe	2.3	0.08	0.63
Gallium	Ga	<0.04	<0.04	<0.04
Potassium	K	2.2	0.70	1.5

TABLE 3-27
1985 CHEMICAL WATER QUALITY DATA FOR BEAR CREEK
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE
PAGE TWO

Parameter	Symbol	Maximum (mg/l)	Minimum (mg/l)	Average (mg/l)
Lanthanum	La	<0.01	<0.01	<0.01
Lithium	Li	0.14	0.07	0.10
Magnesium	Mg	15	7.8	11
Manganese	Mn	0.09	<0.01	<0.03
Molybdenum	Mo	<0.01	<0.01	<0.01
Sodium	Na	11	3.8	5.9
Niobium	Nb	<0.02	<0.02	<0.02
Nickel	Ni	0.08	<0.01	<0.02
Phosphorus	P	<0.03	<0.03	<0.03
Lead	Pb	<0.01	<0.01	<0.01
Scandium	Sc	0.001	<0.001	<0.001
Strontium	Sr	0.15	0.078	0.106
Thorium	Th	<0.02	<0.02	<0.02
Titanium	Ti	0.022	<0.001	<0.009
Vanadium	V	0.004	<0.003	<0.003
Yttrium	Y	0.001	<0.001	<0.001
Zinc	Zn	0.02	<0.02	<0.02
Zirconium	Zr	0.002	<0.001	<0.001

Source: MMES, 1986a.

TABLE 3-28

**1985 CHEMICAL WATER QUALITY DATA FOR EAST FORK POPLAR CREEK
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**

Parameter	Symbol	Maximum (mg/l)	Minimum (mg/l)	Average (mg/l)
Mercury	Hg	0.0039	0.0006	0.0018
Total Suspended Solids	TSS	66	< 5.0	< 20
Total Dissolved Solids	TDS	340	150	240
Chloride	Cl	190	13	34
Cyanide	CN	0.006	< 0.002	< 0.003
Fluoride	F	1.0	0.8	0.9
Surfactants	MBAS	< 0.05	< 0.05	< 0.05
Kjeldahl Nitrogen	TKN	10	0.3	1.4
Nitrate Nitrogen	NO ₃ (N)	34	1.4	6.9
Sulfate	SO ₄	80	44	58
Turbidity (NTU)		17	0.7	7.9
Silver	Ag	0.03	< 0.01	< 0.01
Aluminum	Al	1.2	0.07	0.3
Arsenic	As	< 0.06	< 0.06	< 0.06
Boron	B	0.07	0.02	0.04
Barium	Ba	< 0.2	< 0.2	< 0.2
Beryllium	Be	< 0.0005	< 0.0005	< 0.0005
Calcium	Ca	47	33	39
Cadmium	Cd	< 0.002	< 0.002	< 0.002
Cesium	Ce	< 0.03	< 0.03	< 0.03
Cobalt	Co	< 0.002	< 0.002	< 0.002
Chromium	Cr	< 0.01	< 0.01	< 0.01
Copper	Cu	0.09	0.006	0.019
Iron	Fe	1.3	0.06	0.6
Gallium	Ga	< 0.04	< 0.04	< 0.04
Potassium	K	2.6	1.3	1.9

TABLE 3-28
1985 CHEMICAL WATER QUALITY DATA FOR EAST FORK POPLAR CREEK
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE
PAGE TWO

Parameter	Symbol	Maximum (mg/l)	Minimum (mg/l)	Average (mg/l)
Lanthanum	La	<0.01	<0.01	<0.01
Lithium	Li	0.03	0.01	0.02
Magnesium	Mg	11	8.2	9.5
Manganese	Mn	0.22	0.01	0.08
Molybdenum	Mo	<0.1	<0.1	<0.1
Sodium	Na	36	8.9	16
Niobium	Nb	<0.02	<0.02	<0.02
Nickel	Ni	0.15	<0.01	<0.02
Phosphorus	P	0.3	0.11	0.2
Lead	Pb	<0.01	<0.01	<0.01
Scandium	Sc	<0.001	<0.001	<0.001
Strontium	Sr	0.12	0.09	0.17
Thorium	Th	<0.02	<0.02	<0.02
Titanium	Ti	0.017	<0.001	<0.008
Vanadium	V	<0.003	<0.003	<0.003
Yttrium	Y	0.002	<0.001	<0.001
Zinc	Zn	0.09	<0.02	<0.05
Zirconium	Zr	0.002	<0.001	<0.001

Source: MMES, 1986a.

TABLE 3-29

**TENNESSEE STREAM STANDARDS
FOR THE PROTECTION OF FISH AND AQUATIC LIFE
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**

Parameter	Symbol	Standard (mg/l)
Mercury	Hg	0.00005
Total Dissolved Solids	TDS	500
Chloride	Cl	250
Cyanide	CN	0.0035
Fluoride	F	1.0
Nitrate Nitrogen	NO ₃ (N)	10
Sulfate	SO ₄	250
Cadmium	Cd	0.000025
Chromium	Cr	0.05
Copper	Cu	0.02
Nickel	Ni	0.1
Lead	Pb	0.0038
Zinc	Zn	0.05

Source: MMES, 1986a.

TABLE 3-30

**1985 MONITORING FOR UPPER BEAR CREEK
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**

Parameter	Number of Samples	Concentration (mg/l)		
		Maximum	Minimum	Average
pH(a)	52	7.6	6.3	6.8
Dissolved Oxygen	52	8.8	2.0	6.1
Suspended Solids	52	190	<5	<21.8
Total Dissolved Solids	53	6,500	210	3,077
Chloroform	53	<0.010	<0.010	<0.010
Methylene Chloride	53	0.077	<0.010	<0.036
Perchloroethylene	53	0.097	<0.010	<0.012
Trichloroethylene	53	<0.010	<0.010	<0.010
Trichloroethane	53	0.02	<0.010	<0.011
PCB	53	0.0042	<0.0005	<0.0006
Phenol	53	0.034	<0.0010	<0.0030
²⁴¹ Americium(b)	53	<3	<3	<3
²³⁷ Neptunium(b)	53	32	<6	<7
²³⁸ Plutonium(b)	53	0.51	<0.2	<0.21
²⁴⁰ Plutonium(b)	53	2.5	<0.2	<0.2
⁹⁹ Technetium(c)	53	2.0	<0.3	0.6
²³⁵ Uranium(d)	53	0.54	0.29	0.35
Silver	53	0.04	<0.01	<0.01
Aluminum	53	5.8	0.12	0.78
Arsenic	53	<0.06	<0.06	<0.06
Boron	53	0.14	<0.02	<0.11
Barium	53	<0.2	<0.2	<0.2
Beryllium	53	0.0018	<0.0005	<0.0005
Calcium	53	660	96	446
Cadmium	53	0.031	0.004	0.015

TABLE 3-30
1985 MONITORING FOR UPPER BEAR CREEK
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE
PAGE TWO

Parameter	Number of Samples	Concentration (mg/l)		
		Maximum	Minimum	Average
Cerium	53	<0.03	<0.03	<0.03
Cyanide	52	0.054	<0.002	<0.006
Cobalt	53	0.007	<0.002	<0.004
Chromium	53	0.01	<0.01	<0.01
Copper	53	0.043	<0.004	<0.006
Fluoride	52	10	<0.1	<1.1
Iron	53	2.3	<0.06	<0.28
Gallium	53	0.06	<0.04	<0.04
Mercury	53	0.019	<0.0005	<0.0019
Potassium	53	19	4.8	11
Lanthanum	53	<0.01	<0.01	<0.01
Lithium	53	0.09	0.01	0.03
Magnesium	53	190	14	87
Manganese	53	12	1.1	4.8
Molybdenum	53	<0.1	<0.1	<0.1
Sodium	53	570	60	163
Niobium	53	0.09	<0.02	<0.03
Nickel	53	0.28	<0.01	<0.03
Nitrate Nitrogen [NO ₃ (N)]	52	1,300	45	433
Potassium	53	0.08	<0.03	<0.03
Lead	53	<0.01	<0.01	<0.01
Scandium	53	0.002	<0.001	<0.001
Strontium	53	2.0	0.36	1.06
Thorium	53	<0.02	<0.02	<0.02
Titanium	53	0.024	<0.011	<0.002

TABLE 3-30
1985 MONITORING FOR UPPER BEAR CREEK
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE
PAGE THREE

Parameter	Number of Samples	Concentration (mg/l)		
		Maximum	Minimum	Average
Uranium	53	1.36	0.22	0.947
Vanadium	53	0.01	<0.003	<0.003
Yttrium	53	0.027	<0.001	<0.003
Zinc	53	0.07	<0.02	<0.02
Zirconium	53	0.005	<0.001	<0.001

Source: MMES, 1986a.

- a. pH Units
- b. pCi/l
- c. pCi/ml
- d. Percent

TABLE 3-31

1985 CONCENTRATIONS OF URANIUM ISOTOPES
FOR THE WATER FILTRATION PLANT AT KINGSTON, TENNESSEE (pCi/l)
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE

	Average	Maximum	Minimum
Uranium-234	0.086	0.14	0.052
Uranium-235	1.4×10^{-3}	2.0×10^{-3}	4.8×10^{-4}
Uranium-238	0.053	0.087	0.032

Source: MMES, 1986a

Fats, wax, oil and grease	100 mg/l
BOD	300 mg/l
Suspended Solids	300 mg/l
Total Kjeldahl Nitrogen	40 mg/l
Cadmium	0.040 mg/l
Copper	1.90 mg/l
Zinc	2.92 mg/l
Cyanide	0.071 mg/l
pH	6-9
Temperature	104° F (influent to POTW) 150° F (effluent from Y-12)

In addition to the above, Y-12 is also monitoring chromium, mercury, total uranium, and uranium-235 in the sanitary-sewage discharge. Composite samples are collected monthly and analytical results are reported quarterly. Since the permit only became effective in February 1986, a full year of data is not available. However, the results obtained up to the time of the on-site Survey did not show any exceedances.

3.3.3.4 Fish Monitoring

Fish samples are routinely collected from various locations on the Clinch River. Tissue analyses are performed for radionuclides, mercury, and PCBs. Although the fish are analyzed for several radionuclides, only the uranium isotopes are to be expected to have Y-12 as their source. Other nuclides would have either ORNL or ORGDP as their sources. Based on historical data, three species of fish were selected at the start of 1985 for future analysis of mercury and radionuclides: bass, bluegill, and carp. Only carp were selected for PCB analysis, as past work by both ORNL and TVA indicate that carp tend to accumulate PCBs to a higher level than the other species. Tissue samples of bass, bluegill, and carp were analyzed for radionuclides and mercury. The carp bones were also analyzed for radionuclides for use in calculating the dose assessment because the local population prepare carp patties for consumption by grinding up the entire fish.

Uranium-234 concentrations for bass ranged from a high of 1.2 pCi/kg to a low of 0.61 pCi/kg, for bluegill from a high of 5.1 pCi/kg to a low of 1.7 pCi/kg, and for carp from a high of 3.2 pCi/kg to a low of 0.88 pCi/kg. The high concentrations occurred at the point of discharge from Poplar Creek. Uranium-235 concentrations in bass ranged from a high of 0.23 pCi/kg to a low of 0.023 pCi/kg, in bluegill from a high of 0.49 pCi/kg to a low of 0.12 pCi/kg, and in carp from a high of 0.3 pCi/kg to a low of 0.076 pCi/kg. Uranium-238 concentration in bass ranged from a high of 0.68 pCi/kg to a low

of 0.37 pCi/kg, in bluegill from a high of 2.8 pCi/kg to a low of 0.96 pCi/kg, and in carp from a high of 2.6 pCi/kg to a low of 0.59 pCi/kg.

The carp bones were also analyzed for uranium. Uranium-235 ranged from 7.9 pCi/kg to 2.3 pCi/kg, uranium-238 from 71 pCi/kg to 6.8 pCi/kg, and uranium-234 from 105 pCi/kg to 7.1 pCi/kg.

There are no DOE, NRC, nor EPA regulations that specifically limit the concentrations of uranium in fish. However, the DOE effective dose limit of 100 mrem/year, from all pathways, for the exposure of members of the public may be applied to radionuclides in fish. As is discussed in Section 4.3.3.2, the 1985 maximum effective dose equivalent, from uranium, that could be received by an individual eating fish from the Clinch River was 0.088 mrem/year, or 0.088 percent of the DOE limit.

The mercury concentrations for bass tissue ranged from a high of 370 ng/g to a low of 15 ng/g, for bluegill tissue from 270 ng/g to 23 ng/g, and for carp, from 400 ng/g to 92 ng/g. The high concentrations occurred in all the fish at the location where Poplar Creek discharges to the Clinch River. These levels are under the Food and Drug Administration (FDA) action level for mercury in fish of 1.0 mg/kg (1,000 ng/g).

The PCB concentration in fish flesh at the sampling location where Poplar Creek enters the Clinch River ranged from 1.4 µg/g to <0.05 µg/g for all species that were collected. These levels are below the FDA action level for PCB in fish of 2.0 mg/kg (2.0 µg/g).

In addition to this monitoring, the Oak Ridge Interagency Task Force has included the analyses of fish as part of its study. The Task Force has found both mercury (3.3 mg/kg to 0.20 mg/kg) and PCB (3.7 mg/kg to <0.10 mg/kg) above the FDA action level in samples taken from EFPC. The data from these studies are included in the report of the Task Force (TVA, 1985-1986).

3.3.3.5 Sediment Monitoring

The Oak Ridge Interagency Task Force is also collecting and analyzing samples of sediment as part of its study (TVA, 1985-1986). The results for EFPC show the effect that the discharges from Y-12 have had on this stream. These data are summarized as follows. The figures in parentheses are background levels for metals from TVA data. Since the priority pollutants are man-made, any results above the detection limit is considered to be above background. There are no published standards or criteria for pollutants in sediments. Mercury concentrations have ranged from 1,800 mg/kg to <0.1 mg/kg (1.0-0.2), arsenic from 14 mg/kg to 3.6 mg/kg (12-9), cadmium from 8.5 mg/kg to

<0.5 mg/kg (5.5-1.4), lead from 170 mg/kg to 36 mg/kg (60-30), nickel from 81 mg/kg to 19 mg/kg (30-20), silver from 45 mg/kg to 2 mg/kg (2.5-1.6), and zirconium from 590 mg/kg to 350 mg/kg (270-180). The priority pollutants were total PCBs in a range of 6,000 < 100 µg/kg, fluoranthene from 4,600 to <660 µg/kg, bis (2-ethyl hexyl) phthalate from 2,600 to <660 µg/kg, pyrene from 3,500 to <660 µg/kg, phenanthrene from 4,500 to <660 µg/kg, benzo-a-pyrene from 900 to <660 µg/kg, chrysene from 920 to <660 µg/kg, anthracene from 1,000 to <660 µg/kg, benzo-a-anthracene from 1,200 to <600 µg/kg, and total phenols from 1,300 to <400 µg/kg.

On-site sediment sampling is not performed routinely by Y-12, although samples were taken for specific activities such as remediation studies in Bear Creek Valley (G&M, 1985a) and for the disposal of sediments from NHP into the Chestnut Ridge Sediment Disposal Basin.

3.3.4 Findings and Observations

3.3.4.1 Category I

None.

3.3.4.2 Category II

1. Unrepaired Backflow Preventer. Delays in repairing backflow prevention devices can result in contaminated process water entering the potable water system and from there, EFPC. Backflow Preventer 5000-04 has been reported "unsatisfactory" at each semiannual inspection since June 1981.

The treated water system at Y-12 supplies the fire protection system, the process users, and the potable water (Section 3.3.2.1). Backflow preventers are installed on process water lines to prevent the accidental contamination of potable water lines and/or the treated water system by the process water. The Mechanical Inspection Department has had a program to inspect these units in place since 1976. Backflow preventers are inspected at regular annual or semiannual intervals, and records of the results of these inspections are maintained. If a unit is found to be unsatisfactory, a notification that repairs are needed is prepared. The records indicate that these procedures were followed for this unit. However, Utilities, Maintenance, and the "owner" of the backflow preventer all must be involved in removing the unit from service and getting it repaired. Procedures were lacking to ensure that backflow preventers

found to be needing repair are actually repaired in a timely manner. Steps to initiate repair of this unit were taken before the Survey team left the site.

3.3.4.3 Category III

1. Mercury-Contaminated Water. Water that is contaminated with Mercury in excess of the Tennessee Stream Quality Standards of 0.05 µg/l is entering EFPC from the Y-12 Plant. The annual average concentration of mercury in the discharge from NHP (EFPC as it leaves the Y-12 Plant site) from 1977 to 1985 ranged between 1.4 and 5.0 µg/l (Turner, et al., 1985).

The soils, building structures, and sewers around and beneath Buildings 9201-2, 9201-4, 9201-5, 9204-4, and the 81-10 area were contaminated with mercury during past operations (Section 4.5.2.3). Surface runoff into EFPC and stormwater, groundwater, and/or process water flowing through the sewers into EFPC, which resuspend mercury and mercury-contaminated soils in these areas, result in the continuing contamination of EFPC. The outfalls and the concentrations of mercury found in each are identified in a Y-12 report (Turner, et al., 1985). Y-12 has implemented steps to reduce this contamination, including cleaning, replacement, and/or bypassing of contaminated sewer lines.

In addition to the above, Y-12 has conducted studies to find a method to treat these waters. This resulted in the construction of the Mobile Waste Treatment System (Section 3.3.2.16) for treatment of waters that become contaminated during cleanup operations. This unit is now permanently installed in the basement of Building 9201-4.

2. Untreated Process Water Discharges to EFPC. The discharge of untreated process waste streams and other building drains into EFPC has resulted in exceedance of the NPDES effluent limitations for New Hope Pond (Outfall 303) for the following parameters during 1985: ammonia, heavy metals, total nitrogen, oil and grease, pH, settleable solids, and surfactants, as indicated in Table 3-26.

These sources of contamination were addressed in the MOU, FFCA, and NPDES permit, which set schedules for the construction, startup of operations, and attainment of effluent limitations of facilities to treat these wastes. The operation of these treatment facilities is discussed in Sections 3.3.2.8 through 3.3.2.18.

The volumes and descriptions of these wastes from the buildings at Y-12 are contained in Appendix G. This appendix contains Tables G-1 (Building Discharges to Storm Drain System) and G-2 (Detailed Building Contaminated Process Discharge Data) from the report characterizing the discharges into EFPC (UCND, 1983b). This report was submitted with the NPDES renewal application. As stated previously, the environmental program at Y-12 is dynamic. Most of these flows have been collected for treatment or are in the process of having collection and/or treatment facilities constructed. Additional studies are currently in progress to ensure that all contaminated discharges at Y-12 have been identified and scheduled for treatment if necessary.

In addition to the discharges from the buildings at Y-12, the contaminated groundwater discussed in Section 3.4 and in Finding 3.4.4.3.3 also contributes to the pollution of EFPC. Furthermore, contamination of EFPC is due, in part, to the transportation of contaminated soils (Section 3.2.2) by groundwater and surface water runoff.

3. Contamination of Bear Creek. The Tennessee Stream Quality Standards for heavy metals and nitrates are being exceeded in Bear Creek (Tables 3-27, 3-29, and 3-30) because of the inflow of groundwater that has become contaminated from Y-12 waste disposal practices (Sections 3.4.2 and 4.5.2).

The study of Remedial Alternatives for the Bear Creek Valley Waste Disposal Area (G&M, 1985a) reports that the aquatic and benthic community in Bear Creek had been affected but that improvement is apparent since the S-3 Ponds were denitrified in 1983-84. PCB and volatile organics are also found in the sediments in Bear Creek. Planning is under way for remedial action to eliminate the groundwater contamination and thus also the surface-water problem.

4. Contamination of McCoy Branch. McCoy Branch is unable to sustain aquatic life because of the effects of the discharge of the fly ash sluice water.

This water is used at a rate of approximately 2,300 gallons per minute for 6 hours per day to flush bottom ash and fly ash from the steam plant to the top of Chestnut Ridge. It first enters an impoundment, which has been completely filled, and then follows McCoy Branch to Rogers Quarry. The original bottom and banks of the branch have been eroded by the force of the water and have been stained by the ash. Remedial action plans are being developed for concurrence by TDHE.

5. Off-Site Floodplain Contamination. A Category III finding regarding off-site floodplain contamination in EFPC and other nearby areas appears in Section 4.5.3.3.

3.3.4.4 Category IV

1. Potable Water Bacteriological Samples. The required number of bacteriological samples are not being taken on the Y-12 water distribution system. Furthermore, the records of analysis are not being retained for the required length of time.

A letter from the Tennessee Department of Public Health to ORO, dated February 26, 1979, advises that the monitoring requirements in the Y-12 distribution system are 5 days per week for residual chlorine and 4 bacteriological samples per month. The chlorine analysis requirements are met, but Y-12 does not always collect the required number of bacteriological samples.

Chapter 1200-5-1-20 of the regulations of the State of Tennessee requires the retention of records for fecal coliform analyses for 5 years and chemical analyses for 10 years. The records at the Industrial Hygiene office at Y-12, however, are only available as early as July of 1985.

2. Cooling Water pH. Because of the natural alkalinity of the makeup water and the pH of the treatment chemicals being used, the pH of the cooling water is normally in the range of 8.6 - 8.8. The blowdown or losses from the cooling water systems thus violate the upper pH limit of 8.5, which was established by the NPDES permit.

Trials are under way to determine whether a newly reformulated treatment chemical will still offer the required degree of system protection and yet allow lower pH levels to be established and maintain passing of the required toxicity tests. To date, the trials have all appeared to be satisfactory. The plant will continue to expand the usage of the newly reformulated chemical until all cooling systems are using it.

3.4 Groundwater (Hydrogeology)

3.4.1 Background Environmental Information

3.4.1.1 Site Geology

The Y-12 Plant is located in a valley that lies within the Valley and Ridge physiographic province of the Appalachian Mountains. The Valley and Ridge province is characterized by subparallel ridges and valleys formed by folding and thrust faulting of rock units. Rocks relatively resistant to weathering, such as sandstone and dolomite, form ridges, whereas valleys develop in areas where rocks are easily eroded. In the Southern Appalachians, where the Y-12 Plant is located, the ridges and valleys trend northeast-southwest.

The rock units that underlie the Y-12 Plant area are, from oldest to youngest, the Rome Formation, the Conasauga Group, the Knox Group, and the Chickamauga Limestone. These are all sedimentary rocks of Cambrian or Ordovician age. Minor occurrences of younger formations are present northwest of the plant area, beyond Pine Ridge. Figure 3-24 is a map of the general plant area showing the surface distribution of rock units. This map includes only a small part of the area underlain by the Chickamauga Limestone. The various rock units and their relationship to topography and to site features are discussed further in the next three paragraphs. The streams shown on Figure 3-24, Bear Creek and East Fork Poplar Creek, are part of the Clinch River regional surface water drainage system (see Figure 2-2).

Pine Ridge, the northwest border of the Y-12 Plant site, is formed by the Rome Formation, which is composed of sandstone, siltstone, and shale. The major part of the Y-12 Plant and the Bear Creek Valley Waste Disposal Area are located in Bear Creek Valley, which is underlain by calcium-carbonate-containing shale, siltstone, and limestone of the Conasauga Group. The uppermost unit of the Conasauga Group is the Maynardville Limestone, in which solution cavities are common. Both surface-water streams that flow through the plant area, Bear Creek and East Fork Poplar Creek, are developed on the Maynardville Limestone, which is relatively nonresistant to weathering.

Figure 3-25 is a representative geologic cross section through Bear Creek Valley showing the southeast dip of the rock units and the inferred direction of groundwater flow. This figure is intended to depict conditions anywhere across Bear Creek Valley and is not a specific cross-section for Figure 3-24. Both the main part of the Y-12 Plant and the Bear Creek Valley Waste Disposal Area are located in this valley, and occupy much of the area between the ridges.

2

FIGURE 3 -

GENERALIZED SURFACE GEOLOGY
PLANT, OAK RIDGE RESERVATION

FIGURE 3-25

REPRESENTATIVE GEOLOGIC CROSS SECTION THROUGH
BEAR CREEK VALLEY
Y-12 PLANT, OAK RIDGE RESERVATION

Chestnut Ridge, the ridge southeast of the plant on which several waste disposal sites are located, is formed on the Knox Group, which is primarily cherty dolomite (magnesium carbonate and silica). The Knox weathers to form a deep residual clay soil (see Section 3.2.1) over an irregular bedrock surface. Fractures in bedrock are enlarged by solution, sinkholes are common, and springs arise from the base of the ridge, especially at the contact between the Knox and the underlying Conasauga (Maynardville Limestone).

Rogers Quarry, which is used as a waste disposal site by Y-12, is located in Bethel Valley, southeast of Chestnut Ridge. Bethel Valley is underlain by the Chickamauga Limestone. Solution features, such as enlarged fractures or cavities, are less common in this unit than in the Knox dolomite or Maynardville Limestone. Rogers Quarry is situated entirely on the Chickamauga Limestone, and another waste disposal site, Kerr Hollow Quarry, is situated on the contact between the Chickamauga and the Knox. Kerr Hollow Quarry has been excavated primarily in the upper Knox; the contact between the Chickamauga and the Knox is visible in the southeast highwall of the quarry (G&M, 1986a).

3.4.1.2 Site Hydrogeology

In the main Y-12 Plant area, where the surface-water stream is East Fork Poplar Creek, the former topography of the drainage system for this creek has been altered by plant construction. Rothschild et al. (1984a) point out that flattened hills and filled valleys are general features of plant site topography. Small streams (tributaries) that once flowed into East Fork Poplar Creek are now carried in underground pipes, and the gullies and channels that they once occupied have been filled in. East Fork Poplar Creek itself is now carried in pipes (storm sewers) for about half the length of the main Y-12 Plant area. When the creek emerges from pipes and flows as a surface stream, it follows a straightened channel rather than its original course. The abandoned parts of the original course have been filled in. The material used to fill in the former stream valleys of East Fork Poplar Creek and its tributaries (original topographic lows) is highly variable. Soil, rock, concrete, wood, and steel have all been found in borings of fill material. The compactness of the fill material varies greatly; the fill may be tightly compacted or have a large number of voids. In many places the fill is saturated, because of the shallow depth to groundwater. Thus, the former course of the creek and its tributaries, the fill material which now occupies this former course, and the solution cavities in the subsurface beneath the former and present creek bed in the main plant area all form an integrated creek-fill-solution cavity system that has a major influence on groundwater movement.

Surface-water flow directions are greatly influenced by geological features, so that natural (unaltered) stream courses generally correspond to joint or fracture trends. A prominent fracture zone in the Chickamauga is indicated by the course of McCoy Branch at Rogers Quarry. Joints and fractures in all formations also provide important pathways for groundwater movement. Groundwater also tends to flow along bedding planes, especially in Bear Creek Valley, where the Conasauga Group consists of numerous thin layers or beds. Sharp differences in permeability exist from one layer to another so that groundwater flow can occur more readily parallel to bedding than through bedding. This means that groundwater tends to move along the length of the valley. Groundwater levels parallel topographic contours, and groundwater will eventually move from recharge areas on ridges to discharge areas at springs and streams. However, this flow from high to low areas is not uniform, but follows paths controlled by joints, fractures, bedding planes, and solution features.

Both shallow and intermediate-depth groundwater in Bear Creek Valley, west of the main Y-12 Plant area, discharge to Bear Creek and its tributaries and to the solution-cavity system along Bear Creek. Discharging groundwater sustains the flow of Bear Creek or, at times of low flow, moves through the solution cavities underlying Bear Creek. Some, and possibly all, water from the cavity system emerges farther downstream in Bear Creek or in springs. However, it is not known whether all groundwater in the cavity system discharges to the surface water of Bear Creek before Bear Creek leaves the valley and joins larger streams.

A surface water divide between the Bear Creek drainage system and the East Fork Poplar Creek drainage system is present at the west end of the main Y-12 Plant area. Because of this divide, groundwater in the main Y-12 Plant area discharges to East Fork Poplar Creek. Groundwater may also move through solution cavities underlying the creek. The solution-cavity system continues along the base of Chestnut Ridge in the Maynardville Limestone, although the creek turns north, presumably along a fracture. It is likely that groundwater can move in the cavity system from the East Fork Poplar Creek drainage basin into the Scarboro Creek drainage basin east of the plant (off-site).

The groundwater flow system, especially flow in the deep bedrock, is under investigation by the U.S. Geological Survey under an interagency agreement. This study may answer questions such as the following regarding the potential for contaminant migration at the Y-12 Plant:

- Are the formations sufficiently tight at depth to prevent any significant groundwater flow or do fractures still provide conduits? If groundwater flow in the deep bedrock is possible, where is the ultimate discharge location for this deep groundwater?
- Can contaminated groundwater move out of Bear Creek Valley beneath Chestnut Ridge and thus off-site through the deep bedrock?
- Are there brine zones at depth? If so, contaminated groundwater reaching this depth would mix with already undrinkable water and would thus never be used as a water source.

3.4.1.3 Groundwater Use

There is no known use of groundwater in areas that could be affected by the Y-12 Plant. Most of the residential wells in the immediate area are south of the Clinch River. The Clinch River is a major regional discharge boundary; groundwater moves into the Clinch River and not beneath it, and therefore these wells cannot be affected by the Y-12 Plant.

The major portion of the industrial and drinking water supply in the Oak Ridge area is taken from surface-water sources. However, public and industrial groundwater supplies do exist at a distance of 12 to 35 km (7.5 to 22 miles) from the Oak Ridge Reservation. Yields for these supplies are listed in MMES, 1986a. Water quality data are not available. Most of these wells and springs are in the Knox Group, which is a regional aquifer.

3.4.2 General Description of Pollution Sources/ Controls

3.4.2.1 Introduction

Maps of the Y-12 Plant are generally based on an administrative grid in which grid north is 34°12'51" west of true north. In the following descriptions, locations are given with respect to this grid rather than as true compass directions.

A number of waste storage or disposal sites have been identified by Y-12 staff. These sites are undergoing groundwater investigations, not because any groundwater problems are known or suspected, but in response to requirements of the 1981 Tennessee Department of Health and Environment Hazardous Waste Management Regulation 1200-1-11. For some of these sites,

groundwater monitoring has been in progress for about 2 years; for others, well installation was completed during 1986 and samples from initial sampling rounds are still being analyzed. Sites in the Bear Creek Valley Waste Disposal Area are known sources of groundwater contamination. The existing coal pile in the main Y-12 Plant area is a suspected source of sulfate contamination. Other sites may be potential sources, but either the existence of contamination has not been demonstrated, or contamination has been found but not traced to a specific source.

The sites described briefly in this section are discussed in greater detail in Section 3.4.3, in which environmental monitoring data pertinent to their evaluation are presented. These sites have been shown on Figures 2-3 and 2-6. The following sites are discussed in this section:

- Bear Creek Valley Waste Disposal Area
 - S-3 Ponds
 - Oil Landfarm
 - Burial Grounds
- In-Plant Areas
 - Mercury-contaminated soil
 - Coal Pile
 - S-2 Pond
 - Interim Drum Storage Yard
 - Oil/Solvent Drum Storage Area
 - Beta-4 Security Pits
 - Ravine Disposal Site
 - New Hope Pond
- Chestnut Ridge Sites
 - Chestnut Ridge Sediment Disposal Basin
 - Chestnut Ridge Borrow Area Waste Pile
 - Storm Sewer Sediment-Drying Facility
 - Chestnut Ridge Security Pits
 - Coal-Ash Retention Pond
 - UNC Site
 - Centralized Sanitary Landfill II
 - Oak Ridge Sewage Sludge Land Farming Site
 - Rogers Quarry
 - Kerr Hollow Quarry

The geographical sequence used for site descriptions in this section is (1) west to east in Bear Creek Valley and the plant area; (2) east to west along the northern slope of Chestnut Ridge, and (3) west to east along the southern slope of Chestnut Ridge.

3.4.2.2 Bear Creek Valley Waste Disposal Area (BCVWDA)

The Bear Creek Valley Waste Disposal Area (BCVWDA) is a pollution source that has received considerable attention as a result of a Memorandum of Understanding (MOU) with the EPA and the Tennessee Department of Health and Environment (TDHE) (Appendix D.3) and a TDHE Complaint and Order (Appendix D.5). The BCVWDA, which covers a distance of roughly 2 miles at the western end of the Y-12 Plant, has been used for waste disposal since 1951. It consists of three principal waste-disposal sites: the S-3 Ponds, the Oil Landfarm, and the Burial Grounds. Section 4.5.2 discusses past and present waste disposal practices at the BCVWDA.

Bear Creek flows westward through the area; its headwaters are near the S-3 Ponds. Investigations show that both surface water and groundwater have been contaminated by each of the three major waste disposal areas. The principal contaminant in Bear Creek and its tributaries is nitrate derived from the S-3 Ponds. This surface-water contamination has adversely affected aquatic and benthic communities in Bear Creek, but the situation has improved since neutralization and denitrification of the S-3 Ponds during 1983 and 1984 (G&M, 1985a). Groundwater contamination from volatile organic compounds, heavy metals, radioactive substances, and nitrate is known to exist. The primary effect of groundwater contamination is on the surface water, as a result of groundwater discharge to the surface water system. Groundwater flow in deep bedrock is still under investigation by the U.S. Geological Survey. More than 150 monitoring wells have been installed in the area, but most are in the shallow soil and weathered bedrock rather than the deep bedrock.

Remedial alternatives for the BCVWDA have been presented to the State (G&M, 1985a). Leachate reduction and groundwater clean-up are both under consideration.

3.4.2.3 In-Plant Areas

Mercury contamination of soil beneath the main part of Y-12 Plant is estimated to be 428,000 pounds. A study of soil and groundwater beneath the plant (Rothschild, et al., 1984a) indicated that mercury is bound to shallow soils and is found only at background concentrations in clear groundwater. Mercury migration can occur where conditions are suitable for transport of muddy water. Such conditions can occur from surface runoff, from springs entering basements where mercury-contaminated soil is present, and, possibly, by movement in solution cavities in the Maynardville Limestone. The hydrogeology of the plant is dominated by this extensive solution cavity system and by the original East Fork Poplar Creek drainage system, which existed prior to

Y-12 Plant construction. The original drainage system still controls subsurface movement of water, despite construction activities, removal of hills, filling of valleys, and an extensive storm sewer network.

The study of mercury contamination resulted in the installation of 43 monitoring wells and the detection of contaminants other than mercury. These contaminants include sulfate from the Y-12 coal pile and an eastward-moving nitrate plume from the S-3 Ponds. The S-3 Ponds is on a groundwater divide; contaminants from the ponds are moving both east and west.

The plume from the S-3 Ponds may be combining with contamination from a similar source, the S-2 Pond or pit. (Maps of the Y-12 in-plant area are presented in Section 3.4.3.2.) The S-2 Pond, an inactive site that was located across West Third Street from Building 9720-32, was an unlined surface impoundment used for disposal of waste liquids (H&R, 1986). These waste streams are thought to include corrosive liquids and solvents, deteriorated chemical reagents, and spent extraction raffinates. No barriers, leachate collection, or treatment systems were used at this site. When the site was closed in 1951, the impoundment was filled with soil and seeded with grass.

The S-2 Pond site is now under investigation because it is near the route of a new security fence construction project, the Perimeter Intrusion Deterrent Alarm System (PIDAS). In early 1986, six monitoring wells were installed near this site, and an additional upgradient well cluster was added in July 1986. These wells may also monitor contamination from an additional source: past and present uses of the interim drum storage yard (S-030), located west of Buildings 9720-32 and 9720-33. This site may have been formerly used for transfer of plating solutions or wastes. Elevated levels of copper have been found in groundwater, and copper carbonate has been found in soil. Remains of building foundations at the interim drum storage yard were unearthed during a soil boring program for site characterization related to PIDAS construction. A partial RCRA closure for the southern part of the interim drum storage yard is planned. The remainder of the site is in active use for drummed waste storage.

Another drum storage area that has contributed to groundwater contamination is the Oil/Solvent Drum Storage Area (S-020) in the Y-12 salvage yard. Drums of waste oils and solvents were removed from the western part of this area, which underwent RCRA closure in preparation for PIDAS construction. (Data on soil sampling and analysis for the RCRA closure is provided in Section 3.2.3). An eastern area remains in use. Spillage and leakage of drum contents are contaminating surface runoff within the diked area. A groundwater characterization study is in progress, which involves sampling of nine wells installed in June 1986. Preliminary data suggests that solvents entered

groundwater beneath the closed western portion of this area, but that the active eastern area has not yet produced groundwater contamination.

Waste materials were buried in trenches at the Beta-4 Security Pits, east of the Y-12 Salvage Yard and northwest of Building 9204-4. This site is described further in Section 4.5.2. Organic compounds and acids were deposited here, as well as uranium, tungsten, and other metals. There are no liners, barriers, leachate collection, or leachate treatment systems. Installation of six monitoring wells was completed in 1985. These and most of the other recently installed wells are intended for groundwater characterization studies and not required as part of routine monitoring programs. Where the type of contamination is not mentioned, sufficient data are not yet available to show whether or not any site-related contamination exists.

With the exception of the plant-wide mercury-contaminated areas, the sites described above are in the western part of the plant. Groundwater investigations are also in progress at two sites in the eastern part of the plant area, the Ravine Disposal Site and New Hope Pond.

The Ravine Disposal Site is a ravine north of the garage (Building 9712) that was used for disposal of construction debris and metal scrap. The waste disposal history of this site is discussed in Section 4.5.2. A running track now covers the filled area. The filled-in ravine should act as a west-to-east conduit for groundwater movement (Haase, et al., 1986). Geohydrologic conditions and potential contamination are being investigated through five wells.

New Hope Pond is an artificial impoundment designed to provide final treatment of water in East Fork Poplar Creek before the creek flows out of the Y-12 Plant toward the city of Oak Ridge (G&M, 1985b). Treatment at the pond consists of sedimentation, flow equalization, neutralization through retention, skimming, and aeration. The outfall has an NPDES permit. The pond sediments are known to contain mercury, other metals, PCBs, and low levels of organics. Wells have been installed around the pond to detect potential contamination and along the base of Chestnut Ridge to study groundwater movement in the Maynardville Limestone. There are 20 wells in this general area.

3.4.2.4 Chestnut Ridge Sites

Several sites considered to be potential sources of groundwater contamination are located on Chestnut Ridge, south of the main plant area. The easternmost of these sites, located directly up the slope from New Hope Pond, is the Chestnut Ridge Sediment Disposal Basin (CRSDB). The CRSDB is an

unlined surface impoundment used for disposal of sludge dredged from the bottom of New Hope Pond. The only controls are a dike surrounding the area and a drainage pipe to prevent overtopping. The pipe discharges to East Fork Poplar Creek immediately upstream of New Hope Pond (Battelle, 1985b). Groundwater monitoring was expanded for this site in 1985, and now includes two old and six new wells.

About 1,000 feet west of the CRSDB along Chestnut Ridge is an area used for disposal of mercury-contaminated soil. This area is called the Chestnut Ridge Borrow Area Waste Pile (CRBAWP). Transfer of these soils to the CRSDB has been considered. However, current plans call for retention of the CRBAWP as Industrial Landfill III, to be used for all mercury-contaminated (defined as ≥ 12 ppm) materials that pass the EP toxicity test and are therefore considered non-hazardous. This landfill has a 20-mil-thick PVC liner to segregate natural soils from mercury-contaminated soils. Such segregation would be useful in the future if regulations governing these contaminated soils are changed. No groundwater monitoring is planned here, because the wastes are considered nonhazardous and nonleachable.

Further westward along Chestnut Ridge is the storm sewer sediment drying facility for mercury-contaminated material removed during drainage pipe cleaning and relining. This facility includes gravity filtration units and a sludge storage area. It should produce no effluent if operated according to design as a closed system. The facility has no directly associated monitoring wells but is adjacent to the Chestnut Ridge Security Pits, which have five wells installed to RCRA specifications in 1985 and one older monitoring well.

The Chestnut Ridge Security Pits are a series of trenches used for disposal of classified materials. Both radioactive and nonradioactive hazardous wastes are present, although the site is currently used only for nonhazardous and low-level radioactive wastes. In addition to the trenches, six auger holes approximately 12 feet in depth and 2 feet in diameter were used for disposal of particularly reactive material such as lithium wastes.

West of the Security Pits, the pipe carrying ash slurry from the steam plant discharges to the headwaters of McCoy Branch. This stream flows down Chestnut Ridge on the southern slope, away from the plant area. The flow bypasses a filled coal-ash retention pond and eventually enters Rogers Quarry.

The westernmost potential pollution source on Chestnut Ridge is the United Nuclear Corporation (UNC) site. This site was used for disposal of low-level radioactive wastes generated at the UNC

Recovery Systems facility at Wood River Junction, Rhode Island. Materials disposed here include drums of waste fixed in concrete, drums of contaminated soils, and boxes of contaminated equipment. Plans are being made for closure of this site as a nonhazardous solid waste landfill. Closure is complicated by the formation of the mineral ettringite in the hydrated concrete, a process that causes swelling. This swelling could disrupt any cap placed over the drums. The wastes contain high concentrations (100-8,000 ppm) of nitrate, which is readily soluble in water and thus subject to leaching. Nitrate has been found in soil samples, but it is unclear whether the source is the UNC site or fertilizer application near the area. Groundwater monitoring for this area was expanded in 1985 and now includes two old and three new wells.

South of the UNC site, farther down the southern slope of Chestnut Ridge, is the Centralized Sanitary Landfill II. The operation of this active landfill is described in Section 4.1.2.4. The landfill has three monitoring wells and a vadose zone (unsaturated soil) monitoring system. Vadose zone monitoring is intended to detect migration of soluble materials in soils before they reach the uppermost aquifer. The system is part of a research project for the Low Level Waste Disposal Development and Demonstrations (LLWDDD) program.

East of the landfill, along the southern slope of Chestnut Ridge, is the Oak Ridge Sewage Sludge Land Farming site, which receives wastes from the City of Oak Ridge sewage treatment plant. This site has three monitoring wells and is adjacent to Rogers Quarry, which has eight wells.

Rogers Quarry was used as a source of rock and gravel for construction until quarry operations breached an underground water source. Equipment was abandoned in place when flooding could no longer be controlled. The quarry was used for disposal of radioactive and nonradioactive classified material until 1981. It currently receives ash slurry from the steam plant. The outfall from the quarry has an NPDES permit.

The easternmost site along the southern slope of Chestnut Ridge is Kerr Hollow Quarry. At the time of the on-site part of the Environmental Survey, this quarry was still being used for disposal of reactive materials and compressed gas cylinders (see Section 4.5.2). Seven groundwater monitoring wells were installed in 1985, and the outfall is sampled after disposals according to requirements of an NPDES permit.

Results of environmental monitoring of groundwater at these sites are presented in the following section.

3.4.3 Environmental Monitoring Program

3.4.3.1 Bear Creek Valley Waste Disposal Area (BCVWDA)

In June 1985, an evaluation of remedial alternatives for the BCVWDA was issued by the Y-12 Plant. This document (G&M, 1985a) summarizes 1984 data on groundwater contamination. Figures 3-26 through 3-29 show plumes of VOCs, nitrate, heavy metals, and radioactivity. Table 3-32 presents selected chemical analyses for water from monitoring wells and springs. Figures 3-30 through 3-32 show well and spring locations. A comparison of the table and figures shows that groundwater containing nitrate in excess of the Safe Drinking Water Act limit of 10 ppm is found in a large area adjacent to the S-3 Ponds, which are located near a surface-water and groundwater divide. The highest nitrate concentration, 10,620 ppm, was found in monitoring well GW-109, about 750 feet east of the ponds. Total uranium activity was as high as 985 pCi/l in GW-23 at the burial grounds. Total VOCs reached a maximum of 375.6 ppm in well GW-15 at the burial grounds. As shown on Table 3-32, concentrations of lead and chromium exceeded drinking water standards (0.05 mg/l) for most wells.

Current groundwater sampling and analysis in the BCVWDA is being carried out by Roy F. Weston, Inc., under contract to Martin Marietta Energy Systems. Data from a sampling round conducted in August 1985 were issued in November 1986 (Weston, 1986). Sampling was done in January, May, and August 1986, but the data were not available for this preliminary report. The August 1985 data are not shown on a table; only the maximum values found are presented here. The contaminants of concern are nitrate, radioactivity, VOCs, and metals. The August 1985 data show maximum values of 1,960 ppm nitrate as N (well GW-109, which was also highest in 1984). The highest radioactivity values were found in well GW-103. These values were 12,000 pCi/l gross alpha, 38,000 pCi/l gross beta, and 31.8 ppm uranium, somewhat lower than the total uranium concentration of 45 ppm found in this well in 1984. Activity analyses were not performed for that 1984 sampling round. Well GW-15, which had the highest concentrations of VOCs in 1984, was not resampled in the August 1985 round, but well GW-29, also in the Burial Grounds, had total VOCs of 187.3 ppm. This total includes 87 ppm 1,2-dichloroethene, 23 ppm 1,1,1-trichloroethane, 31 ppm trichloroethene, and 26 ppm tetrachloroethene. For comparison, the drinking water standard (maximum contaminant level) for trichloroethene is 5 ppb, over 6,000 times less than that found in well GW-29. Metal concentrations reach maximums of 2,040 ppm aluminum, 69 ppm barium, 3.5 ppm cadmium, 2.38 ppm arsenic, and 1.0 ppm selenium in GW-104 at the S-3 Ponds. Drinking water standards are 1.0 ppm barium, 0.01 ppm cadmium, 0.05 ppm arsenic, and 0.01 ppm selenium. There is no drinking

**APPROXIMATE AREAS OF VOC CONTAMINATION IN GROUNDWATER IN THE
BEAR CREEK VALLEY WASTE DISPOSAL AREA
Y-12 PLANT, OAK RIDGE RESERVATION**

FIGURE 3-27

APPROXIMATE AREAS OF NITRATE CONTAMINATION IN GROUNDWATER IN THE
BEAR CREEK VALLEY WASTE DISPOSAL AREA
Y-12 PLANT, OAK RIDGE RESERVATION

FIGURE 3 - 28

APPROXIMATE AREAS OF HEAVY METALS CONTAMINATION IN GROUNDWATER IN THE
BEAR CREEK VALLEY WASTE DISPOSAL AREA
Y-12 PLANT, OAK RIDGE RESERVATION

FIGURE 3 - 29

APPROXIMATE AREAS OF GROUNDWATER CONTAMINATION BY RADIOACTIVITY IN THE
 BEAR CREEK VALLEY WASTE DISPOSAL AREA
 Y-12 PLANT, OAK RIDGE RESERVATION

TABLE 3-32

PARTIAL CHEMICAL ANALYSIS OF WATER FROM MONITORING WELLS AND SPRINGS
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE

Well No	Date Sampled	Conductivity (µmho/cm)	pH	Total Nitrate as "N" (mg/l)	Total Sulfate (mg/l)	Total Strontium (mg/l)	Total Lead (mg/l)	Total Chromium (mg/l)	Total Nickel (mg/l)	Total Uranium Activity (pCi/l)	VOCs (µg/l)
S-3 Ponds											
GW-100	OCT 1984	1,100	6.2	54	85	0.481	0.1	0.04	0.04		
GW-101	OCT 1984	34,000	5.4	6,900	2	47.0	0.1	0.14	0.11		
GW-102	OCT 1984	2,250	5.6	420	29	0.907	0.1	0.12	0.11		10
GW-103	OCT 1984	16,000	2.9	2,640	1,638	2.4	0.1	1.0	25.00		1,287
GW-104	OCT 1984	28,000	3.2	4,320	11	11.0	2.7	0.08	12.00		304
GW-105	OCT 1984	5,000	4.1	300	18	1.1	0.1	8.08	0.41		25
GW-106	OCT 1984	5,000	6.5	948	18	8.9	0.1	0.12	0.07		21
GW-107	OCT 1984	1,900	6.3	27	442	0.637	0.1	0.05	0.04		N
GW-108	OCT 1984	48,000	5.7	7,560	12	26.0	0.1	0.02	0.01		10
GW-109	OCT 1984	47,500	4.9	10,620	22	41.0	0.1	0.08	5.7		129
OIL LANDFARM											
GW-1	MAR 1984	120	7.03	0.07	3	0.25	0.15	0.12	0.071	1.19	N
GW-2	MAR 1984	300	6.55	0.02	2	0.13	0.05	0.02	0.02	0.3	N
GW-3	MAR 1984	625	6.67	0.04	3	0.19	0.05	0.36	0.21	3.57	3,280
GW-5	MAR 1984	750	7.00	0.07	6	0.59	0.27	0.2	0.18	42.0	N

TABLE 3-32
PARTIAL CHEMICAL ANALYSIS OF WATER FROM MONITORING WELLS AND SPRINGS
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE
PAGE TWO

Well No.	Date Sampled	Conductivity (µmho/cm)	pH	Total Nitrate as "N" (mg/l)	Total Sulfate (mg/l)	Total Strontium (mg/l)	Total Lead (mg/l)	Total Chromium (mg/l)	Total Nickel (mg/l)	Total Uranium Activity (pCi/l)	VOCs (µg/l)
OAKLAND FARM (CONT.)											
GW-6	MAR 1984	415	7.24	0.80	4	0.21	0.05	0.02	0.02	0.2	162
GW-7	MAR 1984	185	6.91	0.35	2	0.04	0.05	0.08	0.52	2.2	719
GW-8	MAR 1984	245	6.95	0.07	1	0.03	0.06	0.11	0.06	0.9	73
GW-10	MAR 1984	500	6.50	0.55	5	0.2	0.25	0.34	0.12	1.4	54
GW-11	MAR 1984	350	6.90	0.10	2	0.94	0.15	0.02	0.02	0.5	56
GW-12	MAR 1984	170	7.08	0.18	2	0.055	0.17	0.05	0.04	0.5	340
GW-13	MAR 1984	600	6.50	0.03	1	0.23	0.1	0.03	0.03	2.0	N
GW-43	MAR 1984	180	6.10	0.03	8	0.074	0.35	0.17	0.17	4.26	N
GW-44	MAR 1984	310	6.78	0.02	5	0.1	0.18	0.03	0.18	0.4	N
GW-62	MAR 1984	600	6.59	3.00	21	0.11	0.05	0.11	0.1	1.35	51
GW-63	MAR 1984	650	6.80	5.00	13	0.17	0.05	0.12	0.06	2.96	64
GW-64	MAR 1984	600	6.77	7.00	23	0.14	0.22	0.14	0.12	4.09	285
GW-65	MAR 1984	650	7.03	12.00	38	0.11	0.27	0.16	0.11	3.34	140
GW-66	MAR 1984	700	6.40	5.00	150	0.21	0.05	0.09	0.05	3.43	71
GW-67	MAR 1984	900	6.36	3.00	135	1.4	0.05	0.06	0.09	48.1	N
GW-73	MAR 1984	480	6.97	1.00	6	0.5	0.05	0.03	0.03	0.549	5

TABLE 3-32
PARTIAL CHEMICAL ANALYSIS OF WATER FROM MONITORING WELLS AND SPRINGS
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE
PAGE THREE

Well No	Date Sampled	Conductivity (µmho/cm)	pH	Total Nitrate as "N" (mg/l)	Total Sulfate (mg/l)	Total Strontium (mg/l)	Total Lead (mg/l)	Total Chromium (mg/l)	Total Nickel (mg/l)	Total Uranium Activity (pCi/l)	VOCs (µg/l)
OIL LANDFARM (CONT.)											
GW-74	MAR 1984	500	13.10	0.03	6	0.063	0.05	0.02	0.02	0.4	N
GW-75	MAR 1984	1,650	13.80	0.11	90	0.72	0.05	0.14	0.04	1,372	463
GW-76	MAR 1984	400	6.80	0.10	9	0.63	0.07	0.06	0.04	1,252	N
GW-84	MAR 1984	355	6.72	0.06	7	0.24	0.09	0.16	0.14	2.96	N
GW-85	MAR 1984	850	6.72	47.00	7	0.36	0.05	0.05	0.04	0.37	N
GW-86	MAR 1984	315	6.89	0.22	6	0.14	0.15	0.15	0.17	34.7	N
GW-86	AUG 1984	320	7.2	0.81	10	0.10	0.1	0.09	0.09	0.3	22
GW-87	MAR 1984	415	6.65	0.18	14		6.2	0.05	0.7	395.0	1,683
GW-97	OCT 1984	800	6.26	0.02	22	0.401	0.1	0.04	0.04		53
GW-98	OCT 1984	500	10.11	0.03	58	0.395	0.1	0.03	0.01		90
BURIAL GROUNDS											
GW-14	MAR 1984	1,050	6.16	0.04	5	0.66	0.05	0.13	0.13		12,268
GW-15	MAR 1984	1,600	6.12	0.04	11	0.6	0.05	0.05	0.06		375,600
GW-16	OCT 1984	420	6.5	0.01	4	0.13	0.1	0.1	0.07		
GW-18	OCT 1984	80	6.0	0.11	14	0.009	0.1	0.07	0.05		N
GW-20	MAR 1984	1,475	6.22	0.02	2	0.61	0.05	0.04	0.06	1.73	226,686

TABLE 3-32
PARTIAL CHEMICAL ANALYSIS OF WATER FROM MONITORING WELLS AND SPRINGS
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE
PAGE FOUR

Well No.	Date Sampled	Conductivity ($\mu\text{mho/cm}$)	pH	Total Nitrate as "N" (mg/l)	Total Sulfate (mg/l)	Total Strontium (mg/l)	Total Lead (mg/l)	Total Chromium (mg/l)	Total Nickel (mg/l)	Total Uranium Activity (pCi/l)	VOCs ($\mu\text{g/l}$)
BURIAL GROUNDS (CONT.)											
GW-21	MAR 1984	700	6.7	0.03	2	0.42	0.11	0.02	0.02	3.34	2,170
GW-23	MAR 1984	5,000	7.4	43.0	1	4.0	0.05	0.04	0.11	985.0	694
GW-24	MAR 1984	1,800	6.16	0.02	1	0.64	0.16	0.04	0.06	2.3	40,871
GW-26	MAR 1984	290	6.9	0.12	0.75	0.08	0.21	0.09	0.08	541.0	690
GW-27	MAR 1984	1,450	6.47	0.01	1	0.36	0.09	0.03	0.56	22.9	89,035
GW-28	MAR 1984	320	6.39	0.06	4	0.079	0.19	0.04	0.04	2.1	N
GW-29	MAR 1984	2,350	6.4	0.03	75	0.47	0.05	0.03	1.2	4.3	229,920
GW-30	MAR 1984	380	6.63	0.06	5	0.13	0.05	0.11	0.1	0.8	N
GW-31	MAR 1984	465	6.48	0.09	24	0.15	0.05	0.04	0.05	2.34	N
GW-33	MAR 1984	390	6.85	0.09	17	0.09	0.05	0.06	0.05	2.62	N
GW-34	MAR 1984	260	6.76	0.04	11	0.23	0.61	0.34	0.42	182.0	149
GW-35	MAR 1984		6.93	0.03	43	0.19	0.11	0.07	0.05	1.8	N
GW-36	MAR 1984	500	6.39	0.07	7	0.11	0.05	0.06	0.05	5.66	391
GW-37	MAR 1984	415	7.22	0.04	18	0.16	0.05	0.1	0.08	0.94	N
GW-38	MAR 1984	500	7.01	0.85	0.05	0.19	0.15	0.22	0.22	12.35	2,560
GW-39	MAR 1984	1,800	6.84	0.07	5	0.53	0.05	0.18	0.16	1.0	153,241

TABLE 3-32
PARTIAL CHEMICAL ANALYSIS OF WATER FROM MONITORING WELLS AND SPRINGS
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE
PAGE FIVE

Well No.	Date Sampled	Conductivity ($\mu\text{mho/cm}$)	pH	Total Nitrate as "N" (mg/l)	Total Sulfate (mg/l)	Total Strontium (mg/l)	Total Lead (mg/l)	Total Chromium (mg/l)	Total Nickel (mg/l)	Total Uranium Activity (pCi/l)	VOCs ($\mu\text{g/l}$)
BURIAL GROUNDS (CONT.)											
GW-40	MAR 1984	170	7.3	0.06	25	0.046	0.56	0.33	0.27	0.2	N
GW-41	MAR 1984	100	7.72	0.08	23	0.019	0.41	0.06	0.06	0.7	N
GW-42	MAR 1984	75	7.35	0.07	6	0.022	0.16	0.07	0.08	0.7	N
GW-45	MAR 1984	230	7.05	0.81	4	0.064	0.05	0.03	0.02	0.2	N
GW-46	MAR 1984	115	9.1	0.44	10	0.057	0.23	0.32	0.22	3.06	217
GW-47	MAR 1984	90	7.98	0.14	20	0.067	0.07	0.18	0.15	1.82	N
GW-48	MAR 1984	230	6.41	0.06	13	0.098	0.05	0.06	0.06	3.28	N
GW-49	MAR 1984	380	6.55	0.22	4	0.13	0.05	0.04	0.02	0.25	N
GW-51	MAR 1984	280	7.36	0.09	7	0.071	0.09	0.08	0.1	1.8	N
GW-52	MAR 1984	600	6.74	35.0	14	0.17	0.09	0.08	0.05	56.0	N
GW-53	MAR 1984	600	6.88	0.15	10	0.43	0.05	0.1	0.07	1.3	20
GW-54	MAR 1984	245	7.6	0.08	18	0.69	0.76	0.67	0.54	15.17	N
GW-56	MAR 1984	500	6.3	3.0	26	0.29	0.06	0.09	0.09	6.7	5
GW-57	MAR 1984	850	6.2	0.09	26	0.24	0.26	0.08	0.13	7.82	N
GW-58	MAR 1984	500	7.15	4.0	14					11.48	N
GW-59	MAR 1984	5,050	7.48	3.0	47	0.22	0.09	0.36	0.19	8.99	10

TABLE 3-32
PARTIAL CHEMICAL ANALYSIS OF WATER FROM MONITORING WELLS AND SPRINGS
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE
PAGE SIX

Well No.	Date Sampled	Conductivity ($\mu\text{mho/cm}$)	pH	Total Nitrate as "N" (mg/l)	Total Sulfate (mg/l)	Total Strontium (mg/l)	Total Lead (mg/l)	Total Chromium (mg/l)	Total Nickel (mg/l)	Total Uranium Activity (pCi/l)	VOCs ($\mu\text{g/l}$)
BURNAL GROUNDS (CONT.)											
GW-60	MAR 1984	480	6.5	12.0	23	0.12	0.07	0.05	0.03	11.64	N
GW-61	MAR 1984	475	6.68	6.0	23	0.24	0.31	0.11	0.13	12.5	N
GW-68	MAR 1984	550	6.59	0.04	4	1.4	0.05	0.16	0.16	2.81	2.605
GW-69	MAR 1984	370	9.6	0.07	8	0.71	0.05	0.13	0.08	0.84	N
GW-70	MAR 1984	550	10.5	0.03	29	2.5	0.79	0.56	0.61	30.9	61.500
GW-71	MAR 1984	5,000	11.2	0.02	1	11.0	0.05	0.33	0.16	0.885	24.563
GW-72	MAR 1984	3,600	12.2	0.06	2	51.0	0.05	0.11	0.07	0.86	N
GW-77	MAR 1984	290	7.58	0.12	12	0.48	0.39	0.04	0.02	1.19	N
GW-78	MAR 1984	355	7.38	0.12	22	0.13	0.37	0.04	0.02	1.883	N
GW-79	MAR 1984	340	7.28	0.06	7	0.17	0.3	0.07	0.03	0.28	N
GW-80	MAR 1984	100	7.06	0.06	10	0.081	0.58	0.11	0.09	4.56	N
GW-80	OCT 1984	130	5.2	0.01	46	0.94	0.2	0.16	0.13	0.30	15
GW-81	MAR 1984	390	6.94	0.06	26	0.28	0.47	0.12	0.09	6.88	93
GW-82	MAR 1984	430	6.38	0.03	8	0.13	0.18	0.16	0.09	2.3	N
GW-83	MAR 1984	280	7.13	0.03	22	0.11	0.05	0.11	0.06	0.21	N
GW-93	OCT 1984	120	8.05	0.06	3	0.93	0.1	0.03	0.03	-	25

TABLE 3-32
 PARTIAL CHEMICAL ANALYSIS OF WATER FROM MONITORING WELLS AND SPRINGS
 Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE
 PAGE SEVEN

Well No	Date Sampled	Conductivity ($\mu\text{mho/cm}$)	pH	Total Nitrate as "N" (mg/l)	Total Sulfate (mg/l)	Total Strontium (mg/l)	Total Lead (mg/l)	Total Chromium (mg/l)	Total Nickel (mg/l)	Total Uranium Activity (pCi/l)	VOCs ($\mu\text{g/l}$)
BURIAL GROUNDS (CONT.)											
GW-94	OCT 1984	2,200	13.28	0.02	12	1.6	0.1	0.02	0.01	-	N
GW-95	OCT 1984	120	9.09	0.25	82	0.03	0.1	0.05	0.01	-	5
GW-96	OCT 1984	300	6.6	0.02	10	0.224	0.1	0.07	0.07	-	
SPRINGS											
1	AUG 1984	440	8.40	<0.01	<1.0	0.36	<0.01	<0.01	<0.01	0.35	N
S-3	AUG 1984	73	6.8	36.0	31.0	0.23	<0.01	<0.01	<0.01	34.1	31

Source: G&M, 1985a.

- = not analyzed

N = not detected

FIGURE 3 - 30

PARTIAL MONITORING WELL NETWORK AT THE S-3 PONDS
Y-12 PLANT, OAK RIDGE RESERVATION

**LOCATIONS OF EXISTING MONITORING WELLS, OIL LANDFARM
Y-12 PLANT, OAK RIDGE RESERVATION**

SOURCE: Geraghty & Miller, 1985c.

SOURCE: Geraghty & Miller, 1985c.

FIGURE 3-32

LOCATIONS OF EXISTING MONITORING WELLS, BURIAL GROUNDS
Y-12 PLANT, OAK RIDGE RESERVATION

water standard for aluminum. However, aluminum in uncontaminated groundwater was normally below 0.5 ppm; a comparison of this background value with the maximum aluminum concentration of 2,040 ppm indicates the high level of aluminum contamination present.

Contamination from the S-3 Ponds may move through the solution-cavity system in the Maynardville Limestone and be discharged through springs into Bear Creek near the Burial Grounds. Wells south of Bear Creek that are not downgradient of either the Oil Landfarm or the Burial Grounds have shown contamination. These wells (GW-59, 60, 61, 62, and 63) are drilled into the cavity system, and the contamination appears to be chemically similar (elevated uranium and nitrate) to that near the S-3 Ponds. Further investigations of the S-3 plume are in progress. Sixteen additional wells have been installed in the BCVWDA (G&M, 1986b) but data from initial sampling rounds were not available for this report.

The U.S. Geological Survey is conducting studies in Bear Creek Valley to characterize the relationship of this area to the regional hydrogeological regime. Well clusters have been installed on the southern slope of Pine Ridge (USGS Site-1N) and the northern slope of Chestnut Ridge (USGS Site-1S) to provide data on water levels for groundwater modeling efforts. These wells will also serve as background wells for the Burial Grounds in the Y-12 well network.

Although significant groundwater contamination exists in the BCVWDA, the situation is reasonably well understood, and plans for remedial action have been submitted to the State of Tennessee for review. There are no users of the contaminated groundwater, and conditions for aquatic life in Bear Creek have improved since neutralization and biodegradation of the S-3 Ponds were carried out during 1983 and 1984 (G&M, 1985a).

3.4.3.2 In-Plant Areas

Figures 3-33, 3-34, and 3-35 show the Y-12 Plant area, including underlying geologic formations; known waste disposal areas; the former drainage system of East Fork Poplar Creek (EFPC), which existed before plant construction; locations of some major (18-inch or greater) sewer lines; and existing groundwater investigation wells. These figures show how close the various known and potential sources of groundwater contamination are to each other. They also show the geographical relationship of these sources to the present and former EFPC and the cavity-forming Maynardville Limestone.

2

SOURCE: Modified from Haase, et al., 1986; Geraghty & Miller, 1985d; Y-12 Engineering Mechanics Drawing

FIGURE 3 - 3

IT, WESTERN SECTION
OAK RIDGE RESERVATION

2

FIGURE 3 -

PLANT, CENTRAL SECTION
NT, OAK RIDGE RESERVATION

2

SOURCE: Modified from Haase, et al., 1986; Geraghty & Miller, 1985d; Y-12 Engineering Mechanics Drawing.

FIGURE 3 -

PLANT, EASTERN SECTION
NT, OAK RIDGE RESERVATION

Much of the information available on groundwater beneath the Y-12 Plant comes from studies related to mercury contamination. However, the area under most active current investigation is west of the known mercury-use sites (west of Beta-4) and east of the S-3 Ponds (see Figure 3-33). This area contains several RCRA or CERCLA sites (Oil/Solvent Drum Storage Area, Y-12 Salvage Yard, Interim Drum Storage Yard, S-2 Pond, Beta-4 Security Pits). It also contains the site of a former coal pile that could have contributed sulfate contamination to the groundwater in the same manner as the present coal pile. However, data are insufficient to distinguish such an effect from that due to the S-3 Ponds. The nitrate plume from the S-3 Ponds extends eastward through this area, and elevated levels of sulfate as well as nitrate are known to be present in some, but not all, wells associated with the S-3 Ponds (see Table 3-32). Groundwater-level contours and flow directions are shown on Figure 3-36. Data from 1984 and 1985 sampling of the few wells in existence at that time suggest that effluent from the S-3 Ponds may be moving eastward along fractures in the Nolichucky shale and discharging upward from bedrock to the shallow aquifer in unconsolidated surficial material (G&M, 1985c). Contamination migrating in bedrock may be mixing with that leaking from surface pollution sources or leaching from shallow burial sites. Over 30 new wells have been installed in this area during 1985 and 1986, and analytical data from initial sampling rounds have been generated. Only a brief preliminary inspection of these data was possible during the on-site part of the Survey, and most of the data were unavailable for this report. However, it is known that high ppb levels of VOCs are present in wells GW-266 and GW-267 near the Oil/Solvent Drum Storage Area. This contamination appears to be related to the closed western portion of the drum storage area rather than to the active eastern portion.

Data reviewed on-site have been subsequently compiled (Haase, et al., 1987a) for 1986 monitoring of six wells at the Beta-4 Security Pits. These wells, shown in Figure 3-21, are GW-191, -192, -194, -195, -196, and -197. Groundwater flow is to the east-southeast, and GW-196 is the upgradient well. GW-191 is deep enough to monitor conditions in unweathered bedrock; the other five wells are shallow, water-table wells that extend to the top of weathered bedrock. GW-191 and -192 form a well cluster (wells of different depths at the same locations). The water level in the deeper well is higher than that in the shallow well, an indication that groundwater moves upward underneath the site. Analytical data suggest that the Beta-4 Security Pits are not causing groundwater contamination, although anomalies exist. The major anomaly is the presence of 1,2-dichloroethene (1,2-DCE) in well GW-192 for all four quarters of sampling, with a maximum value of 52 ppb. The only other well in which this contaminant was found was in the deeper well, GW-191, at the same location; for this well 1,2-DCE was found only for the third quarter at the very low level of 2 ppb. These wells are at the eastern upper edge of the site and in the drainage pattern near a road. It is possible that the source of the 1,2-DCE is not the Beta-4 Security Pits. It is also possible that a

SOURCE: Geraghty & Miller, 1985d.

FIGURE 3 - 36

GROUNDWATER LEVEL CONTOURS, UNCONSOLIDATED MATERIAL, S-3 PONDS AREA,
DECEMBER 6, 1984
Y-12 PLANT, OAK RIDGE RESERVATION

subsurface pathway, such as a fracture, exists from the Security Pits to this location. Such a fracture, coupled with upward movement of groundwater, could explain why 1,2-DCE does not appear in other wells. However, GW-192 also shows other evidence of contamination not found in any other wells, including GW-191, such as higher specific conductance ($>750 \mu\text{mho/cm}$) than other wells ($250\text{--}500 \mu\text{mho/cm}$) and the presence of tetrachloroethene (maximum 17 ppb) in all sampling rounds. (The terms electrical conductance, specific conductance, and conductivity are interchangeable. The units $\mu\text{mho/cm}$ and $\mu\text{S/cm}$ are also interchangeable. Terminology used in the original source document has been retained for this report.) Continued monitoring should resolve the question of whether GW-192 is being affected by a new, unknown source of low-level contamination. Other anomalies also exist in data for metals and radioactivity for all six wells. The upgradient well GW-196 showed the highest values for total barium and total chromium, which again supports the conclusion that the Security Pits are not the source of contamination. Gross alpha and gross beta values were extremely variable. For example, the upgradient well GW-196 had a gross beta activity value of 482.52 pCi/l for the first quarter and a value of 3 pCi/l for the second quarter. The highest alpha activity, 333.31 pCi/l, was found in first quarter sampling for GW-195, but the second quarter value for this well was 1.01 pCi/l. (Gross alpha and gross beta regulatory limits for drinking water are 15 pCi/l and 50 pCi/l, respectively.) Uranium concentrations were generally below the Y-12 facility background level of $<0.01 \text{ mg/l}$, although a total uranium value of 0.049 mg/l was found for the downgradient well GW-194 in fourth-quarter sampling.

Preliminary data are available from wells near the former S-2 Pond (Table 3-33). This area is complicated by the probable migration of effluent from the S-3 Ponds through the solution-cavity system of the Maynardville Limestone, and by the fact that the S-2 and S-3 Ponds were used for the same types of waste disposal. Thus, contaminants from these two sources can be distinguished only by detailed isoconcentration contours and not by the nature of pollutants. The area is further complicated by the presence of the Interim Drum Storage Yard across the street. Both past and present uses of this area may have caused groundwater contamination. Finally, the area is affected by the former drainage of East Fork Poplar Creek (EFPC). Intermittent surface flow still comes down a ravine from Chestnut Ridge south of this area. This surface flow may itself be transporting such pollutants as nitrate from fertilizer application carried out by the Y-12 Plant staff in grassy areas along the ridge. The ravine is part of the natural drainageway for EFPC, although the creek itself has since been confined to pipes through this area.

As shown on Table 3-33, the most contaminated well near the S-2 Pond is GW-253, a 50-foot-deep well in unconsolidated material east of the pond site. This well has 966 ppm nitrate as N, 180 ppm copper, 9.9 ppm zinc, 0.046 ppm mercury, 7.840 ppm cadmium, and elevated levels of other metals.

TABLE 3-33

**PRELIMINARY CHEMICAL ANALYSES FROM WELLS NEAR THE S-2 POND
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**
(mg/l except where noted)

Well No.	GW-252	GW-255	GW-251	GW-253	GW-256	GW-254
Depth (feet)	49.00	81.50	51.00	50.00	18.50	59.00
Unit ¹	U	WB	U	U	U	WB
Aluminum	7.0	5.8	3.2	12	2.6	1.7
Barium	<0.10	0.06	0.14	0.45	0.61	0.18
Beryllium	<0.0003	0.0004	<0.0003	0.016	0.0033	<0.0003
Boron	0.025	0.024	0.022	0.33	0.050	0.060
Calcium	46	64	120	670	280	410
Cadmium	0.012	<0.002	0.072	7.840	2.230	0.066
Cobalt	0.0055	<0.0050	0.012	0.44	0.20	0.0057
Chromium	0.02	0.02	0.02	0.04	0.02	<0.01
Copper	0.34	0.0082	0.18	180	2.8	0.39
Iron	4.2	8.0	2.3	0.29	1.9	1.2
Lead	0.027	0.017	0.012	0.078	0.012	0.012
Lithium	0.014	0.013	0.0062	0.075	0.010	0.0053
Magnesium	26	37	19	150	36	94
Manganese	0.31	0.75	2.3	50	21	1.1
Mercury	0.0003	0.0002	<0.0002	0.046	0.0011	0.0013
Nickel	0.012	<0.010	0.026	4.0	0.96	0.022
Potassium	2.9	4.4	3.6	7.8	9.5	11.0
Silicon	14	11	6.3	5.6	5.9	5.2
Sodium	20	4.9	16	180	70	51
Strontium	0.023	0.0046	0.13	1.3	0.56	0.54
Zinc	0.043	0.048	0.038	9.9	1.8	0.43
Nitrate as N	1.24	26.2	61	966	1,300	1,520
Chloride	2.2	4.7	5.2	128	52	42
pH	7.9	7.8	6.8	5.2	5.8	6.8
Conductivity (umho/cm)	466	571	874	7,270	2,933	2,945
Uranium (ug/ml)	0.004	0.004	0.008	0.009	0.003	0.011
Gross α (pCi/l)	6.8	1.9	6.4	70	19	7.0
Gross β (pCi/l)	10.8	9.9	12.2	66	29	45

Source: Kimbrough, 1986.

1 U = Unconsolidated Material

WB = Weathered Bedrock

Well clusters are GW-252/GW-255 and GW-256/GW-254

For comparison, primary drinking water standards are 10 ppm nitrate as N, 0.002 ppm mercury, and 0.01 ppm cadmium. Secondary drinking water standards are 1.0 ppm copper and 5 ppm zinc. The high metal concentrations may be from waste disposal into the S-2 Pond itself or from handling of plating wastes in the Interim Drum Storage Yard. Soil sampling at both these areas has been done as part of PIDAS construction, but the data were not available for this preliminary report.

Nitrate is even higher northeast of the pond at the well cluster GW-256 (shallow)/GW-254 (weathered bedrock). GW-256 has 1,300 ppm nitrate, and the deeper well GW-254 has 1,520 ppm. The highest metal concentration found here is 2.230 ppm cadmium in the shallow well GW-256. Nitrate is also found in the deep upgradient well GW-252 (26.2 ppm), in well GW-251 west of the pond (61 ppm), and in bedrock well GW-280 further west (83.5 ppm). This nitrate may be part of the S-3 plume or may be due to westward migration along bedding planes from S-2. Water-level data were not available for these wells, and therefore the horizontal or vertical groundwater flow directions could not be determined.

The plant area east of the S-2 Pond has been studied for mercury contamination. Mercury use at the Y-12 Plant was generally associated with Buildings Beta-4, Alpha-5, Alpha-4, 81-10, 9733-1, and -2, 9202, and Alpha-2. These are shown on Figures 3-33 and 3-34. In all areas except Building 9202, mercury has been found in soils, storm drains, and, to a much lesser extent, in groundwater. A 43-well monitoring network was installed in these areas (Rothschild, et al., 1984a). These wells are identified by a sequence of paired numbers with letters (e.g., 60-1A). The first number refers to the general location on the grid system. The second refers to the order of well sites within an area bounded by longitudinal grid lines. The letters indicate relative depths in a well cluster. "A" indicates that the well was finished in the surficial material, soil, or fill; "B" indicates that the well was finished at an intermediate depth, usually in the zone of weathered rock overlying the bedrock; and "C" indicates that the well was finished in the bedrock.

Locations of the wells were chosen to intersect probable zones of groundwater movement and possible mercury accumulation. These zones included open fractures and solution features in bedrock, open voids in fill material, the contact between rock and fill, and pre-construction topographic lows.

Selected data from sampling of these wells are presented in Table 3-34. Well locations are shown on Figures 3-33, 3-34 and 3-35. Complete data from all sampling rounds may be found in Rothschild, et al., 1984a. Samples were not filtered prior to preservation with nitric acid and potassium dichromate. The authors state the following two reasons: (1) even under ideal conditions, filtration

TABLE 3-34

**COMPARISON OF MERCURY CONCENTRATIONS
IN WATER AND IN SUSPENDED SOLIDS FROM GROUNDWATER SAMPLING
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**

Well Number	Sampling Date	Mercury in Water ($\mu\text{g/l}$)	Quality ^a	Mercury in Solids ($\mu\text{g/g}$)
54-1 A	12MAR84	0.03	TM	0.06
54-2 A	12MAR84	0.09	TM	0.15
55-1 A	25JAN84	0.06	TM	0.25
55-1 A	12MAR84	0.04	TM	0.13
55-1 B	25JAN84	0.09	TM	0.13
55-2 A	26JAN84	0.73	TM	1.60
55-2 A	20MAR84	0.06	TM	2.50
55-3 A	27JAN84	0.04	TM	0.40
55-3 A	20MAR84	20.00	M	2.30
55-3 B	27JAN84	0.33	C	0.05
55-3 B	26MAR84	0.20	TM	0.26
55-4 C	08DEC83	4.00	M	0.26
55-4 C	10FEB84	0.20	M	0.45
55-5 A	05MAR84	93.00	VM	3.70
55-5 A	12MAR84	11.00	VM	5.70
55-6 A	05MAR84	1.10	VM	2.10
55-6 A	12MAR84	4.90	M	2.00
56-1 A	12MAR84	0.16	TM	0.61
56-2 A	05DEC83	5.20	VM	3.10
56-2 A	05DEC83	145.00	VM	3.10
56-2 A	30JAN84	0.86	TM	2.80
56-2 A	20MAR84	0.73	TM	3.10
56-2 B	06DEC83	0.15	C	0.61
56-2 B	30JAN84	0.35	TM	0.55
56-2 B	27MAR84	0.10	M	0.94

TABLE 3-34
COMPARISON OF MERCURY CONCENTRATIONS
IN WATER AND IN SUSPENDED SOLIDS FROM GROUNDWATER SAMPLING
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE
PAGE TWO

Well Number	Sampling Date	Mercury in Water ($\mu\text{g/l}$)	Quality ^a	Mercury in Solids ($\mu\text{g/g}$)
56-2 C	06DEC83	1.30	C	1.60
56-2 C	06DEC83	0.95	C	1.60
56-2 C	27MAR84	0.43	TM	2.20
56-3 A	01FEB84	0.29	TM	8.60
56-4 B	19MAR84	0.10	M	3.00
56-5 A	13MAR84	4.30	TM	17.00
56-6 A	19MAR84	0.17	TM	0.13
56-7 A	13MAR84	7.60	TM	10.00
56-8 A	13MAR84	1.00	TM	1.20
56-9 A	14MAR84	0.05	TM	0.10
58-1 A	15MAR84	30.00	TM	168.00
58-1 B	18JAN84	7.60	TM	6.80
58-1 B	15MAR84	0.71	TM	2.10
58-2 A	19MAR84	0.06	TM	0.29
59-1 A	23JAN84	0.40	TM	0.35
59-1 A	19MAR84	0.40	TM	0.40
60-1 A	13DEC83	8.10	M	6.20
60-1 A	14MAR84	28.00	VM	13.00
60-1 A	14MAR84	28.00	VM	12.00
60-1 B	13DEC83	1.30	M	7.20
60-1 B	18JAN84	0.69	VM	2.60
60-2 A	14MAR84	0.01	C	1.10

Source: Rothschild et al., 1984a.

- a C = Clear
TM = Trace Mud
M = Muddy
VM = Very Muddy

can result in either sample contamination or loss of soluble mercury by sorption to filter and glassware; (2) total analysis is a better index of groundwater contamination by mercury because mercury is expected to be largely (>90%) associated with suspended matter. Efforts were made to obtain samples having only natural suspended sediment (i.e., without sampling-induced turbidity). Ordinarily, groundwater moves through formations without resuspending previously deposited sediments. However, the local temporary velocity increase associated with pumping sometimes results in sediment resuspension. Some wells, particularly the more shallow wells screened in fill, soil, and weathered rock, yielded turbid samples despite all efforts. Since the sample preservative will release sorbed mercury from sediment, resulting in an anomalously high concentration of dissolved mercury in water, the presence of sediment was carefully noted. In Table 3-34, the designations C, TM, M, and VM are approximately equivalent to total suspended matter (sediment) concentrations of < 10 mg/l, 10 to 100 mg/l, 100 to 10,000 mg/l, and > 10,000 mg/l, respectively.

For this study, groundwater samples with values in excess of 0.5 µg/l were interpreted as having mercury concentrations above background. Nine wells (55-1C, 55-8A, 55-8B, 56-1A, 56-1C, 56-2A, 56-2B, 56-3A, 56-5C) yielded "clear" groundwater samples with mercury concentrations suggestive of low-level contamination (0.1 to 1 µg/l) and three wells (55-2A, 56-2C, 56-2B) yielded "clear" samples with mercury concentrations close to 50 percent of the national primary drinking water standard (NPDWS). No wells yielded "clear" groundwater samples with mercury concentrations that exceeded the NPDWS of 2 µg/l. An examination of Table 3-34, which includes only part of the data from the study, shows the influence of suspended solids. It can be concluded that mercury enters groundwater only at low levels. Mercury remains bound to soil. Any conditions that cause contaminated soil to be transported as sediment will cause mercury migration. Normally, the velocity of groundwater is too low for sediment transport unless pathways through open solution cavities or voids in fill exist. Surface runoff, groundwater infiltration into storm drains, and springs flowing through contaminated basements to sumps and outfalls are conditions that cause a soil contamination problem to become a surface water and sediment contamination problem. The contribution of dissolved mercury in groundwater is negligible.

Other contaminants, however, were found in groundwater at significant concentrations. Figures 3-37 through 3-41 show plumes of elevated electrical conductance, alkalinity, chloride, nitrate, and sulfate, respectively. These figures show concentrations of contaminants at various parts of the in-plant area. The most striking feature of the plumes is the apparent high concentrations within the former EFPC drainage and the solution-cavity system beneath the old creek bed. (Compare Figures 3-35 through 3-41 with the former drainage shown on Figures 3-33 through 3-35). This implies that subsurface flow is controlled by the creek-fill-solution cavity system,

ELECTRICAL CONDUCTANCE IN SHALLOW GROUNDWATER AT THE Y-12 PLANT
Y-12 PLANT, OAK RIDGE RESERVATION

SOURCE: Rothschild, et al., 1984a.

FIGURE 3-38

ALKALINITY OF SHALLOW GROUNDWATER AT THE Y-12 PLANT Y-12 PLANT, OAK RIDGE RESERVATION

FIGURE 3 - 39

CONCENTRATION OF CHLORIDE IN SHALLOW GROUNDWATER AT THE Y-12 PLANT Y-12 PLANT, OAK RIDGE RESERVATION

SOURCE: Rothschild, et al., 1984a.

FIGURE 3-40

CONCENTRATION OF NO_3 IN SHALLOW GROUNDWATER AT THE Y-12 PLANT Y-12 PLANT, OAK RIDGE RESERVATION

SOURCE: Rothschild, et al., 1984a.

FIGURE 3-41

CONCENTRATION OF SULFATE IN SHALLOW GROUNDWATER AT THE Y-12 PLANT Y-12 PLANT, OAK RIDGE RESERVATION

and the system probably acts as a collector or drain for the plant site. Elongation of the plumes due to preferential movement of groundwater along the length of the valley is also apparent; groundwater does not necessarily discharge into EFPC adjacent to the apparent sources.

The plume of high electrical conductance is highest at well 56-9A (1,468 $\mu\text{S}/\text{cm}$) just east of the Y-12 coal pile but may be mixed with another plume originating at the S-3 Pond or other sources west of the coal pile. The nitrate plume (maximum 91 mg/l at well 55-2B) may also be related to sources in the western part of the plant. High alkalinity (maximum 440 mg/l as CaCO_3 at well 60-1A) may be due to sources near Buildings 9103, Alpha-4, and Alpha-2. Chloride (maximum 170 mg/l at well 56-4B) is also elevated near Buildings 9103 and Alpha-4, as well as Alpha-5. The locations of these small plumes seem to follow the courses of old tributaries to EFPC. Sources of chloride contamination are unknown but may be due to unrecorded chemical spills during the time of heavy use of these areas for mercury operations.

The concentration of sulfate reaches a maximum of 520 mg/l in well 56-9A just east of the coal pile. The sulfate plume is probably due to the location of the coal pile on the Maynardville Limestone. Although water that has become acidic by percolating through the coal pile will tend to be neutralized by the limestone, it will also tend to enlarge solution features in the process and thus create contaminant migration pathways.

A burial trench for classified uranium materials is located beneath this coal pile. In 1984, a preliminary hydrogeological investigation of this site was conducted (Rothschild, et al., 1984b). Drilling logs indicated that the depth to limestone bedrock is approximately 18 feet. The trench was apparently excavated in fill and alluvium down to the irregular bedrock surface. During the investigation, the depth to groundwater was 13 to 15 feet below the ground surface, suggesting that part of the waste is saturated with water. The study was conducted when the coal pile was not present; water levels were expected to rise when the coal pile was replaced on the site. Significant solution cavities (up to 11 feet from top to bottom) were encountered in the limestone beneath the trench. The cavities were generally filled with mud.

Monitoring wells were installed in four exploration borings drilled around the trench. A permanent sampling pump was placed in each well, with lines for air or gas introduction and sample delivery carried through horizontal access pipes. These pipes extended from the tops of the wells to locations accessible beyond the edge of the coal pile. Figure 3-42 is a generalized diagram of the well locations and the orientation of access pipes. (These wells do not appear on Figure 3-35 because their locations are only approximately known.) Figure 3-42 was sketched when the coal pile was not

FIGURE 3-42

Y-12 COAL PILE/BURIAL PIT LOCATION PLAN SHOWING LOCATION OF BURIAL PIT, MONITORING WELLS, APPROXIMATE WATER LEVEL CONTOURS, AND LOCATION OF CROSS SECTION A-A'
Y-12 PLANT, OAK RIDGE RESERVATION

present; the existing coal pile covers the pit and wells but exact spatial relationships are unknown. Figure 3-43 is a cross section of the burial pit. The wells were located to intercept groundwater moving south towards EFPC and east down the valley. Well 55-7A and the well cluster 55-8A and B are south of the trench; well 55-9A is to the east. The access pipe from 55-7A extended to the north of the coal pile; the other three pipes exited to the east.

One sampling round was conducted after well installation and development. Results are shown on Table 3-35. These results show that uranium movement is not significant in the groundwater beneath the burial trench. Background levels of uranium in groundwater were found to be <0.01 mg/l within the Y-12 Plant area during the Rothschild mercury study. Of the four coal pile/burial pit wells, only well 55-8A had a uranium concentration above background (0.012 mg/l). The data suggest that the burial trench is not causing degradation of the groundwater, but the coal pile is. Leachate generated from the coal pile has resulted in groundwater with a lower pH (acidic rather than alkaline), higher sulfate content, and higher electrical conductance (EC) than in groundwater underlying surrounding areas. Thus, this study supports the conclusion that the plumes shown in Figures 3-37 and 3-41 are primarily due to the coal pile.

Further sampling of these wells was planned, but water could not be obtained in later attempts. It is possible that the sampling pumps failed, that blockages or gaps interfered with the lines, or that construction activities damaged the system. Construction work has been extensive in this area. A treatment facility for coal pile runoff is being built next to the pile; excavation for this facility could have caused water levels to drop below the well screens. The access pipes to these wells have also been altered. A concrete-lined trench to collect surface runoff has been constructed around the pile; the outermost 30 feet of the access pipes to the east were removed for this project. The pipes were left near the pile, some were crimped, but it is not known whether the crimping occurred before or during removal. The access pipe to the north from well 55-7A has been destroyed.

With the cooperation of plant personnel, an attempt was made on November 17, 1986, during the Survey, to take samples from the three remaining access pipes. A sample was obtained from well 55-8A, but not from the others. Well 55-8A is 22 feet deep. Water levels measured 10 days earlier at well cluster 55-3A, B, C north of the coal pile suggest that the water table is no more than 12 feet below ground surface. However, no water could be obtained from well 55-9A (18.50 feet deep) or well 55-8B (45 feet deep and in the cavity system).

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CROSS SECTION A-A' Y-12 COAL PILE/BURIAL PIT

NOTE Indicated are location, depth, and numbers for monitoring wells and the general stratigraphy of the site

SOURCE: Rothschild, et al., 1984b.

FIGURE 3-43

CROSS SECTION A-A' FOR Y-12 COAL PILE / BURIAL PIT
Y-12 PLANT, OAK RIDGE RESERVATION

TABLE 3-35

**GROUNDWATER CHEMISTRY DATA FOR WELLS AT THE COAL-PILE BURIAL TRENCH^a
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**

	Well			
	55-7A	55-8A	55-8B	55-9A
Uranium ^b	<0.001	0.012	<0.001	<0.001
Percent 235-U ^c	<2.0%	0.28%	<2.0%	<2.0%
Thorium ^d	0.006	0.006	<0.003	<0.003
Mercury ^e	<0.0005	<0.0005	<0.0005	<0.0005
Selenium ^e	<0.002	<0.002	0.002	0.002
Cyanide ^d	<0.002	<0.002	<0.002	<0.002
Phenol ^d	0.001	<0.001	0.006	0.002
SO ₄	220	2,800	1,400	1,400
TOC	2	6	2	3
Laboratory pH	6.8	5.6	6.6	2.7
Field pH	6.6	6.3	6.7	5.2
Field Temperature (°C)	21.4	23.5	21.6	22.7
Laboratory EC (μmho/cm)	620	3,200	1,800	---
Field EC (μmho/cm)	490	2,930	1,690	1,610
Silver	<0.01	<0.01	<0.01	<0.01
Aluminum	0.48	0.31	0.19	1.6
Arsenic	<0.06	<0.06	<0.06	<0.06
Boron	<0.02	<0.02	0.03	<0.02
Barium	<0.2	<0.2	<0.2	<0.2
Beryllium	<0.0005	0.0009	0.0008	0.0064
Calcium	78	290	260	280
Cadmium	<0.002	<0.002	0.003	0.010
Cerium	<0.03	0.53	0.27	0.34
Cobalt	<0.002	0.57	0.29	0.30
Chromium	<0.01	<0.01	<0.01	<0.01
Copper	<0.004	<0.004	0.038	<0.004
Iron	0.50	67	5.4	0.88
Gallium	<0.04	<0.04	<0.04	<0.04

TABLE 3-35
GROUNDWATER CHEMISTRY DATA FOR WELLS AT THE COAL-PILE BURIAL TRENCH^a
Y-12 PLANT, OAK RESERVATION, TENNESSEE
PAGE TWO

	Well			
	55-7A	55-8A	55-8B	55-9A
Potassium	6.6	29	7.2	17
Lanthanum	<0.01	0.13	0.11	0.41
Lithium	<0.01	<0.01	0.01	<0.01
Magnesium	7.4	200	56	57
Manganese	2.1	110	48	56
Molybdenum	<0.1	<0.1	<0.1	<0.1
Sodium	7.5	42	10	12
Niobium	<0.02	<0.02	<0.02	<0.02
Nickel	<0.01	0.17	0.20	0.38
Phosphorus	<0.03	<0.03	<0.03	<0.03
Lead	<0.01	<0.01	<0.01	<0.01
Scandium	<0.001	<0.001	<0.001	<0.001
Strontium	0.13	0.40	0.39	0.41
Thorium	0.02	<0.02	<0.02	<0.02
Titanium	0.002	<0.001	<0.001	<0.001
Vanadium	<0.003	<0.003	<0.003	<0.003
Yttrium	0.002	0.094	0.089	0.55
Zinc	<0.02	0.05	0.14	0.13
Zirconium	<0.001	<0.001	<0.001	0.005

Source: Rothschild, et al., 1984b.

- a All data in mg/l except where noted; all analyses performed using inductively coupled plasma--optical emission spectroscopy, except where noted; all samples are unfiltered and are acidified in the field with the exception of Uranium, Thorium, Phenol, Sulfate, Total Organic Carbon, pH, and Electrical Conductivity.
- b Fluorometric measurement
- c Mass spectroscopy
- d Colorimetric analysis
- e Atomic adsorption

Preliminary analytical results from the November 1986 sample show the same low level of uranium that was found in 1984 (0.012 mg/l), low iron (0.2 mg/l), low nitrate as nitrogen (0.2 mg/l), low chloride (24 mg/l), slightly acidic pH (6.11) and high sulfate (3,900 mg/l). For comparison, the drinking water standard for sulfate is 250 mg/l. This sample confirmed that the groundwater contamination problem in this area is sulfate from the coal pile and not uranium from the burial trench.

In the plant area between the S-2 Pond site and New Hope Pond, the only wells existing, except for newly installed wells at the Ravine Disposal Site, are the one remaining functional well under the coal pile and the wells installed for the Rothschild mercury study. Water levels are measured routinely in the "mercury wells" but sampling is done only as part of special projects. Sampling and analysis for organics has been done for only four wells -- 55-1B, 56-2C, 56-5A, and 56-1A. Well 55-1B is northwest of Building 9201-5 (Alpha-5), 56-1A is northwest of Building 9201-4 (Alpha-4), 56-2C is a bedrock well near the old stream channel south of Alpha-4 and 56-5A is in the old stream channel near Building 81-10. Tetrachloroethene (PCE) was found in all wells except 55-1B (McMahon, 1985). The most contaminated well was 56-2C, which contained tetrachloroethene (1,900 µg/l [ppb]), trichloroethene (290 ppb), 1,2, dichloroethene (26 ppb) and methylene chloride (11 ppb). The source of this contamination is unknown. Further sampling of selected "mercury wells" is planned as part of the Survey sampling and analysis program. This sampling should help to determine whether organic contamination is a significant problem in the groundwater beneath the Y-12 Plant. Other parameters will be analyzed as well, for comparison with earlier data.

Moving eastward in the plant area (Figure 3-34), two features related to the former drainage channel of EFPC are worth noting. The first feature is the fact that the former channel meanders through the area south of the present EFPC. This area is probably contaminated from the use of PCB-containing Z-Oil, as described in Section 4.5.2. The basement of Building 9404-3 is known to be flooded with oily water. It is not surprising that water is entering this basement, since the building intercepts the former channel. The discharge of groundwater into this basement may provide a mechanism for movement of potentially contaminated oil. Water and sediment in this basement will be sampled by the Survey.

The second feature relates to the further course of the former channel past the southeast corner of Building 9201-2 (Alpha-2). This is the location of a spring that originally flowed about 500 gallons per minute (G&M, 1985d). The spring was reported to have been plugged with cement prior to construction of Alpha-2. Several drains enter the present EFPC from the south side of Alpha-2. It is likely that at least one of them, probably the drain leading to outfall 51, was installed to divert water

from the plugged spring conduit. Attempts to find the spring orifice have been unsuccessful due to the difficulty of drilling in congested areas with many underground lines. The proximity of the spring to mercury-contaminated areas is unknown, but the discharge from all drains in the area contains mercury in excess of drinking water standards.

At the eastern end of the plant, two sites are currently undergoing groundwater investigations. These are the Ravine Disposal Site and New Hope Pond. Locations of monitoring wells are shown on Figure 3-35. Nine additional wells, not shown on the map, have been installed by the U.S. Geological Survey east of New Hope Pond, in Union Valley, and at the University of Tennessee Arboretum. The purpose of these wells is to investigate the possibility of groundwater flow from the East Fork Poplar Creek drainage basin to the Scarboro Creek drainage basin east of the Y-12 Plant. Preliminary studies of water levels in these wells indicate that such groundwater flow can occur (Bailey, 1986). Sampling of these wells is being conducted by the U.S. Geological Survey.

Data reviewed on-site have been subsequently compiled (Haase et al., 1987b) for 1986 monitoring of five wells at the Ravine Disposal Site. Wells GW-198, -199, -201, and -202 are shallow, water-table wells that monitor the top of weathered bedrock. Well GW-200 is deeper than the other wells at the site and extends into the unweathered bedrock zone. It is paired with well GW-201 to form a well cluster to investigate the vertical component of groundwater flow at the southern corner of the site. The water level in the deeper well is higher than that in the shallow well, showing that groundwater moves upward underneath the site. (This same upward vertical gradient was observed at the Beta-4 Security Pits). Groundwater flow is from west to east, and well GW-202 is the upgradient well for the site. Isolated values in excess of drinking water standards have been observed for gross alpha activity (39 pCi/l) and gross beta activity (124 pCi/l) in well GW-201. Radium values have also exceeded standards in GW-198 (10.27 pCi/l) and GW-199 (19.50 pCi/l). These values are all considered to be anomalous and not indicative of contamination. Semi-annual monitoring of pH, specific conductance, total organic carbon, and total organic halogen is planned for this site. Annual analyses for total uranium and groundwater quality parameters will continue.

New Hope Pond is one of the sites at Y-12 that has a RCRA-equivalent groundwater monitoring program despite the fact that the regulatory status of these sites is undecided. All other sites with new wells have such RCRA-equivalent programs, although only the Chestnut Ridge Security Pits and Kerr Hollow Quarry have RCRA Part B permit applications on file and are under interim status. The RCRA-equivalent programs consist of new wells, installed during 1985 and 1986 to RCRA specifications, which are monitored quarterly for three sets of parameters: the EPA interim primary drinking water standards, groundwater quality parameters (iron, manganese, sodium, chloride,

sulfate, phenols), and groundwater contamination indicators (pH, specific conductance, total organic carbon, total organic halogen). Site characterization studies, such as those previously described for the Beta-4 Security Pits and the Ravine Disposal Site, include well installation and sampling programs that are equivalent to those required under RCRA, although these inactive sites fall under the CERCLA program required by DOE Order 5480.14 (see Section 4.5.1). Quarterly sampling for all wells exclusive of those in the BCVWDA is done by personnel from the K-25 facility. (As mentioned previously, Roy F. Weston, Inc., currently performs BCVWDA sampling and analysis.) The work of the K-25 sampling crew was observed during the Survey and was found to be excellent in procedure and performance. Sampling protocols are on file with Charlotte Kimbrough in the Y-12 Environmental Management Department. Analytical work for these investigations is also performed at K-25. The K-25 laboratory is a reference lab for the EPA Contract Laboratory Program.

The RCRA-equivalent program for New Hope Pond has produced preliminary groundwater monitoring data. Inspection of these data suggests that groundwater contamination is present, particularly in shallow wells. It is unclear whether New Hope Pond is the sole source of this contamination. For example, GW-153 had 1,179 mg/l of nitrate in second quarter sampling; this parameter dropped to less than 2 mg/l for later quarters. No other wells in any sampling round showed nitrate levels in excess of the 10 mg/l drinking water standard; furthermore, well GW-153 should be upgradient of the site. The source of this one-time nitrate increase is unexplained. Well GW-152 should also be upgradient of New Hope Pond, but here lead exceeded drinking water standards in three quarters of sampling (maximum 2.21 mg/l). This well is only 16 feet deep and is near the firing range; it is possible that scattered bullets could be a source of lead. Gross alpha activity was also slightly elevated in this well (maximum 31 pCi/l) for two sampling rounds. Groundwater from other shallow wells (GW-148, -150, -154) exceeded drinking water standards for gross alpha activity (maximum 117 pCi/l), gross beta activity (maximum 252 pCi/l), radium (9.2 pCi/l), lead (0.077 mg/l), chromium (0.13 mg/l), and mercury (0.0152 mg/l) in at least one sampling round. No information is available concerning the amount of suspended solids in the samples showing elevated mercury. Specific conductance and total organic carbon were also high for GW-148. Continued monitoring should clarify the nature and extent of contamination that can be attributed to New Hope Pond.

Locations of groundwater investigation wells for three Chestnut Ridge Sites--the Chestnut Ridge Sediment Disposal Basin (CRSDB), the Chestnut Ridge Security Pits, and the UNC site--are shown on Figures 3-44 through 3-46, respectively. Prior to the RCRA-equivalent programs, the only data available for these three sites were from five wells installed prior to 1983. These data are questionable because the annular space between the well casing and the wall of the borehole was

FIGURE 3 - 44

TOPOGRAPHIC MAP OF THE CHESTNUT RIDGE SEDIMENT DISPOSAL BASIN LOCALITY
Y-12 PLANT, OAK RIDGE RESERVATION

FIGURE 3 - 45

TOPOGRAPHIC MAP OF THE CHESTNUT RIDGE SECURITY PIT LOCALITY
Y-12 PLANT, OAK RIDGE RESERVATION

TOPOGRAPHIC MAP OF THE UNITED NUCLEAR CORPORATION (UNC) LOCALITY
Y-12 PLANT, OAK RIDGE RESERVATION

not properly sealed during well construction (G&M, 1985b). This lack of a proper seal could allow surface contamination to migrate down the borehole and affect groundwater in the immediate vicinity of the well. Thus, the analytical data from these wells may not reflect conditions in groundwater that are due to the influence of the site being monitored. These questionable wells are 1080, 1090, 1091, 1095, and 1096. All wells with GW designations were constructed to RCRA specifications.

Despite uncertainties in interpreting sources of pollution, these wells do suggest that contamination has occurred. Mercury in well 1095 on the north (plant) side of the CRSDDB exceeded the drinking water standard of 0.002 mg/l in October 1984 sampling. Well 1096 on the south side of the CRSDDB showed concentrations in excess of primary and secondary drinking water standards for arsenic, mercury, iron, manganese, and alpha activity, as well as a lowered pH of 5.6. 1986 data from new wells are difficult to interpret. GW-155 should be the upgradient well for this site on the basis of topography, but lead and gross alpha values exceeded drinking water standards for the initial sampling round and radium activity for the third quarter sample was 5.67 pCi/l. A value exceeding standards for an upgradient well in anything beyond the initial sampling round is unusual. Radium was also elevated (5.4 pCi/l) for the third quarter in downgradient well GW-157. Although the drinking water limit is 5 pCi/l and these values are only slightly in excess of that limit, all other radium values were less than the detection limit of 2.7 pCi/l. It is possible that the analytical detection limit for radium was lower in this sampling round. Gross beta values were high in three sampling rounds for well GW-156 (maximum 557 pCi/l) and in two rounds for well GW-159. Specific conductance and total organic halogen values are quite variable from one sampling round to another. Groundwater contamination at the CRSDDB cannot be ruled out on the basis of existing data. It is worth noting that sediments in this disposal basin are considered nonhazardous and nonleachable on the basis of EP toxicity tests performed in 1983 (Battelle, 1985b). As discussed in Section 4.1.1, the regulatory status of the CRSDDB is undecided.

At the Chestnut Ridge Security Pits the older well 1080, in an October 1984 sampling round, showed lead and mercury in excess of drinking water standards, as well as detectable trichloroethane. 1986 data from new wells confirmed the existence of lead in excess of drinking water standards for all downgradient wells (GW-173, -174, -176, and -179) in the initial sampling round. In the same round chromium was found in wells GW-174 and -179 and arsenic in well GW-176. Maximum values were 0.219 mg/l for lead, 0.22 mg/l for chromium, and 0.108 mg/l for arsenic. Drinking water standards are 0.05 mg/l for all three metals. For later sampling rounds, all metals were within limits. Gross alpha, gross beta, and radium values were also high for the initial sampling round (maximum 73 pCi/l gross alpha, 216 pCi/l gross beta, 10.8 pCi/l radium) but were within limits of 15 pCi/l, 50 pCi/l,

and 5 pCi/l, respectively, for later rounds. Thus, the later sampling rounds do not confirm the initial round. Monitoring of this active disposal site will continue.

At the UNC site, the older wells are still being used because well 1090 has been found to be the upgradient well for the site on the basis of water levels. All five wells at the site are water table wells that extend to the top of bedrock. The 1986 data show no evidence of contamination at this site. Although nitrate contamination is a probable future problem here, there is no evidence that it has yet reached groundwater. The water table is relatively deep in this area, and considerable contaminant migration could occur before it could be detected in existing wells. Monitoring of the unsaturated (vadose) zone above the water table for the presence of highly soluble nitrate could serve as an early-warning system. A spring and a patch of especially green vegetation in the area may indicate nitrate contamination reaching the surface through the subsurface. Water and soil samples will be taken at these areas during the Survey sampling and analysis program.

In addition to three older monitoring wells, and a vadose zone monitoring system has been installed at the Centralized Sanitary Landfill II. No data are yet available from the vadose zone system, which is intended primarily as a part of the Oak Ridge National Laboratory LLWDDD waste disposal research project rather than as monitoring required by conditions at the landfill. Data from routine sampling and analysis of the monitoring wells during 1985 are presented in Table 3-36. This table lists selected parameters with detectable values. Analyses were performed for 65 parameters, most of which had values less than the detection limit. These data indicate that groundwater is not being contaminated by the landfill to a significant degree, although the occasional detection of the organics shown on the table indicates that some contaminant migration does occur. No data other than those shown on the table are available. This site is located on Y-12 property, but its monitoring program is part of Oak Ridge National Laboratory operations.

Groundwater sampling has been performed at three wells near the Oak Ridge Sewage Sludge Land Farming site as part of a study conducted by the Oak Ridge National Laboratory (Daniels, 1986b). Samples were analyzed for 81 parameters, and 51 of these were below the detection limit in all three wells. All organics were below the detection limit. Radionuclide analyses are not available. Data for the remaining parameters that were detected in at least one of the wells are presented in Table 3-37. Well 1084 is upgradient from the site; wells 1082 and 1083 are downgradient. A review of the data indicates that, for about half the parameters detected, higher concentrations were measured in the upgradient well. This well may be affected by other sites such as the Centralized Sanitary Landfill II.

TABLE 3-36

**GROUNDWATER MONITORING FOR CENTRALIZED SANITARY LANDFILL II, 1985
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**

Parameter	No. of Samples	Concentration (mg/l) ¹		
		Maximum	Minimum	Average
1,1,1-Trichloroethane	8	0.058	<0.01	<0.016
Tetrachloroethene	11	0.026	<0.010	<0.010
Toluene	11	0.011	<0.010	<0.010
Methylene chloride	11	0.040	<0.010	<0.015
Total Organic Carbon	11	10	<2.0	<4.27
Gross alpha (pCi/l)	11	70	<1.0	<14.8
Gross beta (pCi/l)	11	120	<4.0	<27
Uranium	11	<0.001	<0.001	<0.001
pH (units)	11	8.3	7.3	7.7
Conductivity (µmho/cm)	11	590	300	380
Chloride	11	20	<2.0	<7.8
Nitrate (N)	11	0.5	0.1	0.26
Mercury	11	0.0010	<0.00050	<0.00078
Lead	11	0.010	<0.010	<0.010
Chromium	11	0.010	<0.010	<0.010
Cobalt	11	0.0040	<0.0020	<0.0023
Copper	11	0.013	<0.0040	<0.0064
Lithium	11	0.020	<0.010	<0.011
Zinc	11	0.070	<0.020	<0.030

Source: MMES, 1986a.

1 Unless otherwise stated.

TABLE 3-37

**PARAMETER CONCENTRATIONS IN GROUNDWATER WELLS NEAR THE CITY OF
OAK RIDGE SEWAGE SLUDGE LAND FARMING SITE
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**

Analysis	Well Number		
	1082 Value (mg/l)	1083 Value (mg/l)	1084 Value (mg/l)
Al	0.66	0.22	2.86
Alkalinity	276.30	255.60	847.00
B	<0.08	0.38	<0.04
Ba	<0.02	<0.02	0.06
BOD	<5.00	12.00	<5.00
Ca	110.00	38.00	36.50
Cl	15.00	5.60	6.30
Co	<0.01	<0.01	0.01
Cr	<0.04	<0.04	0.22
Cu	<0.02	<0.02	0.03
Diss. Org. Carbon	5.30	6.30	5.40
F	<1.00	1.00	1.00
Fe	0.62	0.37	2.46
Fecal Coliform (colonies/100 ml)	12.00	N/A*	N/A*
Li	<0.20	<0.20	2.43
Mg	15.00	15.00	0.65
Mn	0.38	0.04	0.02
Na	10.00	84.00	79.10
NH ₃ -N	<0.10	0.42	0.78
Ni	<0.06	<0.06	0.03
NO ₃	15.00	<5.00	<5.00
Si	3.60	4.20	12.80
SO ₄	25.00	74.00	24.00
Sr	0.52	0.80	2.81
Ti	0.03	0.03	<0.01
TKN	0.17	0.42	1.40
V	<0.01	0.01	0.01
Zn	0.05	0.04	<0.01

Source: Daniels, 1986b.

*N/A = Not Analyzed

The remaining sites on the south slope of Chestnut Ridge are Rogers Quarry and Kerr Hollow Quarry. Figure 3-47 is a map of well locations for Rogers Quarry. Figure 3-48 is a cross section through the quarry showing the dipping rock units within the Chickamauga Group and the relative well depths. Water-level data from the Rogers Quarry wells suggest that well GW-184, intended as the upgradient well, may have the highest water levels for only part of the year. Clarification of possible seasonal variations will require at least one more year of data. A preliminary inspection of analytical data for Rogers Quarry suggests that arsenic from coal ash is not getting into the groundwater. A compilation of analytical data was not available for this report. Installation of well clusters (two wells in the same location but completed at different depths) is planned for the area below this dam at the coal ash retention pond and along McCoy Branch at the outfall from the quarry. McCoy Branch flows along a fracture, which is a probable pathway for groundwater affected by quarry operations.

Figure 3-49 is a map of well locations for Kerr Hollow Quarry. Well GW-142, which has the highest topographic elevation, was intended as the upgradient well for this site. However, all wells at the site except for GW-146 have similar water levels without any one well level being consistently higher than others. The water level in GW-146 is about 85 feet lower than that in other wells or in the quarry itself. This well showed elevated levels of gross alpha (18 pCi/l), gross beta (150 pCi/l, 61.13 pCi/l), and radium (14.58 pCi/l) in various sampling rounds. Radium was also elevated above drinking water standards for GW-231 (13.77 pCi/l) and GW-142 (7.56 pCi/l). The drinking water standard for radium is 5 pCi/l. Gross beta activity was above the drinking water limit of 50 pCi/l for GW-145 (92.4 pCi/l, 65 pCi/l), and gross alpha was slightly elevated (16.8 pCi/l) in GW-143. These values show no consistent pattern and are not considered to be indications of contamination due to the quarry. All other parameters were within limits. Monitoring at this site will continue.

3.4.4 Findings and Observations

3.4.4.1 Category I

None.

3.4.4.2 Category II

None.

LEGEND

● Groundwater Investigation Well Location

SOURCE: Haase, et al., 1986.

FIGURE 3-47

TOPOGRAPHIC MAP OF ROGERS QUARRY
Y-12 PLANT, OAK RIDGE RESERVATION

FIGURE 3-48

SCHEMATIC CROSS SECTION OF ROGERS QUARRY LOCALITY
 Y-12 PLANT, OAK RIDGE RESERVATION

LEGEND

● Groundwater Investigation Well Location

SOURCE: Haase, et al, 1986

FIGURE 3-49

TOPOGRAPHIC MAP OF KERR HOLLOW QUARRY Y-12 PLANT, OAK RIDGE RESERVATION

3.4.4.3 Category III

1. Groundwater Contamination in the Bear Creek Valley Waste Disposal Area (BCVWDA). Groundwater in this area, which includes the Burial Grounds, Oil Landfarm, and S-3 Ponds, is contaminated with volatile organic compounds (VOCs), heavy metals, nitrate, and radioactivity.

Maximum concentrations found in August 1986 include total VOCs of 187.3 ppm, 3.5 ppm cadmium, 2.38 ppm arsenic, 5.9 ppm selenium, 1,960 ppm nitrate as N, and 12,000 pCi/l gross alpha activity. Most VOCs are considered hazardous at low ppb concentrations, three orders of magnitude less than those found in the BCVWDA. Drinking water standards for the parameters listed above are 0.01 ppm cadmium, 0.05 ppm arsenic, 0.01 ppm selenium, 10 ppm nitrate as N, and 15 pCi/l gross alpha activity. However, there are no users of groundwater in the area and, therefore, no apparent receptors. The environmental problem is primarily one of surface-water degradation. Surface-water conditions have improved since neutralization and bionitrification of the S-3 Ponds was completed. Characterization of the area is essentially complete and remedial planning is well under way.

2. Transport of Contaminated Soil. Groundwater, under certain conditions, may transport contaminated soil into surface water and sediments.

Except in isolated instances, groundwater is not contaminated with mercury at Y-12. Only low levels of mercury (below the drinking water standard of 2 µg/l) can actually dissolve in groundwater as it moves through contaminated areas. Mercury remains bound to soil, and subsurface groundwater movement is too slow to transport soil particles. However, in cases where groundwater enters basements and drains, the increased flow rate in such open spaces allows this water to serve as a transport mechanism for mercury contamination present in these areas. Thus, groundwater provides a source of water that serves as a mechanism for moving contaminated soil into surface streams, where the contamination becomes a surface water and sediment problem.

It is probable that a similar mechanism occurs for PCBs, which also remain bound to soil. The existence of PCB contamination in soil has not been demonstrated in the main Y-12 Plant area, although the Z-Oil system is suspected of causing such contamination (see Section 4.5.3.3). If PCB-contaminated soil exists, it could be transported by groundwater infiltration into basements and drains, as well as by surface runoff.

Plans have been made for dewatering mercury-contaminated buildings and for treating mercury-contaminated effluents from storm drains, but these plans have not yet been implemented by the site. Work is in progress on storm drain cleaning and lining to reduce mercury transport.

3. Groundwater Contamination in the Main Y-12 Plant Area. Plumes of sulfate, chloride, nitrate, high alkalinity, and high electrical conductance have been detected beneath the Y-12 Plant.

The coal pile appears to be the source of sulfate contamination. Concentrations of sulfate up to 3,900 mg/l have been detected in groundwater from a well beneath this coal pile. The secondary drinking water standard for sulfate is 250 mg/l. The coal pile may also be the source of the plume of high electrical conductance. Electrical conductance is high (1,468 $\mu\text{S}/\text{cm}$) just east of the coal pile, and even higher (3,200 $\mu\text{S}/\text{cm}$) from a well beneath the pile. (Siemen, S, is the international unit for conductance; it is equivalent to mho, which is the more common unit.) Since electrical conductance is a measure of total cations plus anions in a water sample, contaminants in addition to the sulfate ion and contaminants from sources other than the coal pile may be mixing with this plume.

The maximum nitrate concentration found in the main plant area is 1,520 mg/l, more than 150 times greater than the drinking water standard. Nitrate may be due to the eastward migration of the plume from the S-3 Ponds, to the S-2 Pond, or to other, unidentified, sources. Sources for chloride (maximum 170 mg/l) and high alkalinity (maximum 440 mg/l as CaCO_3) are also unidentified. The most probable causes of these contaminants are unrecorded spills of industrial chemicals during the time of heavy use of the Y-12 Plant for mercury operations.

Contamination by copper, cadmium, solvents, and very low levels of uranium has been occasionally detected within the main plant area. There is inadequate characterization and monitoring of in-plant areas with potential for groundwater contamination, partially due to difficulties in drilling in congested areas with many underground conduits. Sampling and analysis of selected wells in the main plant area for organic solvents and metals is planned by the Survey team.

At the eastern end of the main plant area, preliminary data indicate that shallow groundwater may be contaminated with lead, chromium, and possibly nitrate in wells near New Hope Pond. Elevated levels of gross alpha activity, gross beta activity, and mercury have

also been found. Data are not yet available for comparison between dissolved and total metals, and the amount of suspended solids in the samples showing elevated mercury is unknown. Sufficient monitoring data have not yet been obtained for determination as to whether New Hope Pond itself or unidentified sources are causing this contamination.

Both shallow and intermediate-depth groundwater in the main Y-12 Plant area discharge to East Fork Poplar Creek, which passes through New Hope Pond before leaving the site. Effluent from New Hope Pond is under an NPDES permit. Thus, the effect of contaminated groundwater is controlled and monitored at this surface-water monitoring point. However, there is also the potential for contaminants to leave the Y-12 site through deeper groundwater flow in solution cavities in the Maynardville Limestone. This pathway is under investigation by the U.S. Geological Survey.

4. Potential Groundwater Contamination at Chestnut Ridge Sites. The potential for radioactive and chemical contamination of groundwater exists at the UNC site, the Chestnut Ridge Security Pits, the Chestnut Ridge Sediment Disposal Basin (CRSDB), Kerr Hollow Quarry, Rogers Quarry, and the coal ash retention pond.

Groundwater investigations are in progress at all of these sites except for the ash retention pond. Well installation is planned by the Survey at the retention pond, where no wells suitable for sampling exist, and at Rogers Quarry, where the existing well network does not include the most likely groundwater discharge area.

Data currently available for the Chestnut Ridge sites suggest that groundwater contamination may be present only at the CRSDB. Preliminary data at the CRSDB show elevated gross beta activity (maximum 557 pCi/l) and variable specific conductance (electrical conductance) and total organic halogen.

Deteriorating drums at the UNC site will ultimately release wastes into the soil. These wastes could eventually migrate to groundwater and increase nitrate concentrations to levels above the drinking water standards in the immediate vicinity. There are 29,000 drums at the site, containing approximately 300 tons of nitrate. The UNC site is under active investigation as part of the development of a closure plan. The site appears to be incompletely characterized, particularly in the unsaturated zone above the water table. Since groundwater is relatively deep, monitoring of the unsaturated zone could avoid surprises. The Chestnut Ridge Security

Pits also appear to be incompletely characterized, but further well installation by Y-12 is planned here.

3.4.4.4 Category IV

1. Drums at Coal Ash Retention Pond. Drums with unknown contents were observed at this impoundment. These may be remnants of a formerly used flotation device.
2. Inconsistent Well Maintenance. Although most wells were properly maintained, unlocked wells, unlocked sampling heads on wells, cracked slabs, and insufficient protection with bumper posts were also observed.

4.0 NON-MEDIA-SPECIFIC SURVEY FINDINGS

This section discusses findings and observations pertaining to waste management, toxic and chemical materials, radiation, quality assurance, and inactive waste sites and releases. These discussions do not include a background environmental information section because the areas addressed are not necessarily tied to one medium as was the case with the discussions in Section 3.0. These discussions include an environmental monitoring program section, where appropriate and where information was available. The findings for hazardous, radioactive, mixed, and solid waste management are summarized in a section addressing waste management.

4.1 Waste Management

4.1.1 Background Information

Y-12 operations generate a variety of solid and liquid wastes, including hazardous wastes, low-level radioactive wastes, mixed radioactive and hazardous wastes, and nonradioactive/nonhazardous wastes. No high-level radioactive wastes or transuranic wastes are generated in Y-12 facilities. The following are brief definitions of these various waste types:

- Hazardous wastes are those wastes identified as such in 40 CFR 261 (i.e., regulated under the Resource Conservation and Recovery Act--RCRA). Such wastes are either ignitable, reactive, corrosive, or toxic, or contain materials listed in 40 CFR 261.
- Low-level radioactive wastes (LLW) are described in 10 CFR 61 as radioactive waste not classified as high-level radioactive waste, transuranic waste, spent nuclear fuel, or by-product material as defined in Section 11e.(2) of the Atomic Energy Act (i.e., uranium or thorium tailings and waste). At Y-12, LLW consists of depleted uranium and waste that is contaminated with low levels of radioactivity (i.e., naturally occurring radionuclides, and transuranic nuclides at concentrations less than 100 nanocuries per gram).
- Mixed (radioactive and hazardous) wastes are co-contaminated with radioactive and hazardous waste materials. At Y-12, mixed wastes are all low-level radioactive mixed wastes.

- Nonradioactive/nonhazardous wastes contain very little or no radioactive contamination (i.e., <32 picocuries per gram) and no chemical contamination as defined under RCRA and the Tennessee Hazardous Waste Management Act.
- High-level radioactive wastes (HLW) are defined in 10 CFR 60 as (1) irradiated reactor fuel, (2) liquid wastes resulting from the operation of the first cycle solvent extraction system, or equivalent, and the concentrated wastes from subsequent extraction cycles, or equivalent, in a facility for reprocessing irradiated reactor fuel, and (3) solids into which such liquid wastes have been converted.
- Transuranic waste is defined in 40 CFR 191 as waste containing more than 100 nanocuries of alpha-emitting transuranic isotopes, with half-lives greater than 20 years, per gram, except for high-level radioactive wastes.

Some of these wastes are classified (i.e., substances which, in some aspects, reflect information that needs to remain secure). The management of all these wastes and potential environmental problems associated with waste management practices at Y-12 are discussed in this section.

The Survey procedure to identify waste-related environmental problems incorporated four types of activities; (1) inspection of waste generating processes and waste management facilities; (2) interviews with waste management plant personnel; (3) review of relevant files and documents; and (4) comparison of on-site observations with Y-12 reports and procedures. Emphasis was placed on tracking through the plant waste streams that have been identified in various Y-12 documents. Statutes and DOE orders used as guidance to identify problems include

- The Resource Conservation and Recovery Act (RCRA) and its amendments (specifically, 40 CFR 124, 261, 262, 265, and 270).
- The Tennessee Hazardous Waste Management Act.
- The Tennessee Solid Waste Act.
- DOE Order 5820.2 for the management of radioactive wastes.
- DOE Order 5480.1A and 5480.2 for the management of hazardous wastes.

To comply with environmental regulations and DOE policies and to eliminate conditions that could lead to environmental problems, Y-12 has developed a comprehensive, long-term solid waste management program. Recent initiatives under the program include

- Additional waste-stream characterization.
- Development of waste-tracking data bases.
- Startup of a waste minimization program.
- Expansion of the groundwater monitoring program.
- Evaluation of underground storage tanks.
- Preparation of plans to close inactive, old, and substandard waste management units.
- Implementation of remedial activities, including preparation of remedial investigation plans.
- Evaluation of long-range waste management alternatives.

Y-12 is also in the process of obtaining RCRA Part B permits for facilities that are used, or will be used, to treat, store, or dispose of hazardous and mixed wastes. These facilities were included in Y-12's RCRA Part A permit application (last revised during spring 1987), and thus, active facilities are operating under RCRA interim status until permits are granted. Part B permit applications for several facilities have been submitted, and others are in preparation (refer to Tables 4-1 and 4-5 for submittal status). All the applications submitted to date are still pending, and therefore, no permits have been issued for any facility. All RCRA permits for hazardous and mixed waste facilities will be issued by the State of Tennessee. The state has authorization to regulate hazardous wastes and the hazardous components of radioactive mixed wastes.

Four facilities that are used, or will be used, for the treatment of hazardous wastewater constituents are considered by Y-12 to be exempt from 40 CFR 264 and 265 (i.e., do not require RCRA Part B permits) because they are either elementary neutralization units or wastewater treatment units as defined in Section 260.10 of RCRA. Y-12 submitted to the State of Tennessee a permit-by-rule notification for each of these facilities. Through these notifications, the facilities are deemed by the state to be RCRA permitted, at least until the state completes its review of the notification forms.

All of the waste management facilities at Y-12 are shown in Figures 4-1 through 4-5. Active and inactive facilities, and others that are being built or will be built, are included. All facilities are discussed in the following subsections. Table 4-2 lists all Y-12 waste management facilities, gives each an alpha-numeric identification, and provides a reference to the appropriate figure.

TABLE 4-1

**HAZARDOUS AND MIXED WASTE MANAGEMENT
UNITS TO REMAIN IN OPERATION
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**

Unit	Comment
Biodenitrification Facility (T-002)	Treats aqueous process (mixed) waste after neutralization and nutrient addition at the Oak Ridge Gaseous Diffusion Plant (ORGDP). Waste contains nitrate concentrations > 100 ppm and heavy metals. 4-5 percent of weight is solids. Treatment effluent is sent to the Decant Treatment Facility. Treatment sludges are sent to the West End Tank Farm for storage (refer to Table 4-5 and Section 4.1.2.2). A RCRA Part B permit application is to be submitted to the state.
West End Treatment Facility	Includes the West End Tank Farm and a rotary vacuum filter to dewater sludges from the biodenitrification and decant treatment facilities. The tank farm consists of nine 500,000-gallon carbon steel tanks. Six of the tanks are used as biodenitrification reactors, and three are used for storage of sludge from biodenitrification. Reactor effluents are sent to the Decant Treatment Facility. A RCRA Part B permit application has been submitted for this facility (also see Table 4-5 and refer to Sections 3.3.2.9 - 3.3.2.11).
Decant Treatment Facility (T-044)	Polishing unit to remove uranium from process waste after biodenitrification. Includes coagulation, flocculation, sedimentation, and filtration. Treatment effluent is discharged to East Fork Poplar Creek under an NPDES permit (refer to Sections 3.3.2.8 and 3.3.3.1). Treatment sludges are sent to the West End Tank Farm or ORGDP for storage. Permitted by rule; exempt from 40 CFR 264 and 265 requirements.
Central Pollution Control Facility I (CPCF-I, T-006)	Primary facility for batch treatment of non-nitrate process (mixed) wastes that are generated in various operations throughout Y-12. The wastes are trucked to the facility and placed in storage tanks to await treatment. Wastes treated in this system are acidic and caustic wastewaters; hydrogen fluoride scrubber solution; plating shop floor wastes; and mop waters containing oils, detergents and trace heavy metals. The treatment system contains processes for neutralization, chrome reduction, flocculation, precipitation, chemical oxidation, solid-liquid and liquid-liquid separations, and trace organic removal (using granular activated carbon adsorption). Treatment effluent is discharged to EFPC under an NPDES permit (refer to Sections 3.3.2.12 and 3.3.3.1). Treatment sludges are sent to ORGDP for storage. A RCRA Part B permit application has been submitted for this facility.

TABLE 4-1
HAZARDOUS AND MIXED WASTE MANAGEMENT
UNITS TO REMAIN IN OPERATION
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE
PAGE TWO

Unit	Comment
Cyanide Treatment Facility (T-005)	Treats cyanide wastes generated in various Y-12 operations, including wastes from the Metal Preparation Division Plating Shops and the Precious Metals Recovery Operations. The treatment process involves oxidation via alkaline chlorination in plastic-lined 55-gallon drums placed under an exhaust hood (refer to Section 3.3.2.7). Sufficiently treated wastes are shipped to the Bionitrification Facility. A RCRA Part B permit application has been submitted for this facility.
Waste Coolant Processing Facility (T-038)	Used to treat various coolants from non-special nuclear material machining operations. Coolants are water-based and contain depleted uranium, and RCRA-listed metals and solvents. Consists of an extended aeration and clarification system, waste sludge holding tanks, and dewatering equipment (refer to Section 3.3.2.14 for detail). Treatment effluent is discharged to EFPC under an NPDES permit. As soon as the new pretreatment system at the West End Treatment Facility is in operation (refer to Table 4-5), this discharge will be stopped, and the effluent will be taken there for polishing and eventual discharge. The dewatered sludge is sent to ORGDP until it can be incinerated in the ORGDP incinerator. This facility is permitted by rule (i.e., exempt from 40 CFR 264 and 265).
RCRA and Mixed Waste Storage and Staging Buildings (S-028)	Two adjoining buildings; 9401-6 is used to store only hazardous wastes, and 9720-31 is used to store both hazardous and mixed wastes. Both buildings are constructed of concrete block masonry walls and partitions with concrete slab floors sloped to grating-covered blind sumps. Wastes are stored in 55-gallon drums or small lab packs. The buildings are designed to store all categories of hazardous and mixed wastes, including PCB wastes, that could be generated at Y-12 (except enriched uranium). Each building has seven rooms for segregation by waste class. Building 9401-6 has a floor area of 3,000 sq ft and a volume of 31,000 cu ft. Building 9720-31 has a floor area of 3,700 sq ft and a volume of 40,000 cu ft. A RCRA Part B permit application has been submitted for this facility.

TABLE 4-1
HAZARDOUS AND MIXED WASTE MANAGEMENT
UNITS TO REMAIN IN OPERATION
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE
PAGE THREE

Unit	Comment
Building 9720-9 Storage Facility (S-031)	An 11,900 sq ft prefab warehouse; the western half is used to store hazardous and uranium-contaminated wastes, including cleanup wastes. The facility can provide storage of approximately 500 55-gallon drums. All classes of RCRA wastes, except "K" wastes (40 CFR 261.32), can be stored in the facility. Flammable wastes are stored in a separate room (Bay No. 1). The general storage area is intended to store primarily PCB- and mercury-contaminated wastes and electrochemical machining sludge. Areas used to segregate incompatible wastes are separated by wooden dikes. A RCRA Part B permit application has been submitted for this facility.
Building 9409-5 Storage Facility (S-017)	A former cooling tower basin composed of two separate tank storage facilities. The eastern facility contains two 10,000-gallon tanks and two 30,000 gallon tanks used to store waste oil and solvents that are to be recycled. The western facility contains four 5,600 gallon tanks used to store tetrachloroethene and oil contaminated with enriched uranium. A RCRA Part B permit application is to be submitted to the state.
Building 9811-1 Storage Facility (S-021)	Consists of a tank storage area and a container storage and staging area. The tank area consists of a 51-foot by 17-foot concrete diked area which contains a 550-gallon storage tank, a 10,000-gallon storage tank, and a process sump. The tanks store oil/water mixtures contaminated with RCRA-listed solvents. The storage/staging area is a 65-foot by 75-foot curbed concrete pad designed to store up to 1,000 55-gallon drums. Wastes passing through this facility originate from a variety of Y-12 operations and are shipped off-site for disposal or reclamation. A RCRA Part B permit application has been submitted for this facility.

Source: DOE Environmental Survey team, 1987. Adapted from various Y-12 documents, including RCRA Part B permit applications.

2

WASTE MANAGEMENT FACIL
Y-12 PLANT,

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FIGURE

IES IN OAK RIDGE Y-12 PLANT VICINITY
AK RIDGE RESERVATION

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Y-12 PLANT, WESTERN SECTION
Y-12 PLANT, OAK

FIGURE 4-

WASTE MANAGEMENT FACILITIES
RIDGE RESERVATION

2

Y-12 PLANT, CENTRAL SECTION
Y-12 PLANT, OAK

FIGURE 4-

WASTE MANAGEMENT FACILITIES
RIDGE RESERVATION

2

Y-12 PLANT, EASTERN SECTION,
Y-12 PLANT, OAK

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FIGURE 4-5

WASTE MANAGEMENT FACILITIES
RIDGE RESERVATION

TABLE 4-2

WASTE MANAGEMENT FACILITIES*
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE

Facility	Identification	Figure
ACN Drum Yard	S-015	4-3
Bear Creek Burial Ground	D-024	4-2
Beta-4 Security Pits	D-100	4-3
Biodenitrification Facility	T-002	4-4
Building 9212 Tank Farm	S-041	4-4
Building 9404-7 Drum Storage Facility	S-016	4-4
Building 9409-5 Storage Facility	S-017	4-5
Building 9418-3 Uranium Vault	D-115	4-4
Building 9720-9 Storage Facility	S-031	4-4
Building 9818 Recycling Unit	R-110	4-4
Building 9811-1 RCRA Storage Facility	S-021	4-3
Burnhouse (waste paper incinerator)	T-123	4-4
Central Pollution Control Facility	T-006	4-4
Chestnut Ridge Borrow Area Waste Pile	S-042	4-1
Chestnut Ridge Sediment Disposal Basin	D-025	4-1
Chestnut Ridge Security Pits	D-023	4-1
Chestnut Ridge Uranium Oxide Vaults	S-114	4-1
Coal Ash Pond	D-112	4-1
Coal Pile Trench	D-104	4-3
Cyanide Treatment Facility	T-005	4-3
Decant Treatment Facility	T-044	4-3
East Chestnut Ridge Waste Pile	S-043	4-5
Garage Underground Tanks	S-019	4-5
Hazardous Chemical Treatment Area (Includes Burn Yard and Bone Yard)	D-024HC	4-2
Interim Drum Yard	S-030	4-3

TABLE 4-2
WASTE MANAGEMENT FACILITIES*
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE
PAGE TWO

Facility	Identification	Figure
Kerr Hollow Quarry	T-012	4-1
Line Yard	S-120	4-5
Liquid Organic Waste Storage Facility	S-040	4-2
New Hope Pond	T-010	4-1, 4-5
Oak Ridge Sewage Sludge Landfarm	ORSSL	4-1
Oil Land Farm	T-014	4-2
Oil Retention Pond No. 1	T-008	4-2
Oil Retention Pond No. 2	T-009	4-2
Old Steam Plant Waste Storage Area	S-029	4-5
Plating Rinsewater Treatment Facility	T-036	4-4
Preco Incinerator	T-001	4-3
Ravine Disposal Site	D-105	4-5
RCRA and Mixed Waste Storage and Staging Building	S-028	4-3
Rogers Quarry	D-108	4-1
Roofing Waste Pile	S-122	4-3
Rust Spoil Area	D-106	4-2
S-2 Site	D-103	4-3
S-3 Ponds	T-004	4-1, 4-3
Salvage Yard Oil and Solvent Storage Area	S-020	4-3
Salvage Yard Scrap Metal Storage Area	S-111	4-3
Sanitary Landfill I	D-101	4-2
Sanitary Landfill II	D-102	4-1
Spoil Area I	D-107	4-3
Steam Plant Wastewater Treatment Facility	T-037	4-3
Storm Sewer Sediment Drying Facility	T-118	4-1

TABLE 4-2
WASTE MANAGEMENT FACILITIES*
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE
PAGE THREE

Facility	Identification	Figure
Third Street Soil Pile	S-116	4-4
Trash Monitoring Station	TMS	4-3
United Nuclear Landfill	D-026	4-1
Uranium Chip Oxidation Facility	T-113	4-3
Waste Coolant Processing Facility	T-038	4-3
Waste Machine Coolant Biodegradation Facility	T-003	4-3
Waste Material Preparation Facility	T-013	4-3
Waste Oils/Solvent Storage Facility	S-039	4-2
Waste Z-Oil Tank	S-121	4-4
West End Treatment Facility	T-007	4-3
81-10 Soil Pile	S-117	4-4

Source: DOE Environmental Survey, 1986.

- * Facilities are listed in alphabetical order. They include active and inactive facilities, and others that are being built or will be built.

4.1.2 General Description of Pollution Sources/Controls

4.1.2.1 Hazardous Wastes

A DOE inventory identified 173 hazardous waste streams being generated from 12 facilities within Y-12 (DOE, 1985d). Many of these wastes are mixed wastes and are discussed in Section 4.1.2.2. The most common nonradioactive, hazardous wastes are waste organic solvents, waste chemicals (e.g., spent laboratory reagents and residues of commercial chemicals); and mercury- and PCB-contaminated materials (Table 4-3). PCB liquid and solid wastes are discussed in detail in Section 4.2.1.3. Hazardous wastes generally are collected, stored on-site, analyzed for RCRA characteristics, monitored for radioactivity, and then shipped off-site for commercial disposal or recycling. Examples of hazardous wastes sent off-site for disposal, and commercial treatment, storage and disposal firms currently used are listed below:

Hazardous Waste	Commercial Treatment, Storage, and Disposal Firm
Cyanide and DOT "Other Regulated Materials"	Rollins Environmental Services (LA), Inc., Baton Rouge, Louisiana.
Waste oils contaminated with organic solvents	Oldover Corporation, Norwood, North Carolina, and Cascade, Virginia.
Laboratory packs of hazardous substances	Chemical Waste Management, Inc., Emelle, Alabama.
PCB-contaminated equipment and solid waste	Rollins Environmental Services (TX), Inc., Deer Park, Texas.
PCB-contaminated oils	SCA Chemical Services, Inc., Chicago, Illinois; ENSCO, Inc., El Dorado, Arkansas.

Some hazardous process waste streams (e.g., nitrate wastes, non-nitrate wastes, plating wastes, and coolants) are also treated on-site. (Wastewater treatment and discharge are discussed in detail in Sections 3.3.2 and 3.3.3.1.) In addition, certain potentially explosive chemicals and water-reactive metals are treated/disposed of at Kerr Hollow Quarry.

TABLE 4-3

HAZARDOUS, NONRADIOACTIVE WASTE GENERATION
AT Y-12 (1985)
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE

Waste Type ¹	Quantity (kg) ²	Disposition
Waste Solvents	unknown ³	Commercial Disposal or Recycling
Waste Chemicals	58,300	Commercial Disposal or Recycling
PCB Liquid Waste	327,900	Commercial Disposal
PCB Solid Waste	137,000	Commercial Disposal
Total	523,200	

Source: Adapted from MMES, 1986a.

- 1 Waste solvents and chemicals are generated in most process buildings throughout the plant. Sources of PCB wastes are discussed in Section 4.2.1.3.
- 2 Quantities represent amounts shipped off-site.
- 3 The total amount of both radioactive and nonradioactive waste solvents is presented in Table 4-7. No data for hazardous, nonradioactive waste solvents only were available in Y-12 documents or at the time of the on-site Survey.

There are 17 active facilities at Y-12 that are currently being used to store, treat, or dispose of hazardous (and/or mixed) wastes. Eight of these facilities are to be permitted under the Tennessee hazardous waste management program, and two are permitted by rule (i.e., exempt from 40 CFR 264 and 265; Table 4-1). Seven of the active facilities are to be closed in accordance with RCRA standards (Table 4-4). Seven other facilities are being built, or will be built in the near future (Table 4-5).

All together, 15 units will be closed (Table 4-4). In addition to the seven active units to be closed, another eight will be closed that are currently inactive. All 15 facilities are to be investigated by Y-12 regarding closure plans to determine if there is any contamination having resulted from their operation and to evaluate the extent of any cleanup necessary.

Y-12 had also planned to close New Hope Pond (T-010) under RCRA. However, according to Y-12 personnel, Y-12 decided in early 1987 that it would not implement the plan and deleted the pond from the plant's RCRA Part A permit application. Y-12 made this decision because the state does not consider the pond to be a RCRA waste management unit, but rather a body of water to be regulated under the Clean Water Act (i.e., all discharges to EFPC and New Hope Pond are regulated under Y-12's NPDES program; refer to Section 3.3.3.1). EPA Region IV may not agree and may require that the pond be permitted or closed. The Chestnut Ridge Sediment Disposal Basin (CRSDB, D-025), which has received sediments dredged from the pond, may also have to be permitted as a RCRA waste management unit if it is to receive pond sediment in the future, or closed under RCRA if its use is discontinued. Sediments in CRSDB do not possess hazardous characteristics (i.e., they are not ignitable, reactive, corrosive, or toxic as defined by RCRA), but New Hope Pond has received discharges of RCRA-regulated waste streams in the past. Cyanide and phenol were detected in pond sediment, and liquid wastes containing alcohol and toluene were disposed of in CRSDB in 1975 (approximately 100,000 gallons resulting from a leak in the Y-12 methanol-brine system; Battelle, 1985b). Additional hazardous constituents may be present in the sediment from past discharges to EFPC and New Hope Pond. The sediments disposed of at CRSDB also contain uranium (100-300 ppm). Y-12 deleted CRSDB from its RCRA Part A permit application and withdrew its RCRA Part B permit application (see Sections 4.1.2.2 and 4.1.2.4). The facility is an unlined, man-made surface impoundment designed to hold approximately 30,000 cubic yards of sediment. Since its construction in 1972-1973, it has received approximately 10,000 cubic yards of New Hope Pond sediment.

TABLE 4-4

**WASTE MANAGEMENT UNITS TO BE CLOSED
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**

Unit	Comments
Kerr Hollow Quarry (T-012)	Receives potentially explosive chemicals and water-reactive metals (primarily sodium, lithium, and potassium) from Y-12, ORNL, and ORAU. In the past also received compressed gas, cylinders, and other hazardous wastes. The quarry is filled with water that discharges to the Melton Hill Lake on the Clinch River (refer to Sections 3.3.2.2 and 3.3.3.1). No closure plan had been prepared at the time of the on-site Survey, and therefore, no date had been established for initiation of closure activities.
Chestnut Ridge Security Pits (D-023)	Two pits used since 1973 for the disposal of solid and liquid wastes. Two of the four trenches in the western pit are still active for low-level radioactive waste and nonhazardous waste. The inactive trenches received hazardous and mixed wastes through 1984. They were covered with 3 to 4 feet of dirt. In active trenches, wastes are covered daily by 6 to 12 inches of dirt. Associated with the eastern pit are six auger holes, each approximately 2 ft in diameter by 10 ft deep. Two of these are still in use. The auger holes are used for the disposal of various waste materials, including powder mixtures. This facility will be used until a new classified waste disposal facility becomes available. Closure of the three inactive trenches in the eastern pit is scheduled to begin in 1988. Closure of the four trenches in the western pit is scheduled to begin in 1989. The major closure activity planned involves emplacement of a low-permeability cover over clean soil cover.
Bear Creek Burial Ground (BCBG; D-024)	Active areas receiving uranium metal wastes and uranium-contaminated trash. Received radioactive, hazardous, and mixed liquid and solid wastes in the past including PCB oils. For details refer to Sections 4.1.2.3 and 4.5.2.1. The scope of the closure plan includes excavation of contaminated stream sediments and installation of surface drains, buried drains, recovery wells, and an engineered cap to reduce/intercept leachate. A groundwater and surface water monitoring system will also be installed. Closure will begin following completion of an Environmental Impact Statement (EIS) and receipt of Federal funding.

TABLE 4-4
WASTE MANAGEMENT UNITS TO BE CLOSED
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE
PAGE TWO

Unit	Comments
Oil Retention Ponds (T-008 and T-009)	Constructed to collect uranium- and PCB-contaminated oils leaching from Bear Creek Burial Ground. Oil is skimmed off the top; current accumulation is < 50 gallons. Pond water is discharged to Bear Creek via surface flow, and percolation and subsequent exfiltration. For details refer to Sections 3.3.2.5 and 4.5.2.1. Y-12 is working to close the ponds before November 1988 when RCRA amendments require that surface impoundments be closed or lined.
Oil Landfarm (T-014)	Inactive; used to biodegrade approximately 1 million gallons of waste oils and coolants. Contaminated with radioactive and hazardous wastes. For detail refer to Section 4.5.2.1. Closure will involve excavation of soils, installation of a leachate collection system, in-situ biodegradation of remaining oils and greases, and groundwater monitoring. If it is not possible to achieve full and complete removal and decontamination, installation of an engineered cap would be required to prevent further contamination of the environment. Closure activities are planned to begin following completion of an EIS and receipt of Federal funding.
Hazardous Chemical Disposal Area and Bone Yard/Burn Yard (D-024 HC)	The disposal area was used from 1975 to 1981 to react reactive and explosive chemicals and to neutralize gases from leaking gas cylinders. The burn yard/bone yard was used from 1943 to 1970 to collect, burn, and dispose of various wastes, including hazardous wastes. For detail refer to Section 4.5.2.1. Closure activities will be conducted as part of closure activities for the oil landfarm; the scope of activities will be similar.
Sanitary Landfill I (D-101)	An inactive sanitary/industrial landfill operated between 1968 and 1983; it may have received hazardous and mixed wastes. The landfill was closed in 1984. Additional closure activities/investigations will be conducted as part of closure activities for the oil landfarm.
S-3 Ponds (T-004)	Inactive; 4 unlined impoundments for treatment/disposal of various radioactive, hazardous, and mixed liquid wastes. Liquids were removed and treated. Contain approximately 26,000 yd ³ of sludge. For detail refer to Sections 3.3.2.5 and 4.5.2.1. The closure plan involves backfilling, installation of an engineered cap, and groundwater monitoring. Y-12 is working to close the ponds before November 1988, when RCRA amendments require that surface impoundments be closed or lined.

TABLE 4-4
WASTE MANAGEMENT UNITS TO BE CLOSED
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE
PAGE THREE

Unit	Comments
Waste Machine Coolant Biodegradation Facility (T-003)	Inactive; used to treat various coolants from non-special nuclear material machining operations. Coolants are water-based and contain depleted uranium, and RCRA-listed metals and solvents. The facility consists of three storage tanks and a feed tank; a 30,000-gallon elevated concrete reactor and settling basin; two steel sludge evaporation tanks, miscellaneous piping, and two tile drain fields. The closure plan includes removal of all RCRA hazardous wastes, decontamination of the reactor and associated process equipment, and excavation of any contaminated soil and gravel. Closure activities are to be initiated during 1987.
Prencro Incinerator (T-001)	Inactive; used to burn waste acetonitrile (ACN). The closure plan includes disassembly, decontamination, and removal of the incinerator and associated equipment. Closure activities are to be initiated during 1987.
ACN Drum Yard (S-015)	Inactive; a 50- by 116-foot outdoor gravel area used to store containerized waste ACN. Drums have been removed. The closure plan includes sampling, analysis, and, if necessary, removal of contaminated soil and gravel. Closure activities are to be initiated during 1987.
Old Steam Plant Waste Storage Area (S-029)	Inactive; a 50- by 60-foot area on the ground floor used to store discarded or partially used laboratory chemicals (i.e., only hazardous wastes). All waste was removed to an off-site disposal facility in 1984. Closure, consisting of decontaminating the area concrete floor, was in progress during the on-site Survey.
Two Garage Underground Tanks (S-019; tank nos. 0834-U and 0835-U)	In-service steel tanks; used for storage of oil contaminated with uranium, PCB, and/or solvents (refer to Table 4-6). The closure plan includes inventory removal, soil sampling and analysis for contamination, and tank decontamination. If the soil is contaminated, it will be removed, and analysis of area groundwater will be conducted. Closure is expected to begin in 1988.

TABLE 4-4
WASTE MANAGEMENT UNITS TO BE CLOSED
Y-12 PLANT OAK RIDGE RESERVATION, TENNESSEE
PAGE FOUR

Unit	Comments
Salvage Yard Oil and Solvent Storage Area (S-020)	Two outdoor unsheltered gravel pads. The eastern pad (170 by 85 feet) is active; contains approximately 2,800 drums (30- and 55-gallon) of oil, solvents, and oily sludges, some of which are uranium-contaminated. The western pad (160 by 85 feet) contained PCB waste oils, which have been removed. The closure plan includes waste removal; sampling and analysis of soil, gravel, and groundwater; and removal of any contaminated soil and gravel. Closure of the western pad has been initiated. The eastern portion reportedly will remain in operation until 1988 and then will be closed.
Interim Drum Yard (S-030)	An active gravel storage area containing approximately 1,200 drums on wooden pallets. Wastes include ACN, mercury-contaminated material, sludge from the Waste Coolant Processing Facility, electrochemical machining sludge, plating solution, PCB-contaminated materials, and solvents. The closure plan includes waste removal, sampling, analysis, and, if necessary, removal of contaminated soil and gravel. Partial closure of a 25-foot-wide strip across the southern end of the yard was initiated in 1986 as part of a plant security project; the remaining area will be closed during 1988.

Source: DOE Environmental Survey team, 1987. Adapted from various Y-12 documents, including RCRA Closure Plans.

TABLE 4-5

FUTURE WASTE-MANAGEMENT FACILITIES¹
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE

Unit	Comments
West End Treatment Facility (T-007)	At present, the nitrate-containing wastes are transported to ORGDP for pretreatment and then transported back to the Y-12 Site for biodenitrification. A new facility is being constructed to pretreat the waste prior to biodenitrification. The system will provide pH adjustment, cyanide removal, precipitation of heavy metals, and addition of the desired nutrients (for detail refer to Section 3.3.2.11). A RCRA Part B permit application has been submitted for this facility (also see Table 4-1).
Plating Rinsewater Treatment Facility (T-036)	A separate facility will go on line to treat plating rinsewaters from Y-12 plating shops (i.e., metal removal and cyanide destruction). During the on-site Survey, plating rinsewaters were discharged directly to EFPC (refer to Section 3.3.2.13 for detail). Effluent from this facility will be mixed with CPCF-I effluent for discharge to EFPC. This facility will be permitted by rule (40 CFR 270.60) and therefore will not require a RCRA Part B permit.
Steam Plant Wastewater Treatment Facility (T-037)	This facility will treat acidic and caustic waste streams from the steam plant, including coal pile runoff and regenerate from demineralizers. Treatment will involve neutralization. Effluent will be discharged to EFPC under an NPDES permit. Coal pile runoff is currently not controlled, and regenerate is discharged to EFPC after pH adjustment (refer to Section 3.3.2.15 for detail.) This facility will be permitted by rule and therefore will not require a RCRA Part B permit.
Liquid Organic Waste Storage Facility (S-040)	This facility is to be built west of the plant for storage of flammable solvents until they are disposed of or recycled commercially. Flammable solvents are currently being stored in various locations in the plant (refer to Tables 4-1 and 4-4). Details on the facility were not available to the DOE Survey team during the on-site Survey. A RCRA Part B permit application is still to be submitted for this facility.

TABLE 4-5
FUTURE WASTE MANAGEMENT FACILITIES¹
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE
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Unit	Comments
Waste Oils/Solvent Storage Facility (S-039)	This facility is to be built at the west end of the plant for storage of PCB-contaminated oils containing various concentrations of organic solvents and uranium. Some of these oils are currently being stored in the two garage underground tanks (Table 4-4). The facility will include a concrete diked area with pads to support six 40,000-gallon storage tanks, process sumps and auxiliary piping, a sump and sump pump, and instrumentation. It is also to include a truck transfer station, which will contain a temporary storage area (12 x 18 feet) for thirty-two 55-gallon drums. Curbs are to be installed for spill containment. A RCRA Part B permit application has been submitted.
Building 9212 Tank Farm (S-041)	This facility will be built at the west end of the plant for storage of acids and caustic wastes (i.e., pickling waste, acid waste from nitric acid and aluminum nitrate recovery areas, process condensate, and caustic wastes from uranium recovery areas). These wastes are currently collected in tank trucks and in a tank located in the basement of Building 9818. The facility is to include four 10,000-gallon stainless-steel tanks (i.e., one for each of the waste types), four process sumps, a sump and sump pump, a containment basin, and associated piping. Waste materials will be transferred into the tanks via piping from the process areas in which they originate. The process condensate will be pumped from Tank F-33 to the nitric acid recovery system. The remaining three streams will be transferred from the tanks by tankers to either the West End Treatment Facility or the Central Pollution Control Facility. A RCRA Part B permit application has been submitted.
East Chestnut Ridge Waste Pile (S-043)	This unit is to be located at the east end of the plant for storage of hazardous wastes to be generated during site cleanups and facility closures. Details on the facility were not available to the DOE Survey team at the time of the on-site Survey. A RCRA Part B permit application is still to be submitted for this unit.

Source: DOE Environmental Survey team, 1987. Adapted from various Y-12 documents, including RCRA Part B permit applications.

¹Facilities being built or already designed and to be built in the near future.

Y-12 also prepared a RCRA Part B permit application for the Chestnut Ridge Borrow Area Waste Pile (CRBAWP, S-042) (Battelle, 1985c). This site was created after clay soil was excavated for various plant projects and contains mercury-contaminated soil from cleanup projects (see Section 4.1.2.4). The state, however, has decided that the waste material is not hazardous and that the site should be managed as an industrial landfill (according to Y-12 personnel). Mercury concentrations are below the RCRA toxic characteristic level (i.e., mercury concentrations in leachate from the EPA extraction procedure did not exceed 0.2 mg/l). Therefore, Y-12 deleted CRBAWP from the RCRA Part A application and withdrew its RCRA Part B permit application. The site occupies an area approximately 200 by 70 feet and is lined with a single sheet of PVC liner. Approximately 3,200 cubic yards of mercury-contaminated soil was placed in CRBAWP during 1984-1985. The waste pile is below the original site grade and covered by plastic.

In addition to the inactive sites to be closed per RCRA standards (listed in Table 4-4), there are four other inactive sites at Y-12. All are discussed in detail in Section 4.5.2 as existing or possible sources for the release of hazardous substances and environmental contamination. Three are known to have received hazardous wastes (i.e., the Beta-4 Security Pits, D-100; the Coal Pile Trench, D-104; and the S-2 Site, D-103). The fourth site is suspected of having received hazardous wastes (i.e., the Ravine Disposal Site, D-105). None of these sites need to be closed in accordance with RCRA standards because they were taken out of service prior to 1980. Site cleanup/remediation, however, may be required to comply with CERCLA requirements.

Furthermore, there are three facilities used to store hazardous PCB wastes (i.e., Building 9404-7 Drum Storage Facility, S-016; the Line Yard, S-120; and the Waste Z-Oil Tank, S-122). These facilities are not subject to RCRA regulations. Building 9404-7 and the Line Yard are discussed in the report section that addresses PCBs (Section 4.2.1.3). The Waste Z-Oil Tank is discussed in Section 4.5.2.3, which discusses the Z-Oil system.

There are also 20 underground storage tanks (USTs) that currently contain wastes, some of which are hazardous or mixed. In addition, there are three out-of-service waste tanks and another one that has been removed (refer to Section 4.5.2.3). An inventory of in-service and out-of-service waste USTs is presented in Table 4-6. Eighteen of these tanks were reported per RCRA Subtitle I requirements because they were in service during 1974 or later. Two active tanks (2103-U and 2132-U) were not reported because they had not been installed at the time Y-12 prepared its RCRA UST notification inventory. Two other USTs, which contain PCB-contaminated waste oil, are regulated under RCRA Subtitle C.

TABLE 4-6

**UNDERGROUND STORAGE TANKS USED FOR WASTES
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**

Tank No.	Age (Years)	Capacity (Gallons)	Content	Tank Material	Corrosion Protection	Status
0074-U	18	250	Mop water	Concrete	N/A	In service
0084-U	29	500	Used oil	Steel	Coated	In service
0688-U	25	3,000	Beryllium-contaminated waste	Steel	Coated	In service
0690-U	15	3,250	Uranium-Contaminated mop water	Steel	No	In service
0834-U	12	20,000	PCB-contaminated waste oil	Steel	Coated	In service
0835-U	25	10,000	PCB-contaminated waste oil	Steel	No	In service
0836-U	25	10,000	Used oil	Steel	No	In service
2063-U	8	1,000	Waste solvents and oils	Concrete	N/A	In service
2064-U	41	1,000	Laboratory waste contaminated with beryllium	Steel	Nq	Taken out of service in 1955
2065-U	14	500	Waste coolant	Steel	No	In service
2066-U	14	500	Waste coolant	Steel	No	In service
2067-U	14	500	Waste coolant	Steel	No	In service
2069-U	36	1,000	Building drain	Steel	No	In service
2070-U	36	1,000	Building drain	Steel	No	In service
2071-U	36	1,250	Building drain	Concrete	N/A	In service
2072-U	24	55,000	Uranium oxide	Concrete	N/A	In service

TABLE 4-6
UNDERGROUND STORAGE TANKS USED FOR WASTES
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE
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Tank No.	Age (Years)	Capacity (Gallons)	Content	Tank Material	Corrosion Protection	Status
2100-U	41	30,000	Mercury-contaminated water	Concrete	N/A	In service
2101-U	41	32,000	Mercury-contaminated water	Concrete	N/A	Taken out of service in 1986
2103-U	1	550	Building drain	Fiberglass	N/A	In service
2104-U	36	32,000	Mercury-contaminated water	Concrete	N/A	In service
2105-U	18	300	Liquid waste contaminated with beryllium oxide	Stainless steel	No	Taken out of service in 1984
2116-U	Unknown	2,500	Etching waste	Steel	No	Taken out of service in 1970 - removed
2129-U	3	239,360	Uranium oxide	Concrete	N/A	In service
2132-U	1	550	Building drain	Fiberglass	N/A	In service

Source: DOE Environmental Survey team, 1987. Adapted from Y-12's inventory of underground storage tanks, 1986.

N/A = Not applicable

Several USTs could be leaking or could have leaked while in service. These leaks could have caused environmental contamination (refer to Section 4.1.3.3). Eight of the USTs are made of steel, have no corrosion protection, and have, or had, been in service for 15 years or more. Eight tanks are made of concrete. Concrete tanks, and steel tanks without corrosion protection and 15 years or older have a high probability of having leaked. During the on-site Survey, Y-12 was evaluating its USTs to verify tank contents, determine leakage probabilities, and locate leak evidence. Results will be used to determine if certain tanks need to be replaced and if any areas need to be cleaned up.

Waste generators (production divisions) and three nonproduction entities manage hazardous and other waste generated at Y-12. Waste Treatment Operations is responsible for the management of routine liquid process wastes and wastewater treatment sludges. Waste generators are responsible for the characterization, segregation, and containerization of other wastes (e.g., putting wastes into drums, lab packs, boxes, or dumpsters). All new wastes are to be managed as if they are hazardous or mixed until characterization has been completed, although many waste drums were observed by the DOE Survey team to have been stored inadequately outside of buildings for long periods of time (refer to Section 4.1.3.4). Wastes going off-site for treatment or storage at ORGDP and ORNL, or for disposal or recycling at a commercial facility, are to be packaged and labeled to meet United States Department of Transportation (DOT) requirements. Traffic personnel are to prepare all the required shipping documents and to inspect waste packages and vehicles to ensure compliance. Waste Transportation, Storage and Disposal (WTSD) personnel pick up and transport wastes to be stored or disposed of at Y-12, ORGDP, or ORNL. The DOE Survey team determined that WTSD and Traffic personnel also track wastes from their generation source to their disposal point, whether on-site or off-site. They maintain comprehensive data bases on wastes. These data bases identify wastes by source, waste stream composition, RCRA characteristics, generation rate, management method, and by-product/mixed waste classification. Waste movements are tracked by various forms and logs, entered into the appropriate data bases, and verified in the field by WTSD personnel. In addition, WTSD personnel inspect waste storage facilities weekly and record findings in logs that are kept for each facility.

Y-12 also trains personnel in the management of hazardous waste. Environmental officers, who work for the various Y-12 divisions, train division personnel in the identification, handling, and segregation of various waste types. Drivers of waste-carrying vehicles are DOT-trained. Operators of waste treatment facilities receive detailed instruction in the operation of these facilities. In addition, Y-12 has prepared several procedures and manuals for on-site management and off-site disposal of hazardous wastes.

From interviews with plant personnel, the Survey team determined that there are more than 16 divisional environmental officers at Y-12. They have several responsibilities in addition to training their division personnel. These include

- Maintaining an awareness of all of their division's wastes.
- Inspecting drum accumulation, waste packaging, and labeling.
- Reviewing environmental incident reports.
- Reviewing implementation of the waste minimization program.
- Assuring that their divisions are in compliance with waste management policies and regulations.
- Interfacing with Health, Safety, Environment and Accountability Division personnel (e.g., personnel from Environmental Management, Waste Treatment Operations, and Waste Transportation, Storage, and Disposal).

One of the environmental officers is responsible for the ORNL facilities located within the Y-12 complex. Each ORNL division also has an Environmental Protection Officer.

4.1.2.2 Mixed Wastes

Many of the Y-12 wastes, including process wastewaters, are mixed (i.e., radioactive and hazardous). Twenty-nine mixed wastes were reported in the 1985 Hazardous Waste Generation Summary Report to the state. Some of the aqueous process wastes (i.e., nitrate wastes, non-nitrate wastes, and waste coolants) are treated on-site and discharged to East Fork Poplar Creek as nonhazardous effluents, which are regulated under NPDES permits (see Section 3.3.3.1). Other aqueous process wastes (i.e., some nitrate wastes) are transported in tank trucks to ORGDP for neutralization and nutrient addition, and then trucked back to Y-12 for additional treatment and discharge. Wastewater treatment sludges are regulated under RCRA as mixed wastes and are stored on-site or at ORGDP. Other mixed wastes include machining wastes; magnesium chips; oils contaminated with uranium, solvents and/or PCBs; and used clarifier filters from the decant treatment facility. Quantities of mixed wastes generated at Y-12 are listed in Table 4-7. Several of the facilities listed in Tables 4-1 and 4-4 handle the process and non-process mixed wastes mentioned in this section, including

- Bionitrification Facility (T-002).
- West End Treatment Facility (T-007).
- Decant Treatment Facility (T-044).

TABLE 4-7

**MIXED WASTE GENERATION AT Y-12 (1985)
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**

Waste Type	Quantity (kg) ¹	Disposal ²
Waste Oil	58,400	On-site Storage
Waste Solvents ³	70,600	On-site Storage
PCB Liquid Waste	50,600	On-site Storage
PCB Solid Waste	118,000	On-site Storage
DOT ORM-B Wastes ⁴	3,560,000	On-site Storage
RCRA Waste Chemicals	261,800	On-site Storage
TOTAL	4,119,400	

Source: MMES, 1986a.

- ¹ Quantities represent amounts added to storage inventory during 1985.
- ² Wastes stored on-site (i.e., not commercially disposed of or recycled, or sent to Bear Creek Burial Ground or Sanitary Landfill II) are assumed to be mixed wastes. Most are to be incinerated at ORGDP when the incinerator becomes operational and permitted.
- ³ Some of the solvents are nonradioactive, but no data for radioactive waste solvents only are available (refer to Table 4-3).
- ⁴ U.S. Department of Transportation (DOT) Other Regulated Material (ORM) - Category B Wastes, which have a reportable quantity of 100 pounds (40 CFR 172). Includes process and wastewater treatment sludges. Most sludges from biological treatment processes are suitable for incineration. Metal-bearing sludges could be either stabilized or delisted.

- Central Pollution Control Facility (T-006).
- Waste Coolant Processing Facility (T-038).
- Various waste storage tanks and drum storage buildings (S-017, S-020, S-028, and S-031).

In addition, some underground storage tanks (USTs) may store mixed wastes (refer to Section 4.1.2.1 and Table 4-6). During the on-site Survey, Y-12 had initiated a program to evaluate USTs, including analysis of tank contents to determine waste types and required tank management.

Mixed wastewater treatment sludges are generated on-site at the five treatment units listed above. According to plant personnel, approximately 500,000 gallons of sludge are generated annually at the rotary vacuum filter, which dewateres sludge from the biodegradation and decant treatment facilities. This mixed waste sludge is stored in three 500,000-gallon tanks located at the west end of the plant site. Four additional tanks will be constructed by 1988, and eight more will be constructed in the future. Dewatered sludge from the Decant Treatment Facility is also stored at ORGDP. The Central Pollution Control Facility generates approximately 1,250 gallons of sludge and carbon waste per week, and the Waste Coolant Processing Facility generates approximately 50 gallons of sludge per month. Both of these mixed waste sludges are shipped to ORGDP for storage. Their generation and movement are tracked by a data base maintained by Waste Treatment Operations. Approximately 20,000 gallons of sludge have been shipped or are awaiting shipment to ORGDP. Sludges from Central Pollution Control Facility and the Decant Treatment Facility are temporarily stored outside these facilities before shipment. Sludges from the Waste Coolant Processing Facility are temporarily stored at the Interim Drum Yard.

Y-12 is evaluating various long-range sludge management strategies (MMES, 1985a). New waste treatment facilities (refer to Table 4-5) will be generating additional sludge, and storage capacities at Y-12 and ORGDP are limited. As part of one strategy, Y-12 is in the process of preparing petitions to "delist" sludges that are not RCRA-toxic (i.e., that pass the extraction procedure test in accordance with 40 CFR 261) but that contain low concentrations of RCRA-listed wastes. If such sludges are delisted, they can be managed as nonhazardous, radioactive wastes. Y-12 is also conducting treatment feasibility studies to render Y-12 sludges nonhazardous or to reduce radioactivity levels below a minimum threshold so that they can be managed as either radioactive or hazardous wastes, respectively, rather than mixed wastes. In addition, the feasibility of stabilizing sludges in grout matrix and glass matrix is being investigated.

Many of the wastes from cleanup operations may have to be managed as mixed wastes. Cleanup operations include closure of mixed waste management units (e.g., some units listed in Table 4-4),

cleanup of past spills/releases (see Section 4.5.2), and decommissioning of old production/process units. Wastes could include contaminated soil, sediment, and equipment. Sediments in New Hope Pond (T-010) and in the Chestnut Ridge Sediment Disposal Basin (CRSDB, D-025) may be considered as mixed waste (see Sections 4.1.2.1 and 4.1.2.4). The pond received RCRA-regulated waste streams, and uranium concentrations in the sediments are high enough for the sediments to be considered radioactive, 100-300 ppm (Battelle, 1985b). According to plant personnel, Y-12 has proposed additional dredging of New Hope Pond but is presently awaiting resolution of regulatory differences of opinion between the State of Tennessee and EPA Region IV regarding disposition of the dredged material. Y-12 plans to construct a new RCRA waste management unit for wastes from future cleanup operations. (i.e., East Chestnut Ridge Waste Pile, S-043--refer to Table 4-5).

4.1.2.3 Radioactive Wastes

Production activities at Y-12 generate large quantities of nonhazardous, solid waste that is contaminated with low levels of radioactivity. This waste includes depleted uranium metal, depleted uranium turnings (chips) and fines, surface-contaminated scrap metal, general process facility refuse, contaminated building rubble and construction debris, and classified items. Quantities generated are presented in Table 4-8. Uranium is the principal radioactive contaminant, although small quantities of waste containing thorium, fission products, and transuranic nuclides have been and are being generated (MMES, 1985a). The radioactivity of these nuclides is below 100 nanocuries per gram. In addition, ORNL facilities located within the Y-12 complex generate small quantities of low-level radioactive wastes, some of which contain transuranic nuclides. All ORNL radioactive wastes generated within Y-12 are shipped to the ORNL site for treatment, storage, or disposal; none are handled at Y-12 facilities. No high-level or transuranic radioactive wastes are generated or disposed of within the Y-12 complex. Y-12 facilities that handle radioactive solid wastes include Bear Creek Burial Ground (BCBG, D-024), the uranium chip oxidation facility (T-113), uranium oxide vaults (D-115), the United Nuclear Landfill (D-026), the salvage yard (S-111), and the Chestnut Ridge security pits (D-023). There are also some underground storage tanks that contain uranium wastes (refer to Table 4-6). These facilities are discussed below.

According to plant personnel, only depleted uranium and uranium-contaminated solid waste are currently disposed of at BCBG, although in the past, radioactive and hazardous liquid waste were also disposed at the burial ground (refer to Section 4.5.2.1). Some of the uranium-contaminated waste is shipped from ORGDP and ORNL. Radioactive, contaminated trash is disposed of in trenches at BCBG and covered daily. Pyrophoric uranium chips are transported in water-filled dumpsters and disposed of in earthen pits. Chips and solids of a less pyrophoric nature are transported in drums and

TABLE 4-8

**RADIOACTIVE WASTE GENERATION AT Y-12 (1985)
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**

Waste Type	Quantity (kg) ¹	Disposition
Uranium-contaminated Waste	2,150,000	Bear Creek Burial Ground
Classified Waste ²	580,000	Security Pits
Asbestos Waste (rad)	57,200	Bear Creek Burial Ground
TOTAL	2,787,200	

Source: MME5, 1986a.

- 1 Quantities represent amounts disposed of.
- 2 Some of the waste was originally nonradioactive/nonhazardous waste (Table 4-10).

on skids and disposed of in a separate series of earthen pits. Uranium fines and sawdust are disposed in "Walk-in Pits," also at BCBG, and buried with soil because of the high probability of explosion (MMES, 1985a).

The radioactivity of solid wastes are monitored to ensure that radioactive wastes are not disposed of at the active sanitary landfill (D-102) and that nonradioactive wastes are not disposed of at BCBG. It is Y-12's policy to minimize waste volumes taken to BCBG to conserve limited disposal capacity. The Trash Monitoring Station (TMS) monitors trash-filled dumpsters to segregate radioactive from nonradioactive wastes (Section 4.1.2.4). The Waste Preparation Facility (T-013) compacts trash before burial at BCBG to reduce waste volume and conserve disposal capacity. Wastes are compacted if the amount of depleted uranium in a 12-cubic-yard dumpster ranges from approximately 200 to 5,000 grams. If a dumpster contains more than 5,000 grams of depleted uranium, the waste is not compacted to minimize airborne activity and occupational exposure. Such waste is disposed of as bulk waste in separate BCBG trenches.

Waste volumes taken to the BCBG will be reduced further when the uranium chip oxidation facility (T-113) becomes operational. Currently, chips are disposed of at BCBG and undergo oxidation spontaneously in the burial pits; the chip fires can release radionuclides to the atmosphere (see Section 3.1.2.1). In the near future, chips will be oxidized within the plant area in a controlled fashion. The new facility will convert uranium to its most stable form and, in the process, reduce the volume of chips. The resultant uranium oxide will be disposed of in vaults located on Chestnut Ridge (S-114). Two vaults have been built, and additional ones will be constructed in the future. One of the new vaults already contains uranium oxide that was generated during test runs of the chip oxidizer. It is necessary for the chip oxidizer to become operational soon, because very little disposal capacity remains at BCBG for bulk uranium waste and uranium chips (i.e., according to plant personnel, capacity for only a few months remains).

To meet terms specified in the Memorandum of Understanding (Appendix D.3), signed on May 26, 1983, by representatives of DOE, EPA, and TDHE, and in the TDHE Complaint and Order for Bear Creek Valley (Appendix D.5), signed in December 1983, all disposal at BCBG is to be discontinued, and the site is to be closed. Disposal may continue as an interim solution until a final disposal technique is identified. Operating plans for the continued use of BCBG (MMES, 1986i) were submitted by Y-12 to DOE and TDHE. TDHE concurred on extended operations in BCBG, provided that the Y-12 Plant continues to improve burial operations and participate in storage and demonstration programs. Currently, Y-12 is conducting various projects under the Low-Level Waste Disposal Demonstration Development Program (LLWDDD). The projects involve investigation and

evaluation of waste treatment technologies, disposal techniques, and performance evaluation methods (i.e., monitoring and pathways modeling). Results of this program will be used to develop a disposal strategy for low-level radioactive wastes and to establish design parameters for an acceptable disposal facility.

The United Nuclear Landfill (UNC site) that is located adjacent to the Y-12 Plant contains low-level radioactive waste removed from an enriched-uranium recovery plant in Rhode Island that was operated by the United Nuclear Corporation. The site is an unlined, shallow excavation located on Chestnut Ridge (MMES, 1985a). It contains approximately 29,000 drums of contaminated soil and solidified waste sludges. In addition to the drums, there are several hundred boxes containing contaminated hoods, piping, equipment, and building material. Drums are deteriorating. The base of the excavation has a gentle grade allowing rainfall to drain from the pit through a catch basin. The site and the wastes are being investigated to determine best closure action. Wastes are not ignitable, reactive, corrosive, or toxic. Based on knowledge of the UNC recovery processes, wastes contain no RCRA-listed materials. Preliminary results indicate that nitrate is the only contaminant of concern. However, there are approximately 300 tons of nitrate that could leak and eventually migrate down to the groundwater (refer to Sections 3.4.2.4, 3.4.3.2, and 3.4.4.3).

The Salvage Yard is used to store uranium-contaminated and uncontaminated scrap metal. Y-12 generates large quantities of scrap each year associated with modification and renovation projects. The contaminated scrap contains depleted uranium and could contain enriched uranium. Uncontaminated scrap is segregated at the Salvage Yard and sold. Criteria for the release of scrap metal for sale are described in Procedure for Clean Scrap Metal Sales, Y/TS-211 (MMES, 1986j). This procedure establishes acceptable levels of contamination from radioactive materials, PCBs, asbestos, and beryllium. Monitoring is required for all scrap that is potentially contaminated with radioactive materials prior to release; no potentially radioactively contaminated materials may be sold if it is possible that significant quantities of radioactive materials could become entrapped in such a manner that they could not be detected by available monitoring techniques. The radioactive contamination limits for the release of materials for off-site sale are shown in Table 4-9. The levels in the table are based on guidance from DOE (Hickman, 1984); the DOE guidance references U.S. NRC Regulatory Guide 1.86. A log maintained at the Salvage Yard documents materials and quantities coming in and going out. Much of the contaminated scrap is being consolidated at ORGDP for shearing and storage until plans for future processing are developed (MMES, 1985a). Y-12 is also studying methods to reduce the amount generated and alternatives to storage (i.e., sale, compaction and recycle, and hydride recycle).

TABLE 4-9

**RADIOACTIVE CONTAMINATION LIMITS FOR THE
RELEASE OF MATERIALS FOR OFF-SITE SALE
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**

	Direct d/min/100 cm ²			Direct
	Direct Average ²	Direct Maximum ³	Smear Maximum	Beta/Gamma ¹ millirem/hr
Uranium	5,000 Alpha	15,000 Alpha	1,000 Alpha	0.1
Transuranics ⁴ , Ra-226, Th-230, Unknowns	100	300	20	
Th-Natural, Th-232 ²	1,000	3,000	200	
Beta Gamma Emitters				0.1

Source: Hickman, 1984.

- ¹ Although DOE has given no beta monitoring requirement for uranium-contaminated material, Y-12 uses this action point to help assure that release criteria are met.
- ² Measurements of average contaminant should not be averaged over more than one square meter. For objects or less surface area, the average should be derived for each such object.
- ³ The maximum contamination level applies to an area of not more than 100 cm².
- ⁴ Where surface contamination by both alpha- and beta/gamma-emitting nuclides exists, the limits established for alpha- and beta/gamma-emitting nuclides should apply independently.

The Chestnut Ridge Security Pits are used for the disposal of radioactive and nonradioactive classified wastes (see Table 4-4 and Section 4.1.2.4). Because very little disposal capacity remains, the site is scheduled to be closed in 1989. In addition, because the pits received hazardous wastes in the past, they will be closed per RCRA requirements. Y-12 has plans to develop another site for classified wastes within the plant area.

The Y-12 inventory (1986) of underground storage tanks identified a few in-service tanks that contain, or could contain, radioactive waste (Table 4-6). Two building sumps (Building No. 9201-5/Tank No. 0074-U and Building No. 9201-5 North/Tank No. 0690-U) contain mop water, and three tanks (Tank Numbers 2069-U, 2070-U, and 2071-U) contain drainage from a building that was used as a criticality laboratory. In addition, an old vault (Building No. 9418-3/Tank No. 2072-U) contains nonenriched uranium oxide. This vault is the foundation of a former Z-Oil storage building that was filled with uranium oxide during the period 1960 to 1965, and covered with a concrete top and asphalt.

4.1.2.4 Nonhazardous Wastes

Y-12 generates a variety of nonradioactive, nonhazardous wastes. These wastes include garbage, refuse, construction spoil, beryllium oxide, asbestos waste, fly ash, waste oil, scrap metal, tires, batteries, classified waste, and mercury-contaminated soils and sediments, and are discussed below. Quantities of some materials generated are presented in Table 4-10.

Sanitary Landfill II (D-102) was opened in 1983 for disposal of nonhazardous solid waste, and is permitted by the State of Tennessee for disposal of the first five wastes identified above. It is located on Chestnut Ridge near the western end of the plant. In addition to Y-12, it serves Rust Engineering, ORGDP, ORNL, the Oak Ridge Associated Universities, and the Oak Ridge Museum. Wastes are disposed by shallow land burial using the trench-and-fill method. A pond was built to collect sediment from the landfill area runoff.

Various controls are in place to prevent disposal of radioactive and hazardous wastes in the landfill. According to plant personnel, these controls include the following:

- Waste streams are characterized to comply with RCRA regulations (Section 4.1.2.1).
- Generators are instructed regarding waste segregation and mingling of wastes.

TABLE 4-10

**NONHAZARDOUS SOLID WASTE GENERATION AT Y-12 (1985)
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**

Waste Type	Quantity (kg)	Disposition
Sanitary and Industrial ¹	4,200,000	Sanitary Landfill II
Asbestos Waste ²	46,300	Sanitary Landfill II
Fly Ash	18,000,000	Roger's Quarry
Waste Oil ²	193,600	Public Sale
Scrap Metal ² and Tires	2,447,000	Public Sale
Batteries	33,700	Public Sale
Classified Waste ²	Unknown ³	Security Pits
TOTAL	24,920,600	

Source: MMES, 1986a.

- ¹ Includes garbage, refuse, beryllium oxide, and construction spoil.
- ² Considered nonradioactive (i.e., below 32 pCi/g or 50 ppm of depleted uranium).
- ³ Quantity of nonhazardous/nonradioactive and low-level radioactive classified wastes generated is presented in Table 4-8. No data on noncontaminated classified waste only are available.

- Demolition and construction sites are monitored, and decisions regarding disposal are made prior to beginning work.
- Dumpsters of trash and mixed metal chips from areas that handle radioactive materials are monitored at the Trash Monitoring Station (approximately 15 dumpsters per day). Dumpsters containing activity levels below 100 pCi/g (i.e., 150 grams of depleted uranium in a 12 cubic yard dumpster) are sent to the landfill. This monitoring system became operational in August 1986 and is being refined to improve sensitivity for depleted uranium under certain geometric configurations.
- All waste loads from ORGDP and ORNL are monitored and inspected by the landfill custodian. Waste forms and manifests are checked. Y-12 and Rust Engineering dumpsters will be monitored and inspected in the future.
- The landfill custodian conducts spot radiation monitoring and inspections of waste piles before they are covered.
- A locked gate controls the access road when the landfill custodian is not present.
- Wastes are tracked via a daily log of drivers' forms for non-Y-12 wastes, UNC 2109 request forms, waste blankets, long-standing agreement forms, and special forms for asbestos, beryllium oxide, and construction spoil.

Wastes are covered daily to prevent wind dispersal. Groundwater in the area is being monitored (see Section 3.4.3.2). Data presented in Table 3-34 indicate that groundwater is not being contaminated by the landfill to a significant degree, although the occasional detection of organics indicates that some contaminant migration does occur. Because average concentrations are below detection levels, the state most likely will not require any RCRA corrective action.

Y-12 possesses two disposal sites for construction and demolition debris generated by the construction contractor (i.e., Rust Engineering). Spoil Area I (D-107) is active, and the Rust Spoil Area (D-106) is inactive. Both might have received hazardous wastes in the past. Spoil Area I was originally developed as a borrow area to provide clay soil for various plant construction activities. The site is now being backfilled with general construction debris, including asphalt, brick, and concrete. HSE&A monitors the debris for possible contamination before approving it for disposal.

There are no liners, leachate collection system, or barriers at this site. The Rust Spoil Area is discussed in Section 4.5.2.2.

In addition to low-level radioactive wastes, nonhazardous classified wastes currently are disposed of in the Chestnut Ridge Security Pits (refer to Tables 4-4 and 4-8 and Section 4.1.2.3). Plant personnel have indicated that no hazardous wastes have been disposed of in these pits since 1984. Disposal of classified wastes are recorded on request forms (UNC 6538) and in the classified disposal log.

Sediments dredged from New Hope Pond have been disposed of at the Chestnut Ridge Sediment Disposal Basin (D-025). This material is considered nonhazardous by the state but may be considered hazardous or mixed by USEPA (see Sections 4.1.2.1 and 4.1.2.2). In addition, approximately 100,000 gallons of liquid waste resulting from a leak in the Y-12 methanol-brine system were disposed of in the basin in 1975 (Battelle, 1985b). Although this material consisted primarily of water, some alcohol and toluene were included. The site is an unlined, man-made surface impoundment designed to hold approximately 300,000 cubic yards of sediments. Y-12 has withdrawn its RCRA Part B permit application for the site and is currently planning to manage it as an industrial landfill.

Soils and stream sediments contaminated from the release of mercury used in the old lithium isotope separation buildings have been disposed in the Chestnut Ridge Borrow Area Waste Pile (CRBAWP, S-042). Much of the material currently at this site has been excavated from the East Fork Poplar Creek floodplain. Mercury concentrations are greater than 12 ppm, but the waste is not toxic as defined by RCRA (refer to Section 4.1.2.1). Uranium concentrations are below 50 ppm (32 pCi/g). According to Y-12 personnel, CRBAWP will continue to be used for the disposal of mercury-contaminated material as long as it passes the EPA extraction procedure toxicity test and uranium concentrations are below 32 pCi/g. Therefore, Y-12 personnel believe that much of the mercury-contaminated material currently being stored in the basement of Building 9201-4 can be disposed of at CRBAWP. This material consists of insulation, piping, rubber, resins, dried sludge, sweepings, sand, and coal that resulted from clean-up activities since 1984. At present, there is an equivalent of 3,800 drums of material (over 1,000 cubic yards) in the building, packed in 55-gallon drums and boxes. An estimated 30,000-60,000 additional 55-gallon drums (8,000-16,000 cubic yards) will be generated depending on the level of cleanup required (i.e., if all Colex insulation and mercury-contaminated combustibles are included). Drums containing material that does not pass the EPA toxicity test will have to be disposed of as hazardous waste at a RCRA-regulated facility.

There are three other sites used to store wastes potentially contaminated with mercury. Two are used to store soils excavated during construction projects (i.e., the Third Street Soil Pile, S-116; and the 81-10 Soil Pile, S-117), and the third (S-122) is used to store roofing material removed during another construction project. The sites are used temporarily while the wastes are being analyzed to determine final disposition.

Mercury-contaminated sludges are being generated by the storm-sewer cleaning project (refer to Section 3.3.2.21). These sludges are being dewatered in sand-filter units located on Chestnut Ridge (i.e., Storm Sewer Sediment Drying Facility, T-118). Sludges from these units are placed in dumpsters, which are stored on a diked and covered concrete pad adjacent to the sand filters. The filtrate is collected and passed through a carbon filter unit and then trucked down to the plant to be used as make-up to scour (i.e., clean out) the sewers. Excess water, not required for cleaning, is sent to the Central Pollution Control Facility for additional treatment. The sludges are considered nonhazardous because they pass the EPA extraction procedure toxicity test and because priority pollutants have not been detected. According to Y-12 personnel, the state has been notified of this operation and has not voiced any concern or objection.

Ash is generated at the steam plant and at a small on-site incinerator for waste paper (The Burnhouse, T-123). The ash from the incinerator is disposed of at the active sanitary landfill (see Section 3.1.2.4). The fly ash and bottom ash from the steam plant is pumped in slurry form up Chestnut Ridge, where it flows into McCoy Branch and eventually into Rogers Quarry (D-108). At this point, sedimentation and clarification occur. A plan for improvement of the quality of the ash sluice discharge is to be developed by Y-12 and agreed upon the TDHE and EPA. Ash sluice characterization and an engineering investigation of the stability of the fly ash impoundment dam have been completed, and a groundwater study is in progress. The ash is exempt from RCRA regulations and possesses no RCRA hazardous characteristics. The quarry discharge is regulated by an NPDES permit (Section 3.3.3.1).

Uncontaminated waste oil and scrap metal are commercially recycled, as well as tires and batteries. Before material is picked up by the recycler and shipped off-site, it has to be certified as nonradioactive and nonhazardous. To be considered nonradioactive, activity levels must be below 32 pCi/g (i.e., 50 ppm of depleted uranium). Waste oils are stored in the salvage yard oil and solvent drum storage area until they are analyzed for radioactivity and hazardous characteristics (Section 4.1.2.1). Uncontaminated oils are then transferred by tank truck to a dedicated, above-ground 30,000-gallon tank (i.e., one of the four 9409-5 tanks; see Table 4-1) and stored until picked up for recycling. Scrap metal is primarily ferrous and is stored in the salvage yard. Uncontaminated

scrap is segregated in a designated section of the yard. Written procedures have been established for the commercial disposal of waste oil and scrap metal (Y/T5-211; refer to Section 4.1.2.3), and records are kept on all off-site shipments.

4.1.3 Findings and Observations

4.1.3.1 Category I

None.

4.1.3.2 Category II

1. Leaking Drums. The oil and solvent drum storage area within the salvage yard (S-020; refer to Table 4-4) contains some leaking 30- and 55-gallon drums of oil and RCRA-listed solvents. Some of the drum contents are also contaminated with low levels of uranium. Runoff from the area is therefore spreading contaminants to the environment (i.e., soils outside the pad, and potentially EFPC and the area groundwater). An inventory of drums present at the storage area in early 1987 is presented below.

Drum Content	No. of Drums
Clean Oil	100
Oil with solvents	40
Halogenated solvents	800
Nonhalogenated, flammable solvents	340
Oils and solvents contaminated with depleted uranium	80
Oils and solvents contaminated with enriched uranium	540
Oily sludges, clean	50
Oily sludges, contaminated with solvents	30
Oily sludges, contaminated with depleted uranium	45
Drum content being analyzed	300
Total	2,325

The storage area is an unsheltered gravel pad. The south side is diked by a small earthen berm to control runoff from the pad. The area is drained overland via a valved pipe when runoff accumulates.

The gravel, soil, and standing water in the area are discolored, and some drums are deteriorating. The extent of drum leakage and deterioration cannot be determined because drums are crowded together. Plant personnel confirmed that drums were leaking and that spillage also occurs when oil and solvents are transferred from drums to tank trucks. In addition, leaking drums are identified in the weekly inspection log for the area. Comments about leaking drums were included in the log in several consecutive entries. Because of the leaking drums and the crowded drum storage, this drum storage area does not comply with RCRA requirements. Per 40 CFR 265, Subpart I, hazardous wastes from leaking or deteriorating drums must be transferred to containers in good condition or managed in some other way that complies with RCRA requirements. In addition, all drums must be inspectable.

4.1.3.3 Category III

1. Underground Storage Tanks. Y-12 has 57 underground storage tanks (USTs; refer to Table 4-11). These tanks could be leaking, or could have leaked, radioactive and/or hazardous substances to the subsurface environment with adverse impact on groundwater and surface water quality.

Fourteen of the tanks are in service and contain product/raw material (mostly petroleum products). Twenty other in-service tanks contain either waste materials or wastewater. Twenty-one tanks have been taken out of service but may contain abandoned material and/or contaminated water. Two additional tanks have been removed. Thirty-nine of all USTs were reported to EPA and the state (May 1986) in accordance with RCRA Subtitle I requirements (i.e., they were in-service during 1974 or later, and 13 had been taken out of service prior to 1974). Three others were not reported because they had not been installed at the time Y-12 prepared its RCRA UST notification inventory. Two additional USTs, which contain PCB-contaminated waste oil, are regulated under RCRA Subtitle C (i.e., the state has been notified of these tanks via Y-12's RCRA Part A permit application).

Thirty-seven of the USTs (65 percent) may be leaking, or may have leaked while in service, contaminants to the environment because of their age and material of construction. Steel tanks that are 15 years old or more and without any corrosion protection are considered potential leakers. Concrete tanks are also potential leakers. Y-12 has 14 in-service steel tanks that are at least 15 years old without any corrosion protection, and 11 such tanks that have been taken out of service. These tanks contain petroleum products or water contaminated

TABLE 4-11

**UNDERGROUND STORAGE TANKS
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**

Tank No.	Age (Years)	Capacity (Gallons)	Content	Tank Material	Corrosion Protection	Status
0074-U	18	250	Mop water	Concrete	N/A	In service
0084-U	29	500	Used oil	Steel	Coated	In service
0134-U	21	120	Gasoline	Steel	No	Out of service
0439-U	9	20,000	Gasoline	Fiberglass	N/A	In service
0440-U	7	10,000	Diesel	Fiberglass	N/A	In service
0688-U	25	3,000	Beryllium-contaminated waste	Steel	Coated	In service
0690-U	15	3,250	Uranium-contaminated mop water	Steel	No	In service
0713-U	32	10,500	No. 2 Fuel Oil	Steel	No	In service
0714-U	3	8,000	Sodium chloride	Concrete	N/A	In service
0834-U	12	20,000	PCB-contaminated waste oil	Steel	Coated	In service
0835-U	25	10,000	PCB-contaminated waste oil	Steel	No	In service
0836-U	25	10,000	Used oil	Steel	No	In service
0928-U	21	200	Gasoline	Steel	No	In service
1219-U	41	12,000	Diesel	Steel	No	In service
1222-U	19	12,000	Gasoline	Steel	No	In service
2063-U	8	1,000	Waste solvents and oils	Concrete	N/A	In service

TABLE 4-11
UNDERGROUND STORAGE TANKS
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE
PAGE TWO

Tank No.	Age (Years)	Capacity (Gallons)	Content	Tank Material	Corrosion Protection	Status
2064-U	41	1,000	Laboratory waste contaminated with beryllium	Steel	No	Out of service
2065-U	14	500	Waste coolant	Steel	No	In service
2066-U	14	500	Waste coolant	Steel	No	In service
2067-U	14	500	Waste coolant	Steel	No	In service
2068-U	19	1,000	Gasoline	Steel	No	Out of service
2069-U	36	1,000	Building drain	Steel	No	In service
2070-U	36	1,000	Building drain	Steel	No	In service
2071-U	36	1,250	Building drain	Concrete	N/A	In service
2072-U	24	55,000	Uranium oxide	Concrete	N/A	In service
2073-U	24	1,000	Gasoline	Steel	No	Out of service
2074-U	24	1,000	Gasoline	Steel	No	Out of service
2075-U	24	1,000	Fuel Oil	Steel	No	Out of service
2076-U	34	1,000	Propane	Steel	No	Out of service
2077-U	Unknown	65	Gasoline	Steel	No	Out of service/removed
2078-U	22	110	Gasoline	Steel	No	Out of service
2079-U	22	55	Gasoline	Steel	No	Out of service

TABLE 4-11
UNDERGROUND STORAGE TANKS
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE
PAGE THREE

Tank No.	Age (Years)	Capacity (Gallons)	Content	Tank Material	Corrosion Protection	Status
2080-U	16	560	Gasoline	Steel	Coated	In service
2081-U	29	280	Gasoline	Steel	No	Out of service
2082-U	6	8,000	Gasoline	Steel	Yes	In service
2089-U	41	2,000	Propane	Steel	No	Out of service
2090-U	41	2,000	Propane	Steel	No	Out of service
2091-U	41	2,000	Propane	Steel	No	Out of service
2092-U	41	2,000	Propane	Steel	No	Out of service
2099-U	16	560	Gasoline	Steel	Coated	In service
2100-U	41	30,000	Mercury-contaminated water	Concrete	N/A	In-service
2101-U	41	32,000	Mercury-contaminated water	Concrete	N/A	Out of service
2102-U	1	30,000	Methanol	Steel	Yes	In service
2103-U	1	550	Building drain	Fiberglass	N/A	In-service
2104-U	36	32,000	Mercury-contaminated water	Concrete	N/A	In service
2105-U	18	300	Liquid waste contaminated with beryllium oxide	Stainless steel	No	Out of service
2116-U	Unknown	2,500	Etching waste	Steel	No	Out of service/removed
2117-U	16	550	No. 2 Fuel Oil	Steel	No	Out of service

TABLE 4-11
UNDERGROUND STORAGE TANKS
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE
PAGE FOUR

Tank No.	Age (Years)	Capacity (Gallons)	Content	Tank Material	Corrosion Protection	Status
2129-U	3	239,360	Uranium oxide	Concrete	N/A	In service
2130-U	27	580	Gasoline	Steel	No	In service
2131-U	8	30,000	Propane	Steel	Yes	In service
2132-U	1	550	Building drain	Fiberglass	N/A	In service
2153-U	3	8,000	Sodium chloride	Concrete	N/A	In service
2284-U	41	2,000	Propane	Steel	No	Out of service
2288-U	41	750	Propane	Steel	No	Out of service
2289-U	41	750	Propane	Steel	No	Out of service
2290-U	41	475	Propane	Steel	No	Out of service

N/A = Not applicable

Source: DOE Environmental Survey team, 1987. Adapted from Y-12 Plant inventory of underground storage tanks, 1986.

with beryllium, mercury, or uranium. Ten tanks are made of concrete, nine of which are in service. They contain mop water, oil and solvents, building drainage that may be uranium-contaminated, uranium oxide, or mercury-contaminated water.

Currently, there are no leak detection or groundwater monitoring systems in place to identify leaking tanks. Y-12 personnel only use dip sticks to measure inventory of product tanks, but this technique is not sensitive enough to detect small leaks. However, during the on-site Survey, Y-12 initiated an extensive program to investigate all underground storage tanks and to correct any problems. Investigative efforts will verify tank contents, determine leakage probabilities, and locate leak evidence. Results will be used to determine if certain tanks need to be replaced and if any areas need to be cleaned up.

2. Sediment Volume in New Hope Pond. The capacity of New Hope Pond has been reduced by the accumulation of large volumes of sediment over time and now may not provide sufficient containment for a large spill of hazardous material. The shorter retention time may also decrease its effectiveness as a sedimentation basin and may result in release of heavy metals, such as mercury, into East Fork Poplar Creek. Y-12 has proposed dredging of New Hope Pond but is presently awaiting resolution of regulatory differences of opinion between the state of Tennessee and EPA Region IV regarding disposition of the dredged material.

4.1.3.4 Category IV

1. Improper Waste Drum Storage. The DOE Survey team observed that drums of hazardous and mixed wastes are not properly stored in two of the waste storage buildings (i.e., Buildings 9720-9/S-031 and 9720-31/S-028; refer to Table 4-1). Most of the drums in the PCB waste room of Building 9720-31 are crowded together and cannot be properly inspected. There is only one aisle in the middle of the room. Most of the waste drums in Building 9720-9 also are crowded together and cannot be properly inspected. In addition, diking is inadequate and consists of only wooden structures that could not contain a liquid spill (i.e., there is no adequate seal between the wooden structures and the building floor). Proper storage requires that all waste containers be accessible for inspection in order for inspectors to read labels and to detect leaks. Diking must be able to contain all spills from flowing into other storage areas within a building or outside the building.
2. Uncollected Drums. The DOE Survey team observed that there are uncollected waste drums located outside of several buildings (i.e., waste generating sources) awaiting pickup for proper

storage, treatment, or disposal. It was noted, from inspection of drum labels, that many of these drums have been in these locations for several months. The wastes in these drums usually have not yet been analyzed to determine if they are hazardous. In the interim, however, hazardous constituents that may be in the drummed waste could be released and cause adverse environmental impacts (e.g., contamination of surface water and groundwater). Drums in such areas are unsheltered and not inspected, and any releases would not be contained (e.g., by a curbed storage pad). The following examples of improper and lengthy drum storage were noted by the Survey team:

- Thirteen untagged drums of uranium-contaminated vials and plastic bottles were stored near a storm drain behind Building 9995, the Y-12 laboratory. Some empty chemical bottles, which could contain residual hazardous substances, were stored on top and around this storm drain. Several other drums, which were tagged, had been stored in the vicinity since September 1986.
- Thirty-three drums were being stored outside of Building 9204-4. Twelve of these drums had been there since July and August 1986.
- Twenty drums were located outside Building 9204-2 as well as mounds of trash around a trash-filled dumpster.
- The Environmental Officer for ORNL facilities at Y-12 reported that wastes remain unprocessed for as long as 6 months, primarily because the ORNL laboratory gives priority to wastes generated at the ORNL site.

3. Unidentified Hazardous Wastes. Seven metal-bearing wastes may have been disposed of until recently in facilities without proper RCRA authorization. These suspect wastes include the following:

Wastes	Constituents of Concern	Receiving Waste Disposal Facility
1. Machine Turnings	Lead	Bear Creek Burial Ground (BCBG)
2. Film Packages	Lead	Sanitary Landfill II (SLF II)
3. Laboratory Wastes	Arsenic, Chromium, Lead, and Silver	BCBG
4. Lead Fragments	Lead	Security Pits
5. Curing Agent	Lead	BCBG
6. Cable Joint Wastes	Lead	BCBG or SLF II
7. Nonsalvageable Batteries	Cadmium and Lead	BCBG or SLF II

The disposal of these wastes has ceased. The wastes are being analyzed by Y-12 and held in storage pending decisions on appropriate disposal techniques. The disposal facilities that receive the wastes are also being studied (e.g., groundwater data associated with the disposal facilities are being reviewed, and volumes of suspect wastes disposed are being estimated). At the time of the Survey, the state had not been notified of these wastes.

4.2 Toxic and Chemical Materials

4.2.1 General Description of Pollution Sources/Controls

4.2.1.1 Toxics Management

The Y-12 Plant has compiled a formal inventory of all products purchased and used at the facility that contain toxic and/or hazardous chemicals. Over 4,000 products have been identified, and the plant has established written procedures to ensure that hazardous materials are purchased, labeled, handled, used, and disposed of properly. These written procedures were reviewed as part of the Environmental Survey.

All materials in use at Y-12 have been evaluated with respect to potential health, flammability, reactivity, or special hazards according to a standard hazard classification guide. Individuals requesting the purchase of any hazardous material must indicate on the Y-12 Purchase Requisition the hazard ratings that have been assigned to the material and obtain a current Material Safety Data

Sheet (MSDS) from the supplier. The Y-12 Industrial Hygiene Department maintains the MSDS on the hazardous materials in use at the plant, and must approve the purchase of any material that has not previously been evaluated for hazard potential.

Shipments of all materials purchased by Y-12, including toxic and hazardous substances, are processed by the Shipping and Receiving/Stores Department. Warehouses for dry chemicals and specially-equipped storage areas for flammable and combustible materials, compressed gas cylinders, paints, and other products are located in the southeast corner of the plant. During the Environmental Survey, these storage areas were inspected and found to be in good condition with no evidence of spills or leaking containers. However, the concrete pad adjacent to Building 9720-2 (used to store 55-gallon drums of incoming materials such as methyl chloroform, isopropyl alcohol, tetrachloroethene, chlorofluoroalkanes, methyl ethyl ketone, and acetonitrile) was not completely diked or covered with a roof (approximately one-half of the area lacked such controls). During the Environmental Survey, approximately 1500 drums were being stored on the pad. In addition, at several locations surrounding the pad, the soil appeared to be stained or discolored, indicating that spills or leaks from the stored drums had likely occurred in the past. (No sampling and analysis of soils in this area was requested as part of the Environmental Survey because the Y-12 staff was aware of this situation.) The Survey team was also informed that upgrading of the pad and containment dike at 9720-2 was scheduled to occur in the near future.

Building 9720-26, located in the southwest section of the plant, is used solely for storing elemental mercury. This building is equipped with an adequate secondary containment dike, and no evidence of spills was observed in 9720-26 during the Environmental Survey.

Labels detailing the particular hazards associated with a material are affixed to the containers of the material by Stores personnel prior to release to plant users. Training of employees on the hazards of the materials used in their workplaces is provided by the Technical Training Department and division Hazard Communication Coordinators.

4.2.1.2 Tank Farm Facilities

4.2.1.2.1 Above Ground Storage Tanks

Y-12 has established programs for the management of above ground and underground storage tanks that contain toxic and hazardous materials. The Y-12 Plant has more than 1,000 above-ground storage tanks and transfer stations, the latter defined as places or facilities where toxic and

hazardous materials are transferred from portable containers into tanks or process equipment. A complete listing of the above ground storage tanks and transfer stations, and their locations, is presented in Appendix A of the Y-12 Spill Prevention Control and Countermeasures (SPCC) Plan (MMES, 1985d).

The Environmental Survey Team reviewed the Y-12 SPCC Plan, which describes the procedures, equipment, and practices that have been implemented by Y-12 to prevent the release of toxic and hazardous materials to the environment. Standards have been established for the design and construction of spill containment dikes for new above ground storage tanks (Williams, 1985). These standards are also utilized when existing spill containment dikes are upgraded. A study recently completed by Y-12 identified over 200 locations where the secondary containment was inadequate or absent (MMES, 1985a). Standard operating procedures covering security measures, a routine tank and dike inspection program, and an incompatible materials storage program have also been adopted by the Y-12 Plant.

Training requirements for spill response personnel have been established as part of the SPCC Plan, and a contingency plan has been developed that details the actions Y-12 personnel (e.g., hourly employees, supervisors, department heads, laboratories) must take in the event of a spill. As evidenced by interviews held with various Y-12 personnel during the Environmental Survey, the spill response system at Y-12 appears to function well. The Y-12 Spill Response Coordinator is responsible for responding to spills/releases of hazardous materials within the plant. Based upon the severity of the occurrence or the need for formal documentation, the Spill Response Coordinator may request that the responsible generator/spiller complete an Environmental Incident Report. This document details the amount and type of material spilled/released, cause(s) of the incident, clean-up procedures utilized, and actions taken to prevent reoccurrences. The Spill Response Coordinator reviews and approves the incident reports and maintains records of the spills/releases.

4.2.1.2.2 Underground Storage Tanks

The Y-12 environmental staff has identified 57 underground storage tanks at the facility. Information on 41 of the 42 of these tanks that are subject to the reporting requirements of Section 9002 of RCRA had been provided to the State of Tennessee at the time of the Environmental Survey. Thirty-three of these 57 underground storage tanks (USTs) have been, or are currently, used to store non-waste toxic and hazardous substances (Table 4-12). The remaining 24 tanks are (or were) used for the storage of hazardous wastes. Thirty-four of the 57 USTs at Y-12 were in service at the time of the Environmental Survey; the other 23 USTs were either permanently out of use

TABLE 4-12

**UNDERGROUND STORAGE TANKS FOR NON-WASTE
TOXIC AND HAZARDOUS SUBSTANCES
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**

Tank No.	Age	Capacity (Gallons)	Contents	Tank Material	Corrosion Protection	Status
0134-U	21	120	Gasoline	Steel	No	Out of Service
0439-U	9	20,000	Gasoline	Fiberglas	Fiberglas	In Service
0440-U	7	10,000	Diesel	Fiberglas	Fiberglas	In Service
0713-U	32	10,500	#2 Fuel Oil	Steel	No	In Service
0714-U	3	8,000	Sodium Chloride	Concrete	Coated	In Service
0928-U	21	200	Gasoline	Steel	No	In Service
1219-U	41	12,000	Diesel	Steel	No	In Service
1222-U	19	12,000	Gasoline	Steel	No	In Service
2068-U	19	1,000	Gasoline	Steel	No	Out of Service
2073-U	24	1,000	Gasoline	Steel	No	Out of Service
2074-U	24	1,000	Gasoline	Steel	No	Out of Service
2075-U	24	1,000	Fuel Oil	Steel	No	Out of Service
2076-U	34	1,000	Propane	Steel	No	Out of Service
2077-U	-	65	Gasoline	Steel	No	Removed 1964
2078-U	22	110	Gasoline	Steel	No	Out of Service
2079-U	22	55	Gasoline	Steel	No	Out of Service
2080-U	16	560	Gasoline	Steel	Coated	In Service
2081-U	29	280	Gasoline	Steel	No	Out of Service
2082-U	6	8,000	Gasoline	Steel	Yes	In Service
2089-U	41	2,000	Propane	Steel	No	Out of Service
2090-U	41	2,000	Propane	Steel	No	Out of Service
2091-U	41	2,000	Propane	Steel	No	Out of Service
2092-U	41	2,000	Propane	Steel	No	Out of Service
2099-U	16	560	Gasoline	Steel	Coated	In Service

TABLE 4-12
UNDERGROUND STORAGE TANKS FOR NON-WASTE
TOXIC AND HAZARDOUS SUBSTANCES
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE
PAGE TWO

Tank No.	Age	Capacity (Gallons)	Contents	Tank Material	Corrosion Protection	Status
2102-U	1	30,000	Methanol	Steel	Yes	In Service
2117-U	16	550	#2 Fuel Oil	Steel	No	Out of Service
2130-U	27	580	Gasoline	Steel	No	In Service
2130-U	8	30,000	Propane	Steel	Yes	In Service
2153-U	3	8,000	Sodium Chloride	Concrete	Coated	In Service
2284-U	41	2,000	Propane	Steel	No	Out of Service
2288-U	41	750	Propane	Steel	No	Out of Service
2289-U	41	750	Propane	Steel	No	Out of Service
2290-U	41	475	Propane	Steel	No	Out of Service

Source: Environmental Survey team, 1987. Adapted from Y-12 Plant inventory of underground storage tanks.

(abandoned in place or removed) or temporarily out of use. As shown in Table 4-12, many of the non-waste USTs at Y-12 have been in use for more than 15 years, are constructed of steel, and lack corrosion protection. It is commonly accepted that underground storage tanks with these characteristics have a relatively higher probability of leaking (see Section 4.1.3.3). All of the USTs at Y-12 are single-walled, and none are equipped with leak detection systems. The volume of material in the tanks is assessed on a non-routine basis using a dipstick. At the time of the Environmental Survey, plant personnel were compiling data on the tanks and planned to utilize an EPA model to identify those tanks most likely to leak. As part of this process, soil borings were being obtained adjacent to all underground storage tanks. Active and inactive underground storage tanks used to store wastes, including hazardous wastes, and USTs closed or abandoned in place are discussed in Sections 4.1.2.1 and 4.5.2.3, respectively.

4.2.1.3 Polychlorinated Biphenyls (PCBs)

The Y-12 Plant uses electrical equipment, heat transfer equipment, and hydraulic systems containing fluids that are contaminated with polychlorinated biphenyls (PCBs). In addition, the plant maintains storage facilities for PCB (greater than 500 ppm PCB) and PCB-contaminated (less than 500 ppm but greater than 50 ppm) liquid and solid wastes awaiting disposal.

Several Y-12 departments are involved with the use, handling, storage, and disposal of PCBs. These include Environmental Management; Waste Transportation, Storage, and Disposal; Building Utility Services; Industrial Hygiene; Electrical Maintenance; Metal Preparation Division, and several divisions of ORNL at Y-12. During the Environmental Survey, interviews with representatives of all Y-12 departments involved with PCBs were held and the procedures/practices used by the particular department evaluated. Whereas the Environmental Management Department has overall responsibility for compliance with the Toxic Substances Control Act (TSCA) PCB regulations, the Electrical Maintenance Department is responsible for servicing all Y-12 transformers and those transformers that supply power to the ORNL at Y-12 buildings. Electrical Maintenance also drains and refills PCB and PCB-contaminated transformers in order to reduce the PCB concentrations and reclassify the transformers to a PCB-contaminated or non-PCB status. All transformers in use (including those with dikes) are inspected by Electrical Maintenance quarterly. The procedures currently used by Electrical Maintenance to service and inspect PCB transformers, and associated recordkeeping practices, were reviewed during the Environmental Survey and are considered acceptable. Under the Y-12 Environmental Hazard Elimination Project, funding has been provided for the replacement of 44 PCB transformers, and eventually, all PCB transformers will be replaced.

As of December 31, 1985, the Y-12 PCB Annual Inventory Report indicated that 267 PCB transformers were in service at the plant accounting for a total weight of PCB fluids of greater than 350,000 kilograms. Approximately 60 PCB-contaminated transformers were also in service as of December 31, 1985. During the Environmental Survey, transformer stations in various areas of the plant were inspected. In general, the transformers were properly labeled, and no evidence of current leaks was observed. However, a drain valve on a spill containment dike for a PCB transformer on the south side of Building 9201-5N was found in the open position and unattended.

In addition to the PCB and PCB-contaminated transformers, 1,503 large (fluid capacity of at least 3 pounds) capacitors in service at Y-12 are known to contain PCB fluids. Pole-mounted transformers are another potential source of PCB, but these are sampled to determine their PCB content only when they are removed from service for repair. Hence, a complete inventory of pole-mounted transformers with respect to PCB has not been completed.

The heat transfer system at Y-12 consists of above ground and underground piping, storage tanks, and associated pumping and filtration devices, which contain a fluid known as "Z-Oil." The Z-Oil system, which has a capacity of approximately 228,000 gallons, is maintained by the Building Utility Services Department. In the past, the primary function of the Z-Oil system was to provide cooling for the calutron in Building 9204-3 and the cyclotron in Building 9201-2. At present, the calutron operates at a much reduced level, and the cyclotron has been permanently taken out of service. As recently as 1981, approximately 161,000 gallons of Z-Oil were contaminated with PCBs at a level of 70 ppm. This contamination occurred in the 1970s when used transformer oils were intentionally added to the system. However, in October 1981, the Z-Oil was processed to remove the PCBs. When several portions of the system were tested for PCB in December 1984 and July 1985, the highest PCB concentration detected was approximately 20 ppm. Therefore, according to the definitions in the TSCA regulation, the Z-Oil system is now considered non-PCB.

The Z-Oil system is known to have leaked and released oil to the environment. As discussed previously, these leaks may have also resulted in the release of PCBs. Sampling and analysis of soils adjacent to Z-Oil system valves, pipe flanges, and storage tanks is being conducted as part of the Environmental Survey (see Section 4.5.3.3).

The hydraulic systems that are contaminated with PCBs are the responsibility of the Metal Preparation Division and are located in Buildings 9998 and 9215. In the former location, the three separate 350-gallon capacity hydraulic systems contain up to 30 ppm of PCBs. Similarly, in Building 9215, a total capacity of up to 1,250 gallons of hydraulic fluid is contained in four systems of

different capacities (150, 200, 300 and 600 gallons). Of these, the central hydraulic system (200 gallons) evidences the highest level of PCB contamination at 29 ppm. However, analogous to the Y-12 heat transfer Z-Oil system, the hydraulic systems in Y-12 are contaminated with PCBs at levels below that regulated under TSCA. All of the hydraulic systems at Y-12 that contain PCBs were inspected during the Environmental Survey and found to be in good condition with no evidence of spills or leakage.

The PCB storage facilities at Y-12 are managed by the Waste Transportation, Storage, and Disposal Department (WTSD). As of December 31, 1985, a total of 1,908 kilograms of drummed PCB fluid was stored for reuse at Y-12. By comparison, approximately 20,000 kilograms of PCB and PCB-contaminated liquid wastes, contained in 55-gallon drums, were stored for disposal on that date. Buildings 9404-7, 9720-9, and 9720-31 are used to house the drums of liquid PCB stored for reuse, and PCB and PCB-contaminated liquid wastes awaiting disposal. Solid wastes contaminated with PCBs and contained in 55-gallon drums are also stored at these locations. Approximately one-half of the drummed PCB and PCB-contaminated liquid wastes awaiting disposal, and 80-90 percent of the drummed solid PCB and PCB-contaminated wastes, are also contaminated with uranium.

All of the buildings used to store PCB wastes were inspected during the Environmental Survey. Building 9720-31 was recently constructed to be used for storing RCRA and PCB wastes. Each type of waste is stored in a separate room equipped with impervious flooring, explosion-proof lighting, and 6-inch concrete curbs to contain spills. In contrast, Buildings 9720-9 and 9404-7 are older buildings that have been modified in order to store PCB wastes. Concrete curbs have been installed in 9404-7, but wooden dikes less than 6 inches in height are used in 9720-9. The wooden dikes in Building 9720-9 are also not sealed to the floor, and gaps between the floor and the dikes were observed. As a result, if any of the containers of PCB wastes in 9720-9 leaked, the PCB and PCB-contaminated fluids could flow under the wooden dike, exit the building, and enter storm drains that flow directly into East Fork Poplar Creek. Although the Y-12 staff indicated that the wooden dikes in 9720-9 had been scheduled for replacement, this had not been accomplished at the time of the Environmental Survey. With the exception of the wooden dikes in 9720-9, all three buildings used to store drummed PCB wastes appeared to be well maintained, and no evidence of spills or leaking containers was observed.

Approximately 225,000 kilograms of bulk PCB and PCB-contaminated liquid wastes were also stored for disposal at Y-12 at the end of 1985. This bulk liquid waste is stored in both underground tanks and above ground tanks. The underground tanks (OD4-W and OD4-M) are located adjacent to the

north side of Building 9754. Above-ground tanks used to store bulk liquids contaminated with PCB are located in the Salvage Yard (OD3-N and OD3-S), adjacent to Building 9419-1 (OD5-1, OD5-2, OD5-3, and OD5-4), and in Building 9418-9. Only the above ground tanks in the Salvage Yard have not been equipped with concrete spill containment dikes. The bulk PCB and PCB-contaminated liquid waste in the OD5 series tanks also contains uranium, and some of the uranium-contaminated PCB wastes have been stored at Y-12 for more than one year. Although this is technically a violation of the TSCA PCB requirements, neither the State of Tennessee nor EPA have issued Notices of Violation for storage of radioactively contaminated PCB wastes beyond the 1-year TSCA limit, since to date the Nuclear Regulatory Commission had not licensed any facilities for the disposal of radioactively contaminated PCB wastes. However, an incinerator for the disposal of such wastes is being constructed at the K-25 plant. When this facility is operable, Y-12 will dispose of its uranium-contaminated PCB wastes at the K-25 incinerator. Presently, the K-25 incinerator is expected to be operating by the end of 1987.

Transformers and other PCB items are, or have been, stored for disposal and reuse both out-of-doors in unprotected areas lacking secondary containment and inside buildings. PCB transformers are stored indoors for reuse by the ORNL at Y-12 facilities in a diked area in the basement of Building 9204-3. The out-of-doors locations include the area east of the OD-3 tanks in the Salvage Yard, the "Line Yard," and the storage yard east of Building 9204-1. The Y-12 Environmental Management staff has sampled the soil in the Line Yard and detected PCB concentrations as high as 840 ppm. Similarly, the PCB storage area in the Salvage Yard has been sampled as part of a RCRA Closure Plan, and unlike the Line Yard, the soil in the Salvage Yard does not contain concentrations of PCB in soil above 0.1 ppm (see Table 3-21 in Section 3.2.3 of this report). In contrast, no data have been obtained on the extent, if any, of PCB soil contamination in the storage yard east of Building 9204-1 (an ORNL at Y-12 facility). Sampling and analysis of soil from the storage yard east of Building 9204-1 for PCB will be performed as part of the Environmental Survey.

An internal audit of the use, storage, and disposal of PCBs at the Y-12 Plant was performed by the MMES environmental staff in June 1985 (Marcus, 1985). As a result of this comprehensive audit, 41 recommendations were developed covering the Y-12 Environmental Management; Electrical Maintenance; and Waste Transportation, Storage, and Disposal Departments; the Y-12 Metal Preparation Division; and the ORNL at Y-12 facilities. At the time that the Environmental Survey was conducted, most of the recommendations had been implemented by the various responsible parties. The Y-12 Environmental Compliance Group intends to pursue this matter until all PCB issues have been resolved.

4.2.1.4 Asbestos

The management of asbestos-containing materials at the Y-12 Plant is the responsibility of both the Industrial Hygiene (IH) Department and the Waste Transportation, Storage, and Disposal Department. The IH Department provides supervision of Y-12 personnel who perform maintenance operations involving contact with asbestos. In addition, the removal of asbestos applied as surfacing materials, or as pipe insulation, during renovation operations or building demolition projects is overseen by the IH Department. Asbestos removal in connection with renovation or demolition projects is performed by both outside contractors and specially trained Y-12 craftsmen. Since many Y-12 buildings are covered with asbestos siding, such projects at times involve an entire building (or portion thereof).

The procedures established by the IH Department for asbestos abatement projects and associated records, were reviewed during the Environmental Survey. The procedures require written notification of the IH Department prior to the initiation of maintenance, renovation, or demolition activities with potential asbestos exposure. The location, source, and amount of asbestos to be removed must be identified. For projects conducted by Y-12 personnel, the methods described in a formal Health and Safety Procedure must be followed. However, the specifications utilized to solicit bids from commercial asbestos contractors are often vague, and incorporate applicable regulatory requirements only by reference. During the Environmental Survey, the IH Department staff indicated that the internal asbestos removal procedure was being revised to reflect the OSHA Asbestos Standards published in June 1986, and the bid specification for commercial contractors would also be updated.

Building materials (insulation, fireproofing, etc.) are the major source of asbestos at the Y-12 Plant. An inventory of the location and condition of asbestos-containing materials within the various buildings has not been compiled by Y-12. However, the IH Department expected to select a contractor to perform this work early in 1987. In addition to inspecting all Y-12 buildings for asbestos, the contractor will also be required to prioritize the relative necessity of abatement actions in the various buildings.

As stipulated by the National Emission Standard for Hazardous Air Pollutants (NESHAP) for asbestos, the Y-12 Plant notifies the Oak Ridge Operations (ORO) Office prior to initiating any removal or demolition projects involving asbestos. Copies of such documents were provided to the Environmental Survey team. The ORO Office is responsible for forwarding such NESHAP notifications to the state/local regulatory agencies.

The Y-12 personnel who perform asbestos removal work have been trained by the IH Department. The workers utilize "wet work practices," as required by the NESHAP Standard, to minimize the release of asbestos fiber. Monitoring for airborne asbestos is conducted by the IH Department during and after removal work, and the samples are analyzed by the Y-12 Environmental Laboratory. To date, the plant has not utilized negative-pressure enclosures to contain any asbestos fibers potentially released during such projects. (A negative-pressure enclosure consists of covering with plastic the walls and floors of a work area where asbestos is to be removed, and using portable fans to exhaust any asbestos-contaminated air through high-efficiency filters.) However, since the new OSHA Asbestos Standard requires negative pressure enclosures for asbestos removal projects (except for short-duration, small-scale operations such as pipe repair, valve replacement, etc.), the IH Department expects to mandate the use of such controls on future large-scale removal projects.

As indicated earlier, the approval of the IH Department is required for all maintenance, renovation, or demolition activities involving the handling of asbestos. Depending upon the particular location in the plant that such activities take place, the asbestos insulation may also be contaminated with radioactivity. As a result, such projects also require the approval of the Health Physics Department. If it is determined that the asbestos waste is also radioactive, it is buried at the Bear Creek Valley Disposal Area; nonradioactive asbestos waste is disposed of at the Y-12 Centralized Sanitary Landfill II. However, prior to 1984, all asbestos waste was buried in specific pits used exclusively for this purpose at the Bear Creek location. The Waste Transportation, Storage, and Disposal Department is responsible for the disposal of all asbestos wastes.

The Tennessee Department of Health and Environment (TDHE) has permitted the Y-12 Centralized Landfill II to receive nonradioactively contaminated asbestos waste. The State of Tennessee permit requirements for disposal of asbestos waste state that the "...asbestos waste containers must be confined to a specific area..." the location of which must "...be noted on (the) site plan..." The Design and Operating Procedures for the Y-12 Centralized Sanitary Landfill II indicate that "...asbestos waste will be ... buried in the regular landfill trenches in specific cells separated from cells used for the sanitary wastes." In practice, the Y-12 procedure has resulted in the burial of asbestos waste throughout the landfill. Although this practice may comply with the state permit requirements, these requirements, and Y-12's disposal practices, are not consistent with EPA's current recommendations that asbestos waste be confined to a separate trench.

4.2.1.5 Chlorofluoroalkanes

A chemical inventory compiled by the Y-12 Plant in 1984 indicated that at least 20,000 gallons of chlorofluoroalkanes are used in the plant annually. These materials are used primarily for metal cleaning and degreasing, with Freon TF constituting the major chlorofluoroalkane purchased by Y-12. The chlorofluoroalkanes are relatively volatile, and potential environmental problems due to vapor emissions can result if they are not properly handled and stored. The Y-12 Plant purchases chlorofluoroalkanes primarily in 55-gallon containers that are stored on a concrete pad next to Building 9720-2. As discussed previously, this facility is not adequately diked, and is not completely protected from the elements. However, Y-12's future plans include upgrading the secondary containment system and installing a roof over the entire pad. With the exception of the storage of incoming 55-gallon drums of chlorofluoroalkanes, in general, during the Environmental Survey, the handling of chlorofluoroalkanes at Y-12 was observed to be proper.

4.2.1.6 Pesticides/Herbicides

Three groups at Y-12 are involved with the application of pesticides/herbicides: Research Services, Janitorial Services, and General Services. Research Services is responsible for the ORNL at Y-12 grounds only, and uses both pesticides and herbicides around but not inside ORNL at Y-12 buildings. Janitorial Services personnel use insecticides inside all Y-12 buildings, whereas General Services staff apply herbicides on lawns and fence lines and use some rodenticides. Future plans include using outside contractors to spray fence lines and lawns.

An internal audit of the storage, use, and disposal of pesticides/herbicides was conducted by Y-12 Environmental Management staff in August 1985. The recommendations included in the audit report have been implemented, and as a result, the overall pesticide/herbicide management program appears to be satisfactory.

All pesticides/herbicides used in the plant are general-use materials; no restricted-use chemicals are applied. Roundup and Pramitol are the primary herbicides in use at Y-12; the primary pesticide used is Diazinon. A member of the Research Services staff is a certified pesticide applicator. This individual provides instruction to all plant personnel responsible for mixing and applying pesticides/herbicides. A series of formal training sessions have also been completed; training records are maintained.

Pesticides/herbicides are stored at several locations in the Y-12 Plant. These include Buildings 9208, 9401-1, 9723-5, 9728, and 9753. A formal inventory has been compiled, and an inspection program of the pesticide/herbicide storage areas has been initiated by the Y-12 staff. These storage areas were inspected during the Environmental Survey, and all pesticide containers appeared to be intact and properly labeled. No evidence of previous spills or leaks was observed.

A formal procedure for the routine disposal of empty containers of pesticides/herbicides has been developed and implemented by the Y-12 staff. This procedure is consistent with the requirements of 40 CFR 165.0, "Recommended Procedures for the Disposal of Pesticide Containers and Residues."

4.2.2 Findings and Observations

4.2.2.1 Category I

None.

4.2.2.2 Category II

None.

4.2.2.3 Category III

1. Potential PCB Soil Contamination. Soil in the storage yard east of Building 9204-1 may be contaminated with PCB as a result of the past and current Y-12 practice of storing transformers and other equipment containing PCB and PCB-contaminated fluids on the soil and gravel surface in this area.

Interviews during the Environmental Survey with Y-12 personnel and observation of the storage yard east of Building 9204-1 indicate that transformers and other equipment that contain PCB and PCB-contaminated fluids have been (and currently are) stored directly on the soil and gravel surface in this area. Stained soil and gravel in the storage yard was observed during the Environmental Survey. As a result, it is likely that contamination of the soil and gravel in the storage yard has occurred; however, sampling for PCBs has not been conducted by Y-12. Since this area borders East Fork Poplar Creek (EFPC), if PCBs are present, soil contaminated with PCB may enter EFPC during storms. Soil samples for PCB in the storage yard east of Building 9204-1 will be collected as part of the Environmental Survey.

2. Inadequate Spill Containment Measures. The lack of adequate spill containment dikes at many locations at Y-12 where toxic and hazardous materials are stored could result in the release of these materials to the environment in the event of a spill.

Y-12 has identified more than 200 locations where the spill containment dikes for above ground storage tanks or transfer stations are inadequate or missing. In addition, during the Environmental Survey, inadequate spill containment dikes were observed at the concrete pad adjacent to Building 9720-2 that is used to store incoming 55-gallon drums of oils and toxic and hazardous substances, and at Building 9720-9. The latter location is used for the storage of 55-gallon drums of PCB and PCB-contaminated liquid and solid wastes. In the event of a spill or leak from a tank, transfer station, or container in these areas, contamination of the environment with toxic and hazardous materials would likely occur.

4.2.2.4 Category IV

1. PCB Secondary-Containment Drain Valves. A drain valve on a spill containment structure for a transformer containing PCB fluids on the south side of Building 9201-5N was found unattended in the open position during the Survey. Such practices defeat the purpose of providing secondary containment.
2. Asbestos Disposal Practices. The disposal of asbestos-containing waste at the Y-12 Centralized Sanitary Landfill II is not consistent with the recent EPA recommendations regarding disposal of asbestos waste. According to EPA, asbestos-containing wastes should be deposited and buried in separate trenches in a separate area of the landfill. Furthermore, the Tennessee Department of Health and Environment (TDHE) requires that asbestos waste be confined to a specific area of the landfill, and this area must be indicated on the landfill site plan. However, once per week, the Y-12 Plant mixes the asbestos wastes with the daily sanitary wastes, and records the location of the particular cell in which asbestos has been deposited on the site plan. Although it may be contended that the Y-12 asbestos disposal practices technically meet the TDHE requirements, the Y-12 procedures and the TDHE requirements are not consistent with current EPA recommendations.

4.3 Radiation

4.3.1 Background Environmental Information

The background radiation in the vicinity of the Y-12 Plant is a consequence of both natural and man-made sources. These sources include cosmic radiation, natural radioactive materials in the soil and building materials, fallout from past atmospheric weapons detonations, and releases of radioactive materials from nuclear power plants and other facilities handling radioactive materials. Radiation doses to individuals may result from direct exposure to radiation from these sources and the intake of radioactive materials in food, drinking water, and air. The most significant exposure is that to the lungs from background levels of radon. The annual average effective dose equivalent for natural background in the United States is approximately 190 mrem/yr (FR, 1986); this dose is detailed in Table 4-13. About one-half of the dose equivalent is attributable to the inhalation of radon-222 and its decay products, and the other half is direct exposure, primarily gamma radiation. The EPA reports the direct gamma radiation exposure rates for communities throughout the United States on a quarterly basis. During the period July-September 1986, EPA reported measured gamma exposure rates that were equivalent to annual doses of between a high of 160 ± 9 mrem (exposure rate of 18 microR/hr) in Montpelier, Vermont, and a low of 40 ± 4 mrem (exposure rate of 8 microR/hr) in Harrisburg, Pennsylvania (EPA, 1987).

Activities at the Y-12 Plant can contribute to radiation levels in the vicinity of the plant. Because of the random nature of radioactive decay and the numerous contributors to background, it is not possible to predict the exact background radiation in an area. In addition, gross-radiation measurement techniques do not allow accurate differentiation between background radiation and contributions from a localized source such as a nuclear facility. To determine whether Y-12 activities are contributing to the radiation levels in the vicinity of the plant, it is necessary to estimate the radiation level attributable to background sources. One approach to this is to measure the background at a location that is nearby, but sufficiently removed from the plant that contributions from plant sources would be below the detection limit for the measurement technique. For the Y-12 Plant, radiation levels at Knoxville, Tennessee can be considered to be background and free of Y-12 contributions. The annual dose for Knoxville, Tennessee, based on data for the period July-September 1986 was 100 ± 3 mrem (exposure rate of 11 microR/hr) (EPA, 1987). The average dose, for the same time period, of 22 locations monitored throughout the United States by the EPA was 94 mrem, with a standard deviation of 29 mrem.

TABLE 4-13

AVERAGE U.S. ANNUAL EFFECTIVE DOSE EQUIVALENT TO
HUMANS FROM NATURAL BACKGROUND RADIATION
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE

Organ	Annual Effective Dose Equivalent (mrem)
Gonads	24
Breast	14
Lung (Total)	100
Red Bone Marrow	19
Bone Surfaces	6
Thyroid	3
Other	29
Total	189

Source: 52 FR 34836, 1986

As part of its Annual Environmental Monitoring Report, the Y-12 Plant is required to provide an assessment of the potential plant contribution to the public radiation dose (DOE, 1986a). In 1985, the Department of Energy (DOE) adopted an interim environmental radiation protection standard to be implemented in calendar year 1985 (DOE, 1985a). It is DOE policy to follow the guidance of the National Council on Radiation Protection and Measurements (NCRP) to the extent practicable with respect to radiation protection standards. A comprehensive revision of previous NCRP recommendation on a basic radiation protection system is still under development. However, current NCRP guidance is available regarding protection of the public in its September 18, 1984 advice to the Environmental Protection Agency published under the title "Control of Air Emissions of Radionuclides." In this document, the NCRP endorses the recommendation of the International Commission on Radiological Protection (ICRP) to limit the continuous exposure of any member of the public from other than medical sources and natural background to 100 mrem per year whole body dose-equivalent. The previously recommended limit of 300 mrem per year is retained for non-continuous exposures. These recommendations are now adopted as interim standards for DOE environmental activities for all exposure pathways.

40 CFR 61.93 states that dose equivalent to members of the general public shall be calculated using EPA models AIRDOS-EPA and RADRISK, or other procedures, including those based on environmental measurements, that EPA has determined to be suitable. The Y-12 Plant dose assessments are performed using AIRDOS-EPA.

4.3.2 General Description of Pollution Sources/Controls

The Y-12 Plant can contribute to the radiation dose to members of the general public through their exposure to external gamma radiation, inhalation of contaminated airborne particulates, and ingestion of contaminated food stuffs and water. The sources of radioactive materials that might lead to the latter two are discussed in the media-specific discussions of Section 3.0 (i.e., 3.1 Air, 3.2 Soil, 3.3 Surface Water, and 3.4 Groundwater). Each of these media can provide a pathway for the exposure of individuals to radiation. External gamma exposure could result from either gamma emitting radionuclides stored at the Y-12 site, or gamma-emitting materials released from the plant and deposited on on-site or off-site properties.

The radioactive materials currently processed at Y-12 are the uranium isotopes U-234, U-235, and U-238. Both depleted and enriched uranium are processed and stored at Y-12 in production buildings located throughout the facility. Major production facilities for enriched uranium include Buildings 9206, 9212, and 9215. The major depleted uranium facilities include 9201-5, 9204-4,

and 9998. An overview of major operations at Y-12 is provided in Section 2.2. In addition, depleted uranium scrap and low-level radioactive wastes have been disposed on-site. Radioactive waste disposal and storage locations are discussed in Section 4.1.1.3. In the past, natural thorium (thorium-232) was handled at Y-12, and there may be thorium contamination on-site. A characterization of the extent of thorium contamination of the Y-12 site is included in the Y-12 radiological survey described in Section 3.2.3. The Survey team identified no information to indicate that thorium remains stored at Y-12, although the Bear Creek Burial Grounds may have received thorium and thorium-contaminated materials in the past. The Survey team did not identify any documentation regarding quantities of thorium disposed or disposal locations.

Radioactive materials that are deposited on the soil surface as a consequence of past releases of radioactive materials would result in an external gamma exposure to an individual present on contaminated lands. This is called ground-plane irradiation. Soil contamination resulting from the Y-12 Plant's releases is discussed in Section 3.2. Ground-plane irradiation is not a measurable dose contributor to off-site locations.

The principal means used to control the direct radiation exposure to individuals is the restriction of access to the Y-12 Plant site and facilities containing radioactive materials.

4.3.3 Environmental Monitoring Program

4.3.3.1 External Gamma Radiation Monitoring

A routine environmental monitoring program is in place to measure radionuclides in various media (see Sections 3.1.3, 3.2.3, 3.3.3, and 3.4.3). In addition, thermoluminescent dosimeters (TLDs) are used to measure the external penetrating gamma radiation exposure at locations both on and off the Oak Ridge Reservation (ORR). The measurements are made to confirm that activities on the ORR, including Y-12, are not increasing gamma radiation levels significantly above background. There are four groups of monitoring stations for the ORR: (1) ORNL perimeter; (2) ORGDP perimeter; (3) ORR stations; and (4) remote stations. The monitoring stations around ORNL and ORGDP are in place to determine whether the radiation levels around these facilities are higher than those throughout the rest of the reservation. Y-12 has been judged by ORR personnel to have a lesser potential to cause elevated gamma radiation levels than the other facilities and consequently does not have a perimeter monitoring network. The ORR and remote stations can be used to monitor any off-site radiation level increases caused by Y-12 activities. Of the four groups of monitoring stations listed, the latter two are pertinent to Y-12. Locations of the ORR and remote stations are shown in

Figures 4-6 and 4-7, respectively. The ORR network monitors the radiation levels throughout the ORR and will include contributions from all three facilities (Y-12, ORNL and ORGDP). ORR monitoring stations T6, T7, T11, T13, T14, T15, and T16 are located in such a fashion that they would be indicative of Y-12 gamma radiation. These stations range in distance from the Y-12 plant center between approximately 1.5 km (T15) and 7.5 km (T11). The remote stations are located around the reservation at distances between approximately 25 km (T18) and 75 km (T22). It is important to note that any elevated radiation levels observed on the ORR are likely to have contributions from all facilities on the reservation, not just Y-12, and it would not be feasible to explicitly identify the source through a TLD monitoring program.

Table 4-14 presents the 1985 external gamma measurements for the ORR and remote stations. A considerable variation in background levels is typically observed in East Tennessee because of differences in elevation, topography, and the geological characterization of the surrounding soil. Within the uncertainty of the measurements, the measured dose rates are comparable to backgrounds observed throughout the United States (EPA, 1987). Over the period 1981-1985, the average external gamma radiation levels measured at the ORR stations and the remote stations were 10.0 and 7.9 microR/hr, respectively. These average values are representative of background levels of radiation and do not indicate contributions from Y-12.

External gamma radiation monitoring was also conducted in 1985 along the stream course of East Fork Poplar Creek (EFPC) to specifically evaluate potential external exposures from activity that may be contained in the sediments as a result of liquid effluent releases from Y-12. The locations of the monitoring stations are shown in Figure 4-8 and the results of the 1985 measurements are presented in Table 4-15. Measurements were made only for April 4 to August 20, 1985, with only two measurements made at each location. The maximum dose rate observed was 9.8 microR/hr; this value is within the range of typical United States background values.

4.3.3.2 Dose Assessment

Radiation exposures are received from both external sources, as described in the previous section, and from radionuclides taken into the body by inhalation of air, and ingestion of water and foodstuffs. A complete assessment of the radiation dose received by members of the general public as a consequence of activities of Y-12 must include radiation exposures received both externally and internally. Because the TLD monitoring networks have not detected any gamma radiation in excess of background, it may be concluded that radioactive materials stored on-site and soil contamination

FIGURE 4-6

LOCATION MAP OF TLDs ON THE OAK RIDGE RESERVATION
Y-12 PLANT, OAK RIDGE RESERVATION

FIGURE 4-7

LOCATION MAP OF TLDs AT REMOTE LOCATIONS
Y-12 PLANT, OAK RIDGE RESERVATION

TABLE 4-14

**1985 EXTERNAL GAMMA RADIATION MEASUREMENTS
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**

Oak Ridge Reservation Stations^a

Location	No. of Measurements ^c	$\mu\text{R/h}$		
		Maximum	Minimum	Average
T6 ^b	6 ^d	16	9.8	12
T7 ^b	3 ^d	9.8	8.8	9.3
T8	24	21	2.4	9.6
T9	24	21	4.1	12
T10	24	13	2.8	7.9
T11 ^b	24	15	4.8	8.5
T12	24	14	3.7	7.8
T13 ^b	24	20	4.1	8.4
T14 ^b	24	13	3.3	8.8
T15 ^b	24	13	5.3	9.1
T16 ^b	20	16	4.2	11
Overall	221	21	2.4	9.3

Remote Stations^e

T17	4	7.3	5.2	6.4
T18	4	9.2	4.3	6.8
T19	4	8.7	7.8	8.4
T20	4	8.0	6.8	7.5
T21	4	8.8	6.0	7.4
T22	4	10	7.0	8.9
T23	4	14	11	13
Overall	28	14	4.3	8.3

Source: MMES, 1986a.

- a See Figure 4-6.
- b These stations, because of their locations, are those most likely to be indicative of radiation contributions from Y-12.
- c Two measurements are taken per station for each time interval. Two dosimeters are placed in each container to obtain these measurements.
- d Samples were analyzed semiannually with three measurements taken per station for each time interval. Station T7 samples for the second half of 1985 were not reported because they became wet during the sampling period.
- e See Figure 4-7.

SOURCE: MMES, 1986a

FIGURE 4-8

LOCATION MAP OF TLDs ALONG EAST FORK POPLAR CREEK
Y-12 PLANT, OAK RIDGE RESERVATION

TABLE 4-15

**1985 EXTERNAL GAMMA RADIATION MEASUREMENTS
ALONG EAST FORK POPLAR CREEK
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**

Location ^a	No. of Measurements ^{b,c}	$\mu\text{R/h}$		
		Maximum	Minimum	Average
T34	2	5.3	5.2	5.2
T35	2	7.1	6.0	6.5
T36	2	DN ^d	DN	DN
T37	2	8.6	7.2	7.9
T38	2	7.9	6.6	7.2
T39	2	6.9	6.0	6.5
T40	2	4.9	4.2	4.5
T41	2	6.4	4.8	5.6
T42	2	6.1	5.5	5.8
T43	2	5.1	5.1	5.1
T44	2	9.8	4.3	7.1
Overall	22	9.8	4.2	6.2

Source: MMES, 1986b

a See Figure 4-8.

b TLDs in field from April 4 to August 20, 1985.

c Two dosimeters per container.

d DN = Data not given because TLD chips got wet; thus data were not valid.

at the Y-12 Plant do not contribute measurably to off-site radiation doses through direct gamma radiation. However, radionuclides released to off-site locations through airborne emissions and liquid effluents can lead to both external and internal exposures. This section summarizes the Y-12 radiation dose assessment.

Principal pathways for radiation exposure of humans as the result of radionuclides released from operations at ORR facilities, including Y-12, are shown in Figure 4-9. The doses to the various major organs are considered for various exposure pathways. The radiation doses received by a specific organ are weighted and summed to determine the total dose. Radionuclides taken into the body will continuously irradiate the body until they are removed through either radioactive decay or metabolic processes. Consequently, internal dose estimates are calculated as "50-year dose commitments." These are obtained by integrating the total dose received by an individual's body over an assumed remaining lifetime of 50 years.

Airborne effluents are released from several locations within the Y-12 Plant (see Section 3.1.2.1). For the purposes of the dose calculations, the total discharge was assumed to have occurred at a single point located at the plant center. No plume rise resulting from momentum (zero velocity stack discharge) was incorporated into the modeling for the Y-12 Plant. For 1985 estimates, meteorological data collected at ORNL was used for Y-12. Meteorological towers were erected at Y-12 in late 1985, but insufficient data was available to allow its application for the 1985 dose assessment. The meteorological towers are further discussed in Section 3.1.3.3.

Potential radiation doses from Y-12 airborne releases were calculated for the nearest resident off-site (maximally exposed individual), and the population within an 80 km radius of the Y-12 Plant. The calculations were made using the computer code AIRDOS-EPA; this is one of approved dose assessment codes specified for use in 40 CFR 61.93. The code utilized the Y-12 airborne radionuclide emission data for 1985 (Section 3.1.3).

A total of 0.1 Ci of uranium was released into the atmosphere from Y-12 during 1985 (MMES, 1986a). The exact isotopic assay and chemical composition of the material released is unknown. For the purpose of the dose calculations, it was assumed that the uranium was all uranium-234 with one-third of the total release soluble in lung-fluid (D-solubility class), one-third moderately soluble (W-solubility class), and one-third insoluble (Y-solubility class). The assumption concerning the isotopic distribution is conservative, since U-234 has the highest dose conversion factor of the three uranium isotopes released by Y-12. The assumption concerning solubility may or may not be

FIGURE 4-9

Y-12 PLANT DOSE ASSESSMENT PATHWAYS Y-12 PLANT, OAK RIDGE RESERVATION

conservative. Y-12 is currently involved in a program to characterize stack emissions, including a determination of solubility class. The results of this effort will be used to support the validity of dose assessments. The uranium is assumed to be released at a height of 20 m; this may or may not be conservative, depending upon meteorological conditions.

The air-pathway whole-body dose equivalent for the nearest resident is included in Table 4-16. The whole-body dose is estimated to be 0.000016 millirem. This dose results from uranium ground deposition of airborne releases and immersion in uranium contaminated air. Also included in Table 4-16 are the various organ doses that result from both internal and external exposure to a maximally exposed individual, and the 50-year committed effective whole-body dose equivalent, which is calculated at the weighted sum of the organ doses. Ingestion doses were calculated assuming that, for the nearest resident located approximately 570 m in the north-northwest direction, one-third of his food was grown in his own backyard and two-thirds was imported from outside the 80-km region (i.e., uncontaminated) (MMES, 1986a). The primary component of the airborne pathway of exposure is inhalation, although the AIRDOS-EPA calculation includes the other components as well.

For population doses, it was again assumed that one-third of the food consumed was grown locally and two-thirds was imported. The whole-body dose equivalent to the population within 80 km of Y-12 was estimated to be 0.00042 person-rem (external dose only). The effective whole-body dose equivalent to the population is 33 person-rem (weighted sum dose), due primarily to inhalation.

The NESHAP regulatory limits for exposure through the air pathway are 25 mrem/yr whole-body dose and 75 mrem/yr critical organ dose. The 1985 whole-body and lung (critical organ) doses from Y-12 emissions, as calculated by AIRDOS-EPA are 0.000016 mrem/yr and 8.3 mrem/yr, respectively. These doses are 6.4×10^{-5} percent and 11.1 percent, respectively, of the NESHAP limits.

Surface water samples are collected at several locations and analyzed for radionuclides to determine the exposure to members of the general public from the liquid discharges of the ORR facilities. The monitoring of liquid releases from Y-12 is discussed in Section 3.3.3. Liquid effluents and surface drainage from the Y-12 Plant discharge into the East Fork Poplar Creek, which eventually discharges to the Clinch River. No one is known to draw any drinking water from East Fork Poplar Creek.

TABLE 4-16

**CALCULATED DOSE FROM AIRBORNE RELEASES
TO THE NEAREST RESIDENT TO THE Y-12 PLANT^{a, b}
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**

Dose ^c (millirem)					
Whole-Body Dose	Effectived Whole-Body Dose Equivalent	Bone ^e	Kidney	Lung ^f	Stomach Wall
0.000016	1.7	0.78	0.32	8.3	0.0020

Source: MMES, 1986a

- a Nearest resident is 570 m north-northwest.
- b Whole-body doses for uranium are from external doses only because it is not deposited throughout the body. The uranium is considered to be one-third chemically soluble in lung (D-solubility), one-third moderately soluble (W-solubility), and one-third insoluble (Y-solubility).
- c Fifty-year dose commitment.
- d Weighted sum dose.
- e Endosteal cells of the bone.
- f Pulmonary region of the lung

The nearest public water supply to the liquid discharge points from the ORR is located about 26 km downstream at Kingston, Tennessee. The intake to the Kingston water filtration plant is located on the Tennessee River about 0.8 km upstream from the confluence of the Clinch and Tennessee Rivers. The Tennessee River does not receive discharges from ORR. The Clinch River receives Y-12 discharge through East Fork Poplar Creek. Normally, Tennessee River water is used for the Kingston water supply, but under certain conditions backflow can occur. Under backflow conditions, Clinch River water may move upstream in the Tennessee River and be used as the source of water for the Kingston filtration plant. Water samples from the Kingston filtration plant were, during 1985, collected by ORR personnel on a daily basis and composited for quarterly analysis for uranium, fission products, and transuranics (see Section 3.3.3). The only radioactive materials released from Y-12 in detectable quantities are the uranium isotopes. Since the analyses are based on quarterly composites, they will be representative of any backflow occurrences during 1985. The Environmental Survey team calculated the radiation dose to members of the public from uranium in drinking water, for samples collected at Kingston. For the purposes of this calculation it was assumed that all of the uranium observed in the Kingston samples is from Y-12; background levels of uranium and ORGDP contributions were not subtracted. This results in a conservative dose assessment. The calculation used dose conversion factors based on ICRP recommendations (DOE, 1985a). On the basis of the maximum concentrations of uranium-234, 235, and 238 observed in the Kingston samples, the maximum dose resulting from the ingestion of the adult daily requirement of water (730 l/year) is 0.015 millirem for the effective whole-body dose equivalent (50-year commitment). Since no subtraction has been made for background levels of uranium, this result is a conservative estimate of the dose from drinking water.

The potential radiation dose from the ingestion of Clinch River fish was calculated by ORR personnel. Fish were collected during 1985 from several locations along the Clinch River and were analyzed for radionuclides. The locations are identified in Table 4-17, along with the estimated dose resulting from the maximum observed uranium. The sampling locations, identified on the basis of their distances from the mouth of the Clinch River (Clinch River Kilometer, CRK), include (1) CRK 40.0 upstream of the Melton Hill Dam, which serves as a reference point; (2) CRK 33.3, the point where ORNL discharges (White Oak Creek) enter the Clinch River; (3) CRK 19.2, the point where Y-12 discharges (East Fork Poplar Creek) enter the Clinch River; (4) CRK 160.0 and CRK 8.0, points downstream of all ORR facilities; and (5) CRK 3.2, a downstream reference point. Y-12 cannot affect points CRK 40.0 and CRK 33.3 because they are upstream of the East Fork Poplar Creek discharge into the Clinch River. The dose estimates assume a consumption rate of 20 kg/yr of fish obtained from the Clinch River. Analyses were made of the edible tissue of bass, bluegill, and carp obtained from six

TABLE 4-17

**50-YEAR COMMITTED EFFECTIVE WHOLE-BODY DOSE-EQUIVALENT
FROM CONSUMPTION OF CLINCH RIVER FISH DURING 1985
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**

Location ^a	Fish Species	Radionuclide Dose (millirem)		
		²³⁴ U	²³⁵ U	²³⁸ U
Clinch River (km 40.0) ^b	Bass	0.0035	0.00018	0.0021
	Bluegill	0.011	0.0012	0.0049
	Carp	0.0091	0.0020	0.0041
Clinch River (km 33.3) ^c	Bass	0.0068	0.0012	0.0024
	Bluegill	0.015	0.0019	0.0056
	Carp	0.005	0.00075	0.003
Clinch River (km 19.2) ^d	Bass	0.0036	0.00069	0.0034
	Bluegill	0.029	0.0026	0.014
	Carp	0.018	0.0015	0.013
Clinch River (km 16.0) ^e	Bass	0.0043	0.00051	0.0035
	Bluegill	0.011	0.00064	0.0056
	Carp	0.0079	0.0008	0.0038
Clinch River (km 8.0) ^e	Bass	0.0056	0.0011	0.0028
	Bluegill	0.0096	0.00069	0.0082
	Carp	0.0079	0.00085	0.0061
Clinch River (km 3.2) ^f	Bass	0.0036	0.00075	0.0019
	Bluegill	0.012	0.0020	0.0061
	Carp	0.0056	0.00040	0.0033

Source: MMES, 1986a.

- Number in parentheses denotes distance of sampling point, in kilometers, from the mouth of the Clinch River.
- Location upstream of Melton Hill dam, which serves as a reference point.
- Location where discharges from ORNL (White Oak Creek) enter the Clinch River.
- Location where discharges from Y-12 (East Fork Poplar Creek) enter the Clinch River.
- Locations downstream from discharges of all three ORR facilities (ORNL, ORGDP, Y-12).
- Downstream reference point.

locations in the Clinch River. The fish were analyzed for eight separate radionuclides. Only three of these, uranium-234, uranium-235, and uranium-238, can be associated with Y-12 releases. The maximum effective whole-body dose equivalent from uranium, associated with fish obtained at the Clinch River Kilometer 19.2 location, was calculated as 0.088 mrem/yr (MMES, 1986a). The total 1985 dose from the aquatic pathway including drinking water and fish consumption, was 0.10 mrem.

An individual exposed to the maximum concentration of uranium originating from Y-12, in air, drinking water (at Kingston), and fish (CRK 19.2) would receive a 50-year committed effective whole-body dose equivalent of 1.8 millirem/year. Of this dose, 1.7 millirem/year is attributable to the air pathway. The DOE interim radiation protection standard for members of the public, for prolonged periods of exposure, is 100 mrem/yr above background, from all pathways. The estimated dose to the maximum exposed individual is 1.8 percent of the standard. For the airborne pathway, the whole-body dose equivalent of 1.6×10^{-5} mrem and the critical organ (lung) dose of 8.3 mrem are 6.4×10^{-5} and 11.1 percent, respectively, of the NESHAP standard.

It is informative to compare the calculated dose to the estimated average United States natural background radiation dose, from external and internal exposures, of 190 mrem/yr. The effective dose, resulting from Y-12 activities, to the maximum exposed individual is about 1 percent of the average U.S. background.

4.3.4 Findings and Observations

4.3.4.1 Category I

None.

4.3.4.2 Category II

None.

4.3.4.3 Category III

None.

4.3.4.4 Category IV

1. Dose Assessments. Some of the parameters used as input to the AIRDOS-EPA code may not accurately reflect the characteristics of the Y-12 airborne emissions. The isotopic distribution, solubility classes, and particle size distribution of the releases have not been accurately characterized. Because of this, it has been assumed that all of the uranium released is uranium-234 (a conservative assumption); the solubility classes are one-third D, one-third W, and one-third Y (potentially non-conservative); the particles have a 1.1 μ m aerodynamic mean diameter (conservative); and the ORNL meteorology adequately represents Y-12 (potentially non-conservative). While these assumptions should lead to a conservative estimate, that is not a certainty, and the potential exists that the risk to the public from Y-12 releases may be underestimated. However, because the estimated doses are a small fraction of either the NESHAP (11.1 percent, critical organ and 6.4×10^{-5} percent, whole-body) or DOE (1.8 percent) limits, there is no likelihood that any nonconservatism would result in a dose exceeding any health-based radiation protection standards.

Y-12 is currently engaged in a program to fully characterize radionuclide emissions, so that assumptions being used may be verified, or if not accurate, corrected. In addition, two meteorological towers were installed in late 1985 to provide local meteorological information for dose assessments. The data obtained in these studies will provide the necessary input to support validity of the dose assessment.

4.4 Quality Assurance

4.4.1 General Description of Data Handling Procedures

The Y-12 Plant utilizes three on-site laboratories and several contractor laboratories to generate environmental monitoring data. The various Y-12 environmental laboratories are housed in three different buildings: 9720-6, 9995, and 9769.

The Environmental Radiochemistry Laboratory is located in Building 9720-6. This facility performs radiological analyses in support of the NPDES compliance program and also conducts radioactivity determinations on groundwater samples. Ambient air and drinking water samples, as well as analysis of spill response samples for radioactivity, are also part of the Environmental Radiochemistry Laboratory responsibilities.

The Production Radiochemistry Laboratory is located in Building 9995 and performs only radiological analyses of stack emissions samples. The individual who conducts phase contrast and polarized light microscopy analyses of air and bulk samples, respectively, for asbestos is also located in Building 9995.

The main Environmental Laboratory (Building 9769) is responsible for the analysis of nonradiological environmental samples. These include all water samples required under the NPDES permit, Safe Drinking Water Act, and RCRA. In addition, stack samples, and soil and sediment samples are also analyzed. Nonradiological analyses of spills and emergency response samples are performed in Building 9769.

Y-12 also uses several contractor laboratories to analyze environmental samples from the plant. These contractor laboratories include the X-10 and K-25 laboratories, and commercial laboratories operated by the Roy F. Weston, EAL, and IT Corporations. The contractor laboratories may work directly with the Y-12 laboratories, or serve as subcontractors to one or more of the other laboratories. Approximately one-third of the environmental samples collected at Y-12 are analyzed by contractor laboratories; the bulk of these samples are analyzed by the K-25 laboratory.

The Y-12 Plant may also request that contractor laboratories collect as well as analyze environmental samples associated with specific projects or studies. Whether or not a particular contractor laboratory collects and/or analyzes all or only a portion of the environmental samples generated by a project or study depends upon instrument status, analyst availability, types of analyses to be performed, requirements for turnaround time, and other considerations.

The K-25 laboratory is a successful participant in the EPA Contractor Laboratory Program and has implemented a rigorous QA program. During the Environmental Survey, the K-25 QA Program was reviewed briefly. The Y-12 Plant has also performed QA audits of the K-25 laboratory. QA programs have been developed by the other contractor laboratories to which the Y-12 Plant submits environmental samples; these programs were not reviewed by the Survey team.

The Y-12 Plant conducted an internal audit of its environmental laboratories in February 1985. In addition, a comprehensive review of all aspects of the nonradiological environmental sampling and analysis program was performed July 8-12, 1985, by an 11-member team under the direction of the Martin Marietta Energy Systems (MMES) Central Staff. The purpose of this latter effort was to review and assess the Y-12 effluent and environmental sampling and analysis programs, and included an evaluation of the QA/QC programs. Approximately 80 recommendations related to environmental

sampling and analysis were submitted by the audit team, and actions have been implemented by Y-12 to address these recommendations.

The following aspects were considered by the Environmental Survey team in the review of the Y-12 Environmental Laboratory QA/QC Program:

Organization

A QA/QC manager was appointed in June 1986. His responsibilities include both sampling and analysis aspects, but initial efforts have been focused on laboratory QA/QC. At the time of the on-site portion of the Environmental Survey, a formal, written, QA/QC program had not been entirely developed; however, the sample chain-of-custody procedures are considered adequate.

Records

All samples are delivered from the field to the central receiving area in Building 9995. Samples are logged in, assigned a unique requisition number, and placed in a storage bin. A "work card" for each type of analysis to be performed is completed for each sample, and the work card(s) and sample are delivered to the appropriate laboratory. The work cards are white, except when the holding time for a particular analysis is critical, in which case a green work card is used to alert the laboratory.

In the Environmental Radiochemistry Laboratory (Building 9720-6), the work cards are used exclusively by the technicians during analysis. No logbooks are maintained at the work stations, and calculations, observations, etc., are recorded on the work card. However, in the main Environmental Laboratory and Production Radiochemistry Laboratory (Buildings 9769 and 9995, respectively), the analysts maintain work station logbooks in addition to the work card.

The work cards, raw data, and results are maintained at Building 9769 for 3 years. Thereafter, these materials are transferred to the plant central storage facility, where they are maintained for an additional 75 years. Samples are discarded 1 month after the results are reported to the requestor.

The standards analyzed by a particular procedure are recorded in a log for that procedure. The log contains reference values and acceptable ranges for the standard. A reagent shelf-life program has been initiated but not fully implemented. Routine checks of reagent purity are not usually performed.

Sampling Procedures

The Y-12 Plant expects to complete a sampling procedures manual for the collection of various types of environmental samples in 1987. The manual will include standard procedures for sample container cleaning and preparation; sample labeling, collection, preservation, storage, and holding times; and QA/QC samples.

Schedules have been developed for the collection of routine samples in connection with the NPDES and NESHAP compliance programs, and monitoring programs for radiological stack emissions and groundwater. The routine groundwater samples are collected and analyzed in connection with RCRA sites granted interim status, the ongoing characterization of the Bear Creek Valley Disposal Area, and RCRA-equivalent groundwater monitoring at active and inactive waste disposal sites (see Section 3.4.3). It is anticipated that, as appropriate, similar schedules will be devised for the other environmental monitoring programs.

A variety of personnel with varying levels of training and experience are utilized for the collection of environmental samples. Efforts have been initiated by the Y-12 Plant to provide formal training in sampling methods to all such individuals.

Instruments

In general, the Y-12 Environmental Laboratory follows the instrument maintenance procedures specified in the manufacturer's manual. Equipment inspection and maintenance is performed by the Mechanical Inspection Department. At the time of the February 1985 internal Y-12 laboratory audit, the laboratory staff did not maintain copies of the instrument inspection and maintenance records. However, as of June 1986, a system had been adopted whereby the maintenance procedures performed on the major laboratory equipment are recorded in the instrument logbooks.

Calibration procedures have been established for all instruments. Records of instrument calibrations are maintained. For most procedures, the range of calibration standards that are analyzed includes standards at or near the detection limit of the method. The QA Coordinator has ultimate responsibility for ensuring that instrument calibrations are conducted properly.

A formal analyst training program on the use of the various instruments has not been implemented. In general, laboratory personnel are trained in instrument use by experienced analysts who rely

upon manufacturer's manuals. An analyst qualification program has been developed, but full implementation is not expected to begin until at least the end of 1987.

Analytical Procedures

The three Y-12 environmental laboratories maintain copies of all the procedures used in the laboratory in the laboratory office. In addition, the analysts maintain copies of the particular procedures for which they are responsible at their work stations. The analytical methods used in the laboratories are based on widely accepted standard methods. In most instances, the EPA method is the procedure of choice. When an EPA method is not available, procedures from other sources such as "Standard Methods for the Examination of Water and Wastewater" published jointly by the American Public Health Association, the American Water Works Association, and the Water Pollution Control Federation are employed. Procedure editing is the responsibility of the QA Coordinator.

The laboratory procedures specify the proper method for calibration, as well as the minimum reagent quality. All primary standards are National Bureau of Standards (NBS)-traceable or equivalent. Reagents are not logged in nor dated upon arrival at the laboratory, and during the Survey, some buffer solutions were observed being used beyond the expiration dates. The QA Coordinator indicated that he is in the process of initiating a reagent shelf-life program.

Internal Quality Assurance Procedures

As noted above, all of the Y-12 laboratories utilize a work card system to track samples and record results. Calculations necessary to obtain the results are performed on the work card. The analyst who generates the raw data and the analyst who calculates the results (if different) must initial the card. These calculations are checked and approved by supervisory staff, who indicate this approval by also initialing the work card.

The main Environmental Laboratory (9769) analyzes blank samples on a routine basis, and one duplicate is analyzed for every 10 samples processed. In addition, an internal spike sample is generated for every 20 samples analyzed, and spike recoveries are determined.

Blank samples are also analyzed in the Environmental Radiochemistry Laboratory (9720-6). However, in contrast to the main Environmental Lab, the Environmental Radiochemistry Laboratory does not analyze sample duplicates. The Environmental Radiochemistry Laboratory does analyze

spike samples, but at the time of the Environmental Survey, because of the recent departure of the laboratory radiochemist, the methods utilized to calculate spike limits could not be ascertained.

The Production Radiochemistry Laboratory (9995) routinely assesses "background" radioactivity levels (the equivalent of a blank). Because of the type of sample that the laboratory analyzes, it is not possible to process sample duplicates. Although spike samples could be generated, these are not analyzed.

Y-12 has acquired the basic software for a data management system. At the time of the Environmental Survey, the system had not been implemented, and plans had not been finalized to implement the system. This deficiency was also noted in the February 1985 Y-12 internal audit and the July 1985 Central Staff Review.

Quality Assurance Plans for the various types of analyses performed by the Y-12 Environmental laboratories were issued in June 1986. These plans addressed radiochemical analyses, RCRA samples, NPDES/groundwater samples, drinking water samples, and tissue or vegetation samples.

The appointment of a Y-12 Environmental Laboratory QA coordinator in June 1986 is expected to have an overall positive effect on the QA/QC program. The resolution of most major QA/QC deficiencies identified in the internal Y-12 and MMES Central Staff audits is targeted for 1987.

Education of Personnel

The educational backgrounds of the various sampling and laboratory analysis personnel at the Y-12 Plant is variable. As far as can be determined, however, all sampling and analysis personnel possess at least a high school diploma. Future plans call for the development of formal job descriptions requiring at least 2 years of university-level chemistry.

As indicated earlier, for the most part, "on-the-job" training is the primary means of developing sampling and analysis personnel. However, an analyst qualification program has been published, and full implementation by the summer of 1988 is one of the goals of the QA Coordinator.

Outside Laboratory

The primary outside laboratory used by the Y-12 Plant for the analysis of environmental samples is the K-25 laboratory. Any Y-12 samples to be analyzed by K-25 are delivered directly to the K-25 laboratory sample receiving area with a chain-of-custody form.

The K-25 laboratory maintains a QA/QC program. It is certified by the State of Tennessee to perform drinking water analysis and is a successful participant in the EPA Contract Laboratory Program. The Y-12 Plant personnel audited the K-25 laboratory in December 1984. The report generated by the Y-12 staff was generally favorable.

External Quality Assurance

The Y-12 environmental laboratories participate in a total of six external quality assurance programs. One program is administered by the Y-12 Quality Division, four others are operated by government agencies (one of which is DOE), and the sixth is a commercially-available service. Typically, these programs involve the analysis of blind samples for multiple parameters. The extent to which a particular Y-12 environmental laboratory participates in such external QA programs depends upon the types of analyses required.

The Y-12 Quality Division prepares blind samples for analysis by all three Y-12 environmental laboratories. The types of samples generated include uranium analyses, smears for radioactivity, TLD badges, and polychlorinated biphenyls, and are submitted to the laboratories weekly. Most of the standards used in the preparation of these QA samples are NBS-traceable. According to the Quality Division Staff, outlier reports (i.e. notification that the data obtained from analysis of standard samples were not in the normal range) are forwarded to the laboratory weekly. At the time of the Environmental Survey, these reports were not reaching the QA Coordinator for at least 2 weeks after the outlier report was generated.

The main Environmental Laboratory (9769) participates in two EPA-administered external QA programs, one related to NPDES compliance and the other required under the Safe Drinking Water Act (SDWA). Whereas participation in the former is voluntary, the Environmental Laboratory must analyze the SDWA QA samples in order to maintain certification to conduct analysis of drinking water. In both instances, blind samples are forwarded to Y-12 by the USEPA annually. No radioactive samples are included. The data obtained by Y-12 is submitted to EPA or its

representative, and a report covering the laboratory's performance is prepared by EPA. To date, the Environmental Laboratory has performed satisfactorily in each of these programs.

The main Environmental Laboratory also obtains and analyzes blind QA samples covering approximately 40 parameters from Analytical Products Group (APG), a commercial QA service company. The APG samples include most NPDES and SDWA parameters, but no radiological analyses; they are analyzed and reported monthly.

QA samples for radiological analyses are provided to the Y-12 Production Radiochemistry and Environmental Radiochemistry Laboratories by the EPA Environmental Monitoring Systems Laboratory (EMSL) and the DOE Environmental Measurements Laboratory (EML). Participation in both programs is on a voluntary basis. Depending upon the particular radionuclide, the QA samples from EMSL are provided and analyzed at frequencies ranging from every two months to semiannually. In contrast, the EML samples are sent to participating laboratories once per year. All EML and EMSL QA samples, with the exception of uranium samples, are analyzed by the Environmental Radiochemistry Laboratory. The Production Radiochemistry Laboratory processes all uranium samples. Both labs have a successful history of participation in these external QA programs.

Asbestos samples (both bulk samples for asbestos content and asbestos in air) are analyzed in Building 9995. In the past, the analyst who performs this work successfully participated in the Proficiency Analytical Testing program sponsored by the American Industrial Hygiene Association for airborne asbestos samples, but withdrew from the program in October 1985. With respect to bulk asbestos samples, the analyst has attended a commercially-available training course, but does not participate in the EPA bulk asbestos sample quality assurance program. No formal internal quality assurance programs are in place in lieu of these widely accepted external programs.

The Oak Ridge Operations (ORO) office of the Department of Energy periodically conducts Environmental Monitoring Appraisals of the Y-12 Plant. The most recent appraisal was performed at Y-12 in August 1986. In its report, ORO recommended that Y-12 focus on consolidating written sampling and analysis procedures into a referable procedures manual. ORO also expressed concern that as environmental monitoring programs expand rapidly at Y-12, the environmental laboratories may experience an increased demand for analyses beyond their current capabilities.

4.4.2 Findings and Observations

4.4.2.1 Category I

None.

4.4.2.2 Category II

None.

4.4.2.3 Category III

None.

4.4.2.4 Category IV

1. Laboratory QA/QC Program. Environmental monitoring results may be suspect because the Y-12 Environmental Laboratories QA/QC Program does not entirely meet commonly accepted QA/QC program standards.

An audit of the Y-12 environmental laboratories' QA/QC programs for nonradiological analyses was conducted by the MMES Central staff in July 1985. This audit identified approximately 80 recommendations for improving these QA/QC programs. An internal Y-12 audit of all Y-12 environmental laboratories yielded similar findings. Many of these concerns were addressed by Y-12 prior to the Environmental Survey. Examples of the deficiencies in the Y-12 environmental laboratories QA/QC programs noted during the Environmental Survey include the following: (1) a formal analyst qualification program has not been implemented; (2) work-station log books are not utilized, and several buffer solutions were observed in use in the Environmental Radiochemistry Laboratory (9720-6) despite the fact that the expiration dates had been exceeded; (3) neither an internal nor external QA/QC program for asbestos analyses was practiced; and (4) the Environmental Radiochemistry Laboratory lacks formal written procedures for conducting quality control checks of the radiation counting equipment.

2. Sampling QA/QC Program. Environmental monitoring results may be suspect because Y-12 has not implemented a QA/QC program for environmental sampling.

Environmental samples at Y-12 are collected by a variety of personnel that possess varying levels of training and experience. At the time of the Environmental Survey, formal training in environmental sampling was not provided to these personnel. In addition, an environmental sampling manual that included standard procedures for sample container cleaning and preparation; sample labeling, collection, preservation, storage and holding time; and QA/QC samples had not been compiled. Because of the lack of a formal environmental sampling QA/QC program, the analytical data obtained from environmental samples collected at Y-12 may not be valid.

4.5 Inactive Waste Sites and Releases

4.5.1 Background Information

This section provides an overview of past releases of hazardous substances into the environment as a result of inactive waste sites, and spills and leaks at the DOE Oak Ridge Y-12 Plant. Information on these inactive waste sites and releases is provided in several documents, including

- Executive Overview: Martin Marietta Energy Systems, Inc., 1985. Y-12 Plant Long-Range Environmental Management Plan, December.
- Geraghty & Miller, Inc., 1985. Remedial Alternatives for the Bear Creek Valley Waste Disposal Area, Y/SUB/85-00206C/3, June.
- Martin Marietta Energy Systems, Inc., 1986. Environmental Surveillance of the Oak Ridge Reservation and Surrounding Environs During 1985, ORNL-6271, April.
- Martin Marietta Energy Systems, Inc., 1986. Waste Management Plan for DOE Order 5820.2, Oak Ridge Y-12 Plant, Y/TS-170, May.
- Union Carbide Corporation - Nuclear Division, 1983. Mercury at the Y-12 Plant, A Summary of the 1983 UCC-ND Task Force Study, Y/EX-23, November.

- Tennessee Valley Authority, 1986, Summary Report, Task 5, Instream Contaminant Study, January.
- Martin Marietta Energy Systems, Inc., 1986. Phase I Installation Assessment of Inactive Hazardous Waste Disposal Sites at the Y-12 Plant, Y/TS-114, April.

Based on the information available to the Survey team, there are 18 inactive waste sites and areas of releases (known and potential) for Y-12. Some of these sites are aggregates of smaller yet distinct waste disposal areas. Twelve of the 18 sites were already identified in published reports. The Survey team determined that six more should be added as a result of the on-site Survey. Information on all of the sites is presented in Section 4.5.2.

Of the 18 inactive waste sites and areas of releases, the Survey team has identified 15 to be of potential environmental concern, based on an independent review of environmental records, personnel interview files, aerial and ground photographs, discussions with plant personnel, and on-site inspections of known or possibly contaminated areas. Environmental findings for these 15 sites are presented in Section 4.5.3.

There is a possibility that other inactive waste sites and areas of releases will be discovered at Y-12 as a result of ongoing environmental monitoring and site investigations under the direction of Health, Safety, Environmental, and Accountability (HSE&A). For example, soil borings are taken routinely for new site construction and the samples are analyzed for possible contamination. HSE&A also requires that construction spoil be analyzed for possible contamination prior to disposal. Another example of an ongoing environmental study is soil sampling conducted for the Perimeter Intrusion Deterrent Alarm System (PIDAS) site survey. PIDAS will replace and/or fortify the existing security barrier system and will extend several miles around the secured zone of Y-12 (PIDAS crosses through areas known to have been active during the early years of Y-12 production). The PIDAS survey is taking soil borings along the proposed route, and samples will be analyzed for possible soil contamination (e.g., mercury, PCBs, radionuclides and other contaminants). If an area is determined to be contaminated, it will be identified for site characterization and possible remediation before PIDAS construction begins in that area.

Other studies that are on-going and proposed will help clarify the nature and extent of environmental contamination at Y-12. Site investigations are currently underway at the Bear Creek Burial Grounds. Other areas proposed for future investigations include the S-3 Ponds, the Z-Oil system, and underground storage tanks.

The environmental studies identified above will assist DOE in complying with several agreements and orders with the USEPA Region IV and the State of Tennessee Department of Health and Environment, and in resolving issues related to the radioactive and hazardous wastes at Y-12. Recent agreements and orders that include inactive waste disposal and release sites are presented in Appendix E.

4.5.2 General Description of Pollution Sources/Controls

Table 4-18 lists 18 inactive waste sites and areas of releases (known and potential) for Y-12. The sites are listed according to five broad geographical areas. The selection of these sites was based in part on known wastes that were buried and/or released at these areas, and the possibility for wastes (quantity and type undocumented) to have been disposed of at these sites. Also, a preliminary review of existing hydrogeologic and geophysical data strongly suggests that some of these sites may already be sources for contaminant releases to the environment (see Section 3.2.2, Soil; Section 3.3.2, Surface Water; and Section 3.4.2, Groundwater).

Following is a brief overview of the sites. For each site, the location is described, as well as past waste disposal practices and release incidents.

4.5.2.1 Bear Creek Valley Waste Disposal Area

The Bear Creek Valley Waste Disposal Area (BCVWDA) is located in Bear Creek Valley, west of the Y-12 Plant. The BCVWDA extends for about 2 miles in a general east-west direction. It is bordered on the north by Pine Ridge and on the south by Chestnut Ridge. Bear Creek flows through the valley and to the south of BCVWDA before it discharges into East Fork Poplar Creek, which flows into Poplar Creek, a tributary of the Clinch River.

The BCVWDA has been used for waste disposal since 1951 and parts of it remain active today. The majority of wastes that have been disposed of at this area have come from Y-12, although some wastes have also come from ORNL and K-25. The principal types of wastes have been mop waters, oils, solvents, coolants, heavy metals, liquid nitrate wastes, acids, caustics, asbestos, heavy metals, and uranium wastes. Other wastes have included degreaser solvents, cyanide, paint, thorium, iodine, lithium compounds, PCBs, poisons, concrete, wood, beryllium, and gasoline.

TABLE 4-18

LIST OF INACTIVE WASTE SITES AND AREAS OF RELEASES
(KNOWN AND POTENTIAL)
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE

1. Bear Creek Valley Waste Disposal Area

- Bear Creek Valley Waste Disposal Area which includes the S-3 Ponds, Oil Landfarm Site (i.e., Oil Landfarm, Bone Yard, Burn Yard, Hazardous Chemical Disposal Area, and Sanitary Landfill I), and the Burial Grounds (i.e., A, B, C, D, E, J, Walk-in Pits, and two Oil Retention Ponds).

2. West End Spoil Area

- Rust Engineering Spoil Area.

3. In-Plant Areas

- Mercury-contaminated Areas.
- Z-Oil-Contaminated Areas.
- Beta-4 Security Pits.
- S-2 Site.
- Coal Pile Trench.
- Ravine Disposal Area.
- Building 9766-- Beryllium Contamination.
- Cesium Contamination of Railroad Tracks at East End of Y-12.*
- Building 9728 (Former Y-12 Laundry Operation).*
- Dirt Pile North of Portal 18 and East of the S-3 Ponds.*
- Inactive Underground Storage Tanks.*

4. Chestnut Ridge

- Rogers Quarry.
- Kerr Hollow Quarry.
- Unidentified Area on Chestnut Ridge.*

TABLE 4-18
LIST OF INACTIVE WASTE SITES AND AREAS OF RELEASES
(KNOWN AND POTENTIAL)
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE
PAGE TWO

5. Off-Site Areas

- Off-site Floodplain Contamination in East Fork Poplar Creek and Other Nearby Areas.
- Off-site Recipients of Contaminated Scrap Metal.*

*Inactive waste site or area of release not identified in published reports at the time of the DOE On-site Survey.

The BCVWDA is a known source of groundwater, surface water, and soil contamination (refer to Section 3.2.2, Soil; Section 3.3.2, Surface Water; and Section 3.4.2, Groundwater). Environmental contaminants include nitrates, volatile organic compounds, heavy metals, and radionuclides.

The BCVWDA consists of three principal waste disposal sites: the S-3 Ponds, the Oil Landfarm Site, and the Bear Creek Burial Grounds (see Figure 4-10). The history of each site is summarized below, as presented in the documents titled Remedial Alternatives for the Bear Creek Valley Waste Disposal Area (G&M, 1985a) and Phase I Installation Assessment of Inactive Hazardous Waste Disposal Sites at the Y-12 Plant (MMES, 1986k).

S-3 Ponds

The S-3 Ponds are located at the west end of the Y-12 Plant, at the hydrologic divide separating the headwaters of Bear Creek (to the west) from the headwaters of East Fork Poplar Creek (to the east). The S-3 Ponds consist of four unlined impoundments covering an area of roughly 400 feet by 400 feet. Each pond is 17 feet deep and has a capacity of 2.5 million gallons. The area around the ponds has been significantly altered by construction activities. The original land surface at the site was reported to be wet, but has become relatively dry since the emplacement of fill materials during construction of the ponds in 1951. The ponds were designed to maximize rates of evaporation and percolation.

The S-3 Ponds were built as a disposal site for liquid wastes. During the 1950s, uranyl nitrate solutions containing trace amounts (data unavailable) of transuranics and other fission products (e.g., Ce-137; Co-56 and -60; Np-237; Nb-95; Pu-238 and -239; Ru-106; Tc-99; Th-228; and Zr-95) were placed in the ponds. At later dates, depleted uranium in nitric acid solutions, raffinate, and condensate containing technetium and transuranics were added. Other wastes included dilute acids, machine coolants, caustic solutions, denitrification sludges, and concentrated acids with a pH less than 2.0.

Liquid wastes were discharged into the ponds from tanker trucks, small containers, and an underground pipeline. When the nitric acid recovery system came on-line in 1976, the quantity of liquid wastes disposed of at the S-3 Ponds was reduced significantly (see Section 3.3.2.5, Bear Creek Valley Waste Disposal Area). In 1983, the quantity of liquid wastes disposed of at the ponds was about 2.7 million gallons. Discharge into the ponds terminated in March 1984.

2

**INACTIVE WASTE SITES AND RELEASES
Y-12 PLANT, OAK RIDGE**

FIGURE 4-10

5 THAT ARE OUTSIDE THE Y-12 PLANT AREA
K RIDGE RESERVATION

Cleanup of the S-3 Ponds began in 1984 when all four ponds were neutralized. The pond water was also denitrified to levels less than 50 ppm. The ponds were dewatered in early 1987. The remaining sludge is considered to be a mixed waste sludge and will be stabilized and removed under a proposed RCRA closure plan (see Section 4.1.1).

The underground waste acid discharge pipe to the S-3 Ponds remains in place. The pipe has been fitted with a valve to prevent further discharge to the S-3 Ponds.

Oil Landfarm Site

The Oil Landfarm Site is located in Bear Creek Valley west of the S-3 Ponds and approximately one mile west of the Y-12 Plant. The "Oil Landfarm Site" includes the Oil Landfarm, Bone Yard, Burn Yard, Hazardous Chemical Disposal Area, and Sanitary Landfill Number 1.

Oil Landfarm

In 1972, a study was undertaken in conjunction with the DOE-Oak Ridge National Laboratory to determine whether natural soil and microbial assimilatory processes could be used to slowly degrade oily wastes from the Y-12 Plant. The process involved application of waste oils and coolants to nutrient-adjusted soils, followed by frequent soil cultivation to maintain aerobic conditions. A study area for the process was selected in early 1973, designated as the Oil Landfarm. This 4-acre site remained operating until the practice was terminated in 1982.

Beginning in May 1973, liquid wastes were collected in tank trucks and transported to the Oil Landfarm for disposal. The waste oils and coolants were distributed over the surface of the plots and cultivated into the uppermost three inches of soil. The Oil Landfarm operated on a seasonal basis from April to October, the period with the most favorable conditions for soil microbial activity.

In 1979, it was discovered that liquid wastes disposed of at the Oil Landfarm contained PCBs. Up to this time, liquid wastes were not analyzed for chemical composition, although it is believed that Oil Landfarm wastes contained beryllium compounds, depleted uranium, PCBs, tetrachloroethene, and 1,1,1-trichloroethene (MMES, 1986k). Information on the concentration of these contaminants is not available. After the discovery of PCBs, liquid wastes were subsequently analyzed for uranium, beryllium, thorium, and PCBs. Liquid wastes containing greater than 5 mg/l PCBs were prohibited

from being landfarmed but instead were shipped off-site for disposal or stored on-site for future incineration (see Section 4.2.1.3, Toxic and Chemical Materials).

In December 1981, the analyses of liquid wastes was expanded to include chlorinated hydrocarbons. Records reportedly indicate that waste oils disposed at the Oil Landfarm contained less than 3 percent chlorinated hydrocarbons (G&M, 1985a). Approximately one million gallons of liquid wastes were applied at the Oil Landfarm during the 9 years of operation (MMES, 1986k).

Bone Yard

The Bone Yard is located east of the Oil Landfarm. This site was an active waste disposal site from 1943 to 1970. Wastes included acids, beryllium, organics (e.g., oils, coolants), metals, and debris. The quantity of material disposed of at the site was not recorded.

Magnesium chips were burned at the Bone Yard in large burn pans. Solvents were used to ignite the burn. Residues from the burning operation were dumped in trenches, backfilled after each deposition, and covered with topsoil and seeded when the trench became full. No leachate collection system, liner, or impermeable cap was used at this site.

Burn Yard

The Burn Yard was located southwest of the Bone Yard and consisted of two trenches approximately 300 feet long, and 40 feet wide and 10 feet deep. This site is no longer visible because the Hazardous Chemical Disposal Area was developed on top of it (refer to Hazardous Chemical Disposal Area).

The Burn Yard functioned as a waste burn site from 1943 to 1968. It is estimated that the site received approximately 4,000 tons per year of refuse (type of refuse undocumented) resulting from plant operations (MMES, 1986k). Waste materials may have included empty pesticide containers, metal shavings, solvents, oils, and laboratory chemicals. The wastes were placed in unlined earthen trenches and burned. Oils and other flammable liquids were used to start and sustain combustion. When filled, the trenches were covered with soil. No leachate collection system or impermeable cap was used at this site.

Hazardous Chemical Disposal Area

The Hazardous Chemical Disposal Area (HCDA) is located on top of the former Burn Yard and directly southwest of the Bone Yard and covers an area of several acres. The site received solid, liquid, and gaseous waste materials from 1975 to 1981. It is estimated that less than five tons of waste per year were deposited at the site (MMES, 1986k). The waste was broadly characterized as ignitable, reactive, corrosive, toxic, highly flammable, or, in some instances, inert.

As a rule, the HCDA received wastes that were otherwise unwanted and which posed safety hazards within the plant. Material came from two sources; gas cylinders with leaking or damaged valves, and laboratory chemicals considered to be reactive or explosive. Gas cylinders containing noncorrosive gases were intentionally leaked to the atmosphere. Cylinders containing corrosive gases were bled through neutralizing slurries. Empty gas cylinders were either buried at the Burial Grounds or removed for repair. Laboratory chemicals included acids, bases, organics, water-reactive compounds, and explosive compounds such as picric organics, benzoyl peroxide, and ether. Bottled chemicals were broken under a water spray inside a wide-diameter concrete pipe that was short and placed on end. Liquids from the chemical reaction percolated into the soil. Any remaining material was removed and transported to the Bear Creek Burial Grounds.

Sanitary Landfill I

The Sanitary Landfill I is located immediately south of the Oil Landfarm. This site was used between 1968 and 1983 for the disposal of solid wastes including paper, cardboard, plastics, rubber, wood, brush, animal bedding, garbage, and asphalt roofing materials. Administrative controls were reportedly used to exclude the disposal of toxic chemicals and other contaminated materials at the site. No leachate collection system or impermeable cap was used at the Sanitary Landfill I.

Trenches were excavated into the landfill for waste burial. The depth was approximately 20 feet. At least two of the trenches (farthest south from the Oil Landfarm) were excavated to a depth below the groundwater table and, as a result, waste contaminants came in contact with the groundwater.

Burial Grounds

The Burial Grounds are located in Bear Creek Valley approximately one-half mile west of the Oil Landfarm. The Burial Grounds are on the southern flank of Pine Ridge.

The disposal area consists of several principal sites including Burial Ground A, B, C, D, E, J (there is no trench F, G, H, or I), the "Walk-in Pits," and two oil retention ponds. Several of these sites (i.e., sections of A, D, E, J, and the Walk-in Pits), remain active for the disposal of depleted uranium and uranium-contaminated metal wastes (see Section 4.1.2.2, Waste Management). Liquid wastes are no longer disposed of at the Burial Grounds. Table 4-19 presents an overview of waste disposal activities at the Burial Grounds.

Liquids were previously disposed of using "standpipe disposal," "rock pit disposal," and land application. Standpipe disposal involved the partial excavation of a closed trench, installation of a vertical pipe, and backfilling the base of the pipe with large stone for support and to maximize drainage. Waste liquids were then poured through the top of the pipe and subsequently splashed on the stone and seeped into the underlying buried wastes. Rock pit disposal involved the partial excavation (2-3 feet) of a completed solid waste trench and backfilling with rock. Liquids were then poured directly onto the rocks and allowed to infiltrate the underlying soil and buried wastes. Land application of waste liquids occurred primarily at a designated area in Burial Ground A ("isolation area"). Gravel was placed on top of the ground, and waste liquids (mostly organic solvents) were poured onto the gravel. Liquids either percolated into the soil or vaporized.

Burial Ground A opened in August 1955 to receive wastes generated at the Y-12 Plant. Wastes included construction debris and contaminated scrap metal (waste type and quantity is classified). There were no trench liners or impermeable barriers used at this site. Sections of Burial Ground A remain active today (see Section 4.1.2, Waste Management).

In 1959 the disposal of liquid wastes began. Mop waters comprised the majority of waste liquids disposed of at this site. Mop waters (i.e., waste liquids and possibly low-level radioactive liquids generated from Y-12 floor cleaning operations) were transported to Burial Ground A in drums and tank trucks, and then were drained into standpipes, rock pits, and trenches. An estimated 600,000 gallons of mop waters were disposed annually by these methods at Burial Ground A between 1971 and 1978; the quantities disposed of prior to 1971 were not recorded. Disposal of mop waters in Burial Ground A was terminated in 1979 after which time they were disposed of at the S-3 Pond.

Burial Ground A also was used for the disposal of waste oils (including PCB-contaminated oils) and coolants. Prior to 1961, these wastes were disposed of together with solid wastes in unlined trenches at the Burial Grounds. In 1961, an open-top vertical tank was installed in Burial Ground A to hold

TABLE 4-19

**HISTORICAL SUMMARY OF WASTE DISPOSAL
AT THE BURIAL GROUNDS
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**

Waste	Burial Grounds – Trenches						Walk-in Pits
	A	B	C	D	E	J	
Heavy Metals ¹	P	NI	P	NI	NI	NI	P
Oils and Coolants	P	NI	P	NI	NI	NI	P
Salts	P	NI	P	NI	NI	NI	P
Debris	P	NI	P	NI	NI	NI	NI
Solvents	P	NI	P	NI	NI	NI	NI
EDTA	--	NI	NI	NI	NI	NI	P ³
Asbestos	P ²	NI	P	NI	NI	NI	P
Material Contaminated with Radioisotopes (U-235 and 238)	P	NI	P	NI	NI	NI	P
Mop Water	P	NI	NI	NI	NI	NI	NI
Uranium Chips and Other Metal Turnings	-	P	-	P	P	P	-
Uranium Fines/Sawdust	--	P	--	--	--	--	P

Source: Adapted from G&M, 1985a; and Bailey, 1987.

- P Identified in the records as having been disposed of at this site.
 NI Believed to have been disposed of at this site, although not documented.
 1 Includes beryllium and uranium
 2 In A-North only (inactive)
 3 Bottle-size only

waste oils and coolants; the accumulations then were burned, and liquids that did not burn were drained into nearby trenches. An estimated 180,000 gallons of oils and coolants were disposed of in the open-top tank between 1961 and 1968, when the practice was terminated. In January 1969, another procedure was adopted, whereby waste oils and coolants were poured into standpipes installed vertically in the waste trenches. This practice continued until the mid-1970s. By 1976, however, most of the waste oils and coolants were disposed of at the Oil Landfarm, and in 1979, liquid waste disposal at Burial Ground A (and the remaining Burial Grounds) was terminated.

Waste solvents were also disposed of by burning in an open tank located east of Burial Ground A. Approximately 100,000 gallons of solvents were disposed of in this manner when the practice was discontinued in 1970.

Burial Ground A has also received asbestos wastes. Radioactive and nonradioactive contaminated asbestos wastes were disposed of at this site until 1983-84. Since then, only radioactively contaminated asbestos wastes have been disposed of at this site. Nonradioactive contaminated asbestos waste is disposed of at Sanitary Landfill II (see Section 4.2.1.4, Toxic and Chemical Materials).

Burial Ground B was opened in 1962 for the disposal of depleted uranium metal and oxides. Trenches were excavated and the wastes were dumped inside. Soil was then backfilled to bury the wastes. No liners or impermeable caps were used. Burial Ground B was filled to capacity and closed in 1982.

Burial Ground C was opened in 1962 for the disposal of beryllium, beryllium oxide, thorium, and solid waste contaminated with these materials; other materials contaminated with enriched uranium also were disposed in Burial Ground C. No impermeable barriers or trench liners have been used at Burial Ground C. Burial Ground C was closed in 1984.

Burial Ground D was used beginning in 1968 for the disposal of depleted uranium metals and oxides after Burial Ground B was closed. No impermeable barriers or trench liners have been used at this site. A section of this burial ground remains open today.

Burial Grounds E and J opened around 1982-83 to receive waste uranium chips. There are no trench liners or impermeable barriers at these sites. Burial Grounds E and J remain in active use.

To collect oils seeping into surface streams from the Burial Grounds, Oil Retention Ponds 1 and 2 were constructed at the western and eastern borders of Burial Ground A, respectively. In 1974

and 1975, approximately 15,000 gallons of oil were skimmed from the surfaces of these ponds and disposed at the Oil Landfarm. Some of this oil was found to contain PCBs (no data available). An additional 18,000 gallons of oil were removed from Pond 1 in 1979 and placed in an underground storage tank at the Y-12 Plant for future disposal. There have been no significant accumulations of oil observed on either pond. RCRA plans have been developed to close both ponds.

An area of the Burial Grounds referred to as the Walk-in Pits was used from 1966 to 1981 for the disposal of hazardous chemicals (type and quantity undocumented) and uranium fines. There are two pits: one measures 500 feet long by 500 feet wide by 15 feet deep; the other measures 500 feet long by 300 feet wide by 15 feet deep. Since 1981, the Walk-in Pits have been used solely for the disposal of uranium fines. No liners or impermeable barriers are used at this site. Sections of these Walk-in Pits remain active today.

4.5.2.2 West End Spoil Area

Rust Engineering Spoil Area

The Rust Engineering Spoil Area is a closed disposal site where construction spoil was disposed of by the Y-12 construction contractor--Rust Engineering. The site is located at the west end of the plant area (about a half-mile west of the S-3 Pond) and is bordered on the north by Bear Creek and on the south by Old Bear Creek Road. See Figure 4-10.

In the early 1960s, the site began receiving general construction debris (e.g., steel reinforcing bar, concrete, block, soil) and other materials generated by Rust's construction operations at Y-12. The site was closed in 1984 according to a closure plan filed and approved by the Tennessee Department of Health and Environment. The site has been graded and capped with a clay barrier.

The groundwater at this site is contaminated. The source of contamination is believed to be the S-3 Ponds, although there could be some contribution by the Rust Engineering Spoil Area (see Section 3.4.3, Groundwater).

4.5.2.3 In-Plant Areas

Mercury-Contaminated Areas

The large-scale use of mercury at the Y-12 facility was associated with the production of lithium (i.e., lithium-6) which was used in the production of hydrogen weapons. When the need was recognized for the large-scale separation of the lithium-6 isotope, there was no process developed at the time to accomplish this separation. Major research and development work was conducted at Y-12 to develop the separation process.

In the early 1950s, research and development began on the Elex process (an electrically driven chemical exchange) and the Orex process (an exchange process between an organic solution of lithium and a lithium amalgam). Research and development on the Colex (word contraction of "column exchange") process began in 1951 and proved successful, resulting in the termination and dismantling of the Elex and Orex efforts. The Colex process operated from 1955 to 1963, when it was terminated.

Buildings associated with the lithium separation process include the following: Elex development in Building 9733-2 (1950-1951); Elex pilot plant in Building 9201-2 (1951-1955); Orex development in Building 9733-1 (1951-1952); Orex pilot plant in Building 9202 (1953-1954); Colex pilot plant in Building 9201-2 (Alpha-2) (1951-1955); Colex production in Building 9201-5 (Alpha-5) (1955-1959), and Building 9201-4 (Alpha-4) (1955-1962); mercury-recovery furnace in Building 81-10 (1957-1962); Rust Engineering Dumping Station north of Alpha-5 and at the site of Building 9103 (no dates available for the construction debris dumping operation); and the mercury storage house at Building 9720-26 (constructed 1963) (UCND, 1983a).

The Colex equipment for Building 9201-5 was dismantled and disposed of during 1965 and 1966; however, the Colex equipment in Building 9201-4 remains unchanged. Presently, there are no plans to remove the mercury-contaminated equipment from Building 9201-4.

Past releases of mercury have resulted in mercury-contaminated soil (see Section 3.2.2, Soil). Mercury-contaminated soil has also washed into the surface water and infiltrated the groundwater (see Section 3.3.2, Surface Water; and Section 3.4.2, Groundwater, respectively). Mercury analyses of soils indicate that high concentrations (up to one percent by weight) of mercury occur in the shallow soil fill at several sites within the plant (Rothschild, et al., 1984a).

When mercury was spilled at the Y-12 Plant, the general practice has been to remove the recoverable mercury from the contaminated area and then cover the spill area with clean soil. Areas of mercury contamination have been generally well identified at the Y-12 Plant. See Figure 4-11.

In 1983, a task force was formed to develop the best estimates as possible for the amount of mercury lost or unaccounted for from the lithium separation process at Y-12. (Members of the task force were appointed from the Union Carbide Company - Nuclear Division.) The study concluded that 733,000 pounds of mercury were lost to the environment. Table 4-20 lists the estimated losses to the environment. Another 1.3 million pounds could not be accounted for. Therefore, total mercury lost and "not accounted for" was approximately 2 million pounds (UCND, 1983a).

The Oak Ridge Interagency Task Force identified eight major mercury spills that contributed approximately 425,000 pounds to the 733,000 pounds of mercury released to the environment. The operations where these spills occurred were associated with the lithium-mercury separation process. Table 4-21 lists the mercury spill incidents.

Of the 1.3 million pounds of mercury not accounted for, approximately 500,000 pounds were believed to be attributed to a shortage in receipts (i.e., vouchered but never received at Y-12). Another 60,000 pounds of mercury could be contained in the walls, ceilings, floors, etc. of the process buildings. An additional 85,000 pounds were attributed to other specific losses (but unspecified in the Task Force Summary Report). The Task Force's estimate of the true amount "not accounted for" is the balance, or about 655,000 pounds. This represents about 30 percent of the Y-12 mercury consumption (UCND, 1983a).

Z-Oil-Contaminated Area

Z-Oil is used as a heat transfer agent for electrical equipment at various buildings, including Building 9201-2 (Alpha-2) and 9204-3 (Beta-3). The Z-Oil system is located along the south side of the plant, paralleling East Fork Poplar Creek and extending west toward Building 9204-3. See Figure 4-12.

The Z-Oil reclamation, storage, and transfer system became contaminated with PCBs during the late 1970s, when used PCB transformer oil and hydraulic oil were discarded into the system. PCB concentration within the system ranged as high as 70 ppm before the system was flushed several times with clean Z-Oil in 1980. The system currently has a PCB concentration around 20 ppm (refer to Section 4.2.1.3, Toxic and Chemical Materials).

FIGURE 4-11

GENERAL AREAS WHERE MERCURY WAS USED HISTORICALLY AT Y-12
Y-12 PLANT, OAK RIDGE RESERVATION

SOURCE: MMES, 1986k.

TABLE 4-20

**ESTIMATES OF MERCURY LOST TO THE ENVIRONMENT
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**

Lost To	Estimated Amount, Loss (lb.)
Air	51,000
East Fork Poplar Creek	239,000
Ground beneath Y-12 Plant	428,000
Sediments in New Hope Pond	15,000
TOTAL	733,000

Source: UCND, 1983a.

TABLE 4-21

**PROCESS SPILLS INVOLVING MERCURY, 1951-1966
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**

Date	Location (Building)	Estimated Quantity Spilled (lb.)	Estimated Unrecovered Loss (lb.)
1951-1955 (3 accidents)	9102-2	100,000-120,000	95,000
January 1, 1956	9201-5	113,000-170,000	70,000
July 17, 1956	Ramp north of 9201-5	22,500-90,000	85,000
Summer 1956	Between 9204-4 and 9201-5	22,500-90,000	85,000
November 15, 1956	9201-5	22,500-45,000	40,000
March 28, 1966	9201-5	105,000	49,853
TOTAL			424,853

Source: UCND, 1983a.

FIGURE 4-12

Z-OIL CONTAMINATED AREA Y-12 PLANT, OAK RIDGE RESERVATION

The Z-Oil system consists of a series of buildings, vaults, storage tanks, pumps, and piping. The overall length of the system is approximately one mile.

The Z-Oil system is generally accessible for inspection and maintenance. Most of the system is exposed with the exception of underground piping at the west end near Beta-3. As to be expected with old systems, the Z-Oil system shows signs of past leaks and spills. Discoloration is particularly evident around transfer valves, overflow valves, drain valves, pipe flanges, tanks, and the floors around the Z-Oil transfer pumps. One inactive pump house (Building 9404-3) has a flooded basement presumably from groundwater infiltration.

Z-Oil is moved along the system using a number of pumping stations, transfer tanks, and pipes. Building 9620-2 is the filter pump house that filters the dirty oil and pumps clean oil into the system. Dirty oil is stored in a 110,000-gallon, above-ground tank near Building 9620-2. Make-up oil (clean) is stored in a 6,000-gallon, above-ground tank in the same area. Buildings 9418-1, -2, -4, -5, and -9 are the transfer stations which store and pump Z-Oil along the system. Each building contains a transfer pump and a large, steel storage tank (at least 1,000-gallon capacity), which is mounted below grade on a concrete floor.

At the far western end of the system, there is a two-level tank tower which supplies Z-Oil to Beta-3. The upper tank contains clean Z-Oil and the lower tank contains dirty Z-Oil. The tank volumes are each approximately 3,700 gallons.

Past releases of Z-Oil could likely have resulted in PCB contamination of soil around the Z-Oil system (see Section 3.2.2, Soil). It is also possible that PCB-contaminated soil has washed into nearby storm drains and East Fork Poplar Creek.

Beta-4 Security Pits

The Beta-4 Security Pits are located toward the west end of the plant, northwest of Building 9204-4 (Beta-4) and south of Bear Creek Road. See Figure 4-13. The disposal site operated from 1968 to 1972.

The site consists of a series of four east-west trenches excavated in a large earthen mound which measures about a half-acre in area. The 10-foot deep trenches were filled with wastes, backfilled with 10 to 20 feet of soil, and graded to approximately the contour of the original mound. The

FIGURE 4-13

**BETA-4 SECURITY PITS, S-2 SITE, AND COAL PILE TRENCH
Y-12 PLANT, OAK RIDGE RESERVATION**

waste consists of uranium and uranium alloys, depleted and enriched uranium-contaminated metal, organic compounds, acids, tungsten alloys, and other solid wastes. Approximately 2,200 tons are considered hazardous (quantities and exact nature of the wastes are classified).

There is no liner or leachate-collection system at the site. Also, there is no impermeable cap on top of the grassy mound. Surface runoff flows around the base of the mound and likely into a catch basin located immediately south of the mound. There are several underground storm-water pipes that extend from the east and west sides of the mound to the catch basin. During the Survey, it was observed that the catch basin and an outlet pipe were partially full with sediment. Two of the inlet pipes also were half-full with sediment. The flow capacity of these storm-water pipes is clearly impaired and it is not known whether the catch basin overflows during a heavy rain.

Data from nearby groundwater monitoring wells indicate the presence of 1,2-dichloroethene (see Sections 3.4.2.3 and 3.4.3.2, Groundwater).

S-2 Site

The S-2 site is a former chemical waste disposal pond that operated from 1943 to 1951. The S-2 site is located toward the southwest end of the Y-12 facility, south of West Third Street and at the north base of Chestnut Ridge. See Figure 4-13.

The pond consisted of an unlined earthen impoundment into which liquid wastes were disposed of for evaporation, and/or percolation. These wastes were characterized to have been corrosive and toxic and probably were similar in nature to the liquid wastes that were later discharged to the S-3 Ponds. There are no known records of the type and quantity of wastes disposed of at the S-2 site.

When the S-2 site was closed in 1951, the remaining liquids were neutralized, and the impoundment was filled with soil and then seeded. The pond was neither dewatered nor was the sludge removed. There was no impermeable cap or leachate collection system used at this site.

The groundwater at this site is contaminated. The source of contamination is believed to be the S-2 Pond, although there could be a contribution from the S-3 Site (see Sections 3.4.2.3 and 3.4.3.2, Groundwater).

Coal Pile Trench

The Coal Pile Trench is located beneath a 90-day coal storage pile. The coal is used to supply the Y-12 steam plant (Building 9401-3) which is located at the south central side of the plant, south of Buildings 9201-4 and -5 (Alpha-4 and -5) and east of Building 9720-5. See Figure 4-13.

The Coal Pile Trench was active in 1965 and again in 1966. Classified shapes and wastes were buried in the trench which measures approximately 161 feet long, 15 feet wide, and 16 feet deep. The trench was then backfilled and covered with a 4-foot-thick clay cap.

Approximately 1,925 tons of depleted uranium and uranium wastes were disposed in the coal pile trench. In addition, carbon forms, molybdenum, aluminum, resin, and other metal waste materials were buried. The quantity and exact nature of the wastes are classified.

The trench was partially reopened on March 8, 1984 to determine whether waste contaminants were released to the surrounding soil. Soil sampling and analysis indicated that uranium contaminants were being released to the soil but only at an average rate of 1 inch in 15 years.

It had been speculated that the trench wastes were partially submerged and therefore contaminants would be in contact with groundwater. This was not verified when the trench was opened in 1984. While workmen probed the wastes to detect standing water, they witnessed several sparks emitted from the wastes (i.e., pyrophoric wastes sparking as a result of uranium hydride oxidizing to uranium oxide). These sparks presented an unacceptable risk to the workers' safety and as a result, the trench was backfilled and covered with a clay layer. There are no plans to uncover this trench again because of the potential danger posed by the pyrophoric wastes.

The coal pile trench does not have a liner or a leachate collection system.

Data from groundwater monitoring wells at this site do not indicate groundwater contamination.

Ravine Disposal Area

The Ravine Disposal Area is a former dump located in a field north of the garage at Building 9712. See Figure 4-14. Formerly a ravine, this area was used as a solid waste disposal site until the early 1950s. Construction spoils, uranium contaminated scrap metal, depleted uranium, tools, etc., were disposed of in the ravine and periodically covered with dirt. There is no documentation of the

quantities of wastes disposed. The site was graded and landscaped in 1956. Storm sewers and water pipes were later installed beneath the grassy field. There are no liners or impermeable cap at this site.

In 1968, there was a break in a 16-inch water main which crosses the field in a north-south direction. The Utilities Department, Y-12, dug approximately 20-feet deep to repair the main. During excavation of the soil, waste debris was uncovered and subsequently removed and buried at the Bear Creek Burial Grounds. There is no documentation regarding the type of waste that was uncovered and removed.

Data from groundwater monitoring wells at this site do not indicate groundwater contamination.

Building 9766 - Beryllium Contamination

Building 9766 is located near the east central area of the plant, south of First Street. See Figure 4-15. During the late 1940s, this building was used originally as a site for process operations involving beryllium. During the early years of operation, some of the interior ventilation ducts became contaminated with beryllium. A cooling tower at the west end of the building also became contaminated with beryllium as well as a 1,000-gallon steel underground storage tank (tank number 2064-U) (see Section 4.5.2.3, Inactive Underground Storage Tanks).

During the late 1950s, the building was converted to an administrative office. The contaminated duct was sealed off and left in place, and a new ventilation duct system was installed. Today, air inside Building 9766 is monitored continuously to check for beryllium releases from the contaminated ventilation duct. No releases have been reported (see Section 3.1.2.2 Beryllium Sources and Controls). The abandoned cooling tower is well signed to alert the public of a potential danger involving exposure to beryllium. The underground storage tank is empty and the piping is disconnected. The soil surrounding the tank will be analyzed for possible contamination as part of the proposed Y-12 Underground Storage Tank (UST) survey (see Section 4.2.1.2.2, Underground Storage Tanks).

Cesium Contamination of Railroad Tracks at East End of Y-12

There is evidence of radioactive soil contamination along two railroad spurs located at the east end of Y-12 plant area, west of Scarboro Road. There is similar evidence of soil contamination off-site along an abandoned railroad spur east of Scarboro Road and a railroad track leading to Oak Ridge.

FIGURE 4-15

**BUILDING 9766 - BERYLLIUM CONTAMINATION
Y-12 PLANT, OAK RIDGE RESERVATION**

See Figure 4-16. Approximately 120 "hot spots" (i.e., radioactive contaminated areas measuring less than one square foot each) have been identified along these tracks. Dose rates at the soil surface have been measured to be on the order of 1 mR/hr, although the Survey team measured one location along the railroad tracks (on-site) that had a dose of 3.6 mR/hr. The CSX Company owns the tracks, which are on land leased from DOE, and has been notified by the DOE Oak Ridge Operations Office of the soil contamination.

The radioactive contaminated soil was discovered on-site during the summer of 1986 by the ORNL-Radiological Survey Activities Group. Subsequent to this work, the Oak Ridge Associated Universities (ORAU) surveyed the nearby off-site tracks for radioactive contamination. The DOE-Oak Ridge Operations Office coordinated both studies. A report on the results of both surveys (i.e., ORNL and ORAU) is expected to be available in 1987. Preliminary soil data indicate the presence of cesium-137. Strontium-90 was not found. Soil samples will be analyzed for other contaminants.

It is not known how the release occurred. It is probable that a railcar(s) was the source of the release.

It is also not known when the release occurred. It could have taken place during a period from 1958 to 1964 when ORNL was using cesium for plant operations (Adams, 1986). During that period, Y-12 received all ORNL rail deliveries because ORNL had no rail receiving facility (and does not today). As a result, the release could have occurred when an ORNL cesium rail shipment was received at the Y-12 facility. Y-12 has never used cesium for its plant operations (Adams, 1986).

Building 9728 (Former Y-12 Laundry Operation)

At the south side of Building 9728, there is evidence of radioactive soil contamination. Building 9728 is the site of the former Y-12 laundry operation and is located at the east central area of the plant, south of First Street and north of Building 9201-3 (Alpha-3). See Figure 4-17. Building 9728 has been used recently for cleaning respirator masks since the Y-12 laundry operation moved to K-25 in October 1983.

This one half-acre area was identified as being contaminated with radioactivity based on a recent (summer 1986) gamma survey of Y-12 conducted by the ORNL - Radiological Survey Activities Group (see Section 4.3.2, Direct Radiation). Radioactive contamination was confirmed by the Survey team during a visit to the building site. A gamma reading taken during the Survey was about 500 mR/hr, which is above background readings of five to 10 mR/hr (see Section 3.2.3, Soil). Areas of elevated

FIGURE 4-16

**CESIUM-137 CONTAMINATION ALONG RAILROAD TRACKS
Y-12 PLANT, OAK RIDGE RESERVATION**

FIGURE 4-17

BUILDING 9728 - FORMER Y-12 LAUNDRY OPERATION
Y-12 PLANT, OAK RIDGE RESERVATION

radioactivity also included the interior of a concrete valve vault, and a concrete settling basin which are both below grade. The underground discharge pipe to East Fork Poplar Creek could be contaminated as well. The below grade structures contain standing water and the concrete settling basin appears to have sludge on the bottom. Other contaminants (i.e., non-radioactive) could be present.

It is probable that the laundry wastewater contaminated the discharge system as a result of past discharges from laundering operations. Even today, there are infrequent wastewater discharges as a result of plant personnel washing respirator masks in Building 9728. This practice is expected to cease in 1987.

The effluent discharge pipe from Building 9728 does not have an NPDES discharge permit (see Section 3.3.2, Surface Water).

Dirt Pile North of Portal 18, and East of the S-3 Pond.

At the west end of the plant, there is evidence of unauthorized dumping of approximately five to ten cubic yards of dirt. The Survey team was unable to locate any documentation as to its origin, content, or manner of disposal. This dirt pile was identified as being contaminated with a level of radioactivity higher than background, based on a recent (summer 1986) gamma survey of Y-12 conducted by the ORNL Radiological Survey Activities Group (see Section 4.3.2, Direct Radiation).

This site is located immediately north of the security gate at Portal 18 (near the intersection of West Second Street and Old Bear Creek Road) and east of the S-3 Pond. See Figure 4-18. The dirt pile is inside a fenced area near the southeast corner of Building 9814 and immediately upgradient of an earthen catch basin which ultimately discharges stormwater to East Fork Poplar Creek.

Inactive Underground Storage Tanks

There are 21 inactive underground storage tanks (USTs) at Y-12. In addition, two other USTs have been removed. An inventory of these tanks is presented in Table 4-22. Nineteen of the USTs contained commercial product, and four contained liquid waste. Chemical product tanks are empty. Ten of the 21 tanks were reported, per RCRA requirements, because these had not been taken out of service prior to 1974.

FIGURE 4-18

DIRT PILE NEAR PORTAL 18
Y-12 PLANT, OAK RIDGE RESERVATION

TABLE 4-22

**INACTIVE UNDERGROUND STORAGE TANKS
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**

Tank No.	Age	Capacity (gallons)	Content	Tank Material	Corrosion Protection	Status
0134-U	21	120	Gasoline	Steel	No	Taken out of service in 1982
2064-U	41	1,000	Laboratory waste contaminated with beryllium	Steel	No	Taken out of service in 1955
2068-U	19	1,000	Gasoline	Steel	No	Taken out of service in 1980
2073-U	24	1,000	Gasoline	Steel	No	Taken out of service in 1979
2074-U	24	1,000	Gasoline	Steel	No	Taken out of service in 1979
2075-U	24	1,000	Fuel oil	Steel	No	Taken out of service in 1979
2076-U	34	1,000	Propane	Steel	No	Taken out of service in 1964
2077-U	Unknown	65	Gasoline	Steel	No	Taken out of service in 1964 Removed
2078-U	22	110	Gasoline	Steel	No	Taken out of service in 1979 flushed, then filled with sand
2079-U	22	55	Gasoline	Steel	No	Taken out of service in 1979 flushed, then filled with sand
2081-U	29	280	Gasoline	Steel	No	Taken out of service in 1970
2089-U	41	2,000	Propane	Steel	No	Taken out of service in 1964
2090-U	41	2,000	Propane	Steel	No	Taken out of service in 1964
2091-U	41	2,000	Propane	Steel	No	Taken out of service in 1964
2092-U	41	2,000	Propane	Steel	No	Taken out of service in 1964

TABLE 4-22
INACTIVE UNDERGROUND STORAGE TANKS AT Y-12
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE
PAGE TWO

Tank No.	Age	Capacity (gallons)	Content	Tank Material	Corrosion Protection	Status
2101-U	41	32,000	Mercury-contaminated water	Concrete	No	Taken out of service in 1986
2105-U	18	300	Liquid process waste contaminated with beryllium oxide	Stainless Steel	No	Taken out of service in 1984
2116-U	Unknown	2,500	Etching waste	Steel	No	Taken out of service in 1970 Removed
2117-U	16	550	#2 fuel oil	Steel	No	Taken out of service in 1983
2284-U	41	2,000	Propane	Steel	No	Taken out of service in 1964
2288-U	41	750	Propane	Steel	No	Taken out of service in 1964
2289-U	41	750	Propane	Steel	No	Taken out of service in 1964
2290-U	41	475	Propane	Steel	No	Taken out of service in 1964

Source: DOE Environmental Survey Team, 1987. Adapted from Y-12 Plant inventory of underground storage tanks, 1986.

Several of the tanks could have leaked when in service, and therefore, could have caused contamination of the environment (refer to Section 4.1.3.3, Waste Management). Thirteen USTs are made of steel, have no corrosion protection, and have been in service for 15 years or more. One of the tanks is made of concrete. In general, concrete tanks, and steel tanks without corrosion protection and 15 years or older, have a high probability of having leaked.

4.5.2.4 Chestnut Ridge

Rogers Quarry

In the 1940s, the Manhattan Engineering District of the Atomic Energy Commission leased this site to Ralph Rogers Company, Inc., to provide rock and gravel for construction activities at the Y-12 plant. The quarry was successfully developed but, in the late 1950s, an underground water system was breached and the quarry pit flooded. Quarry operations were shut down permanently.

The quarry is located south of the Y-12 plant along the south side of Chestnut Ridge. It is bordered by Bethel Valley Road on the south side. See Figure 4-10.

The pit measures approximately 1,150 feet long, 250 feet wide, and 275 feet deep. Because of the constant and relatively great depth of water, Rogers Quarry was used to dispose of classified wastes from Y-12 operations (quantity and nature of the wastes are classified). In general, these wastes were low-level radioactive materials. Classified disposal operations at Rogers Quarry began in 1965 and were terminated in 1981. Classified wastes now go to the Chestnut Ridge Security Pits (refer to Section 4.1.2, Waste Management).

Rogers Quarry is still used today for the disposal of fly ash from the Y-12 coal-fired steam plant (see Section 3.3.2.3, Surface Water).

Data from groundwater monitoring wells do not indicate groundwater contamination at this site.

Kerr Hollow Quarry

During the late 1940s, the Ralph Rogers Company, Inc. also developed a quarry site at Kerr Hollow. Similar to the fate of Rogers Quarry, quarry operations breached an underground water system at the Kerr Hollow Quarry. As a result, the quarry flooded and operations were shut down permanently.

The quarry is located south of the Y-12 plant along the south side of Chestnut Ridge. It is bordered by Bethel Valley Road on the south side and is about 1.3 miles east of Rogers Quarry. See Figure 4-10.

The pit measures about 500 feet long, 200 feet wide, and 65 feet deep. The quarry historically has been used principally for the disposal of water-reactive chemicals (e.g., sodium), potentially explosive materials, and partially full cylinders of compressed gas. The four general categories of wastes disposed are corrosive (e.g., sulfide, chloride, fluoride, bromide, chlorine, fluorine), flammable (e.g., oxygen, hydrogen, deuterium, acetylene, propane, butane, methane), irritating (e.g., ammonia, freon), and inert (e.g., argon, nitrogen, carbon dioxide). Records (e.g., waste materials, weight package material) for waste disposal at this site have been kept since 1972.

Prior to 1975, access to the quarry was not regulated. Operating contractors from ORNL, Y-12, and K-25 reportedly had uncontrolled access to the quarry for waste disposal. However, beginning in 1975, all disposal operations at the quarry were assigned to the operating contractor for Y-12.

Data from groundwater monitoring wells at this site do not indicate groundwater contamination.

Unidentified Area on Chestnut Ridge

An aerial photograph taken on April 7, 1950, indicates an area of several acres on Chestnut Ridge that was at one time cleared of trees and vegetation. This area appears to be several hundred yards east of the Chestnut Ridge Security Pits (an active burial ground for classified materials). See Figure 4-10. The disturbed area could have been used in the past for waste disposal. However, no evidence has been found to prove (or disprove) this possibility. The area has since grown over with vegetation and trees.

The 1950 photograph is identified as No. 6418-5 (UCND, 1984b).

4.5.2.5 Off-Site Areas

Off-site Floodplain Contamination in East Fork Poplar Creek and Other Nearby Areas

In 1983, the Oak Ridge Task Force was organized to address off-site contamination associated with the Department of Energy facilities at the DOE Oak Ridge Reservation. The Task Force is comprised of representatives from DOE, EPA Region IV, Tennessee Department of Health and Environment

(Chair), Army Corps of Engineers, Tennessee Valley Authority, U.S. Geological Survey, and the City of Oak Ridge. Through the Task Force, the DOE authorized the Tennessee Valley Authority (TVA) to sample and analyze water, sediment, and fish in the floodplains downstream of the DOE Oak Ridge Reservation. See Figure 4-19. The data were used to identify the nature and extent of off-site contamination, including the transport of mercury-contaminated sediments. The results of this study will assist the Oak Ridge Task Force with assessing health risks and remedial actions pertaining to off-site contamination. The results of this study are summarized in a document titled: Summary Report, Task 5, Instream Contaminant Study, Office of Natural Resources and Economic Development, TVA, January 1986.

Following are observations presented in TVA's Summary Report as they pertain to downstream contamination in East Fork Poplar Creek and Bear Creek as a result of past activities at Y-12:

East Fork Poplar Creek

Mercury Contamination

- The floodplain and channel of East Fork Poplar Creek (EFPC) contain an estimated 16 million cubic feet (760,000 tons) of contaminated sediment exceeding a mercury concentration of 5.0 ppm. The normal background level is less than 0.5 ppm. An estimated 170,000 pounds of mercury are contained in the contaminated sediment, covering an area of approximately 450 acres of the 600-acre floodplain. Approximately 75 percent of the mercury (130,000 pounds) is in the upper third of the stream (i.e., approximately 5 miles in length). The maximum observed mercury concentration along this reach was 1,800 ppm and the maximum depth of contamination was 3.5 feet. (The upper one third of EFPC is designated generally as upstream of EFPC mile 9.45. By way of comparison, EFPC mile 0 is downstream of EFPC mile 9.45 and is at the confluence of EFPC and Poplar Creek; EFPC mile 1.5 is at the confluence of EFPC and Bear Creek; and EFPC mile 14.7 is at the discharge point of the New Hope Pond.)
- Approximately 80 percent (138,000 pounds) of the mercury is contained in the 25 percent of the contaminated sediment with a mercury concentration exceeding 100 ppm. (Most of the mercury is in the upper reaches of the stream and is contained in areas where the mercury concentration exceeds 100 ppm.)

FIGURE 4-19

SURFACE STREAMS IN THE VICINITY OF DOE FACILITIES AT OAK RIDGE, TN
Y-12 PLANT, OAK RIDGE RESERVATION

- An estimated 500 pounds of mercury per year are leaving the East Fork Poplar Creek watershed and flowing downstream to Poplar Creek which flows into the Clinch River. Approximately 75 pounds per year being discharged directly from New Hope Pond. Under natural conditions, the watershed will be a continuing source of substantial quantities of mercury for hundreds of years. Land disturbances (e.g., dredging) within the floodplain could increase this annual export rate.
- Total mercury concentrations in water samples from East Fork Poplar Creek exceeded both the Tennessee source standard (0.2 ppb) and the EPA drinking water standard (2.0 ppb), during both baseflow (2.5 ppb maximum value) and stormflow (44 ppb maximum value) conditions.
- Mean total mercury concentrations in the flesh of large mouth bass, redbreast sunfish, rock bass, and frogs from East Fork Poplar Creek equal or exceeded 1.0 ppm. The Food and Drug Administration action level for mercury in fish is 1.0 ppm methyl mercury. (All aquatic biota samples were analyzed for total mercury rather than methyl mercury. The FDA action level of 1 ppm was changed from total mercury to methyl mercury on November 19, 1984, after the above analyses were completed. In making this change the FDA stated that "in most fish, almost all the mercury present is in the form of the methyl compound."

PCB Contamination

- Mean total PCB concentration in sediment from East Fork Poplar Creek was relatively low although it did exceed the detection limit of 0.1 ppm. The maximum value was 6.0. For PCB-contaminated soils, a remedial action is generally required if the soil has a PCB concentration greater than 10 ppm.

Lithium Contamination

- Lithium has been detected at elevated concentrations in East Fork Poplar Creek. The maximum observed concentration was 30 ppb (measured at baseflow). Background concentrations are less than 10 ppb. Lithium has been used at Y-12 since 1955 (i.e., Colex process) and is still used today. The current NPDES discharge permit for New Hope Pond includes a lithium discharge limit of 5.0 ppm.

Bear Creek

Information on Instream contamination in Bear Creek is presented in Section 3.3.2.5, Surface Water. The Task Force found the following contaminants during its 1985 study:

Mercury Contamination

- Maximum mercury contamination in sediments was 3.9 ppm. The mean concentration was 0.63 ppm.

PCB Contamination

- Mean total PCB concentrations in sediments were relatively low. The maximum concentration was 1.4 ppm. For PCB-contaminated soils, a remedial action is generally required if the soil has a PCB concentration greater than 10 ppm.

Cadmium Contamination

- Maximum cadmium concentration observed at baseflow was 26 ppb. Approximate background concentration is <2 ppb. The U.S. EPA Interim Drinking Water Standard for cadmium is 10 ppb.

Nitrate/Nitrite Contamination

- Maximum nitrate/nitrite concentration observed at baseflow was 380 ppm. Approximate background concentration is 0.4 ppm. The Drinking Water Standard is 10 ppm.

Other Contaminants

- Maximum conductivity was 10 orders of magnitude greater than background (200 $\mu\text{mho/cm}$).
- Maximum hardness was about 8 orders of magnitude greater than background concentration (130 ppm as CaCO_3).

The Task Force is also addressing a concern related to the contamination of off-site floodplain, particularly East Fork Poplar Creek. The concern has to do with the public coming into contact with contaminated floodplain sediments. In the early 1980s, mercury-contaminated soil was removed from the East Fork Poplar Creek by a local contractor. The soil was used as backfill and top dressing for a sanitary sewer line which was constructed in an urban area of Oak Ridge. The contractor reportedly did not seek permission nor was authorized to remove this soil. As a consequence of using this soil, several public areas became contaminated. These areas included Robertsville Junior High School, Jefferson Junior High School, and the municipal civic center in Oak Ridge. The contaminated soil at both junior high schools has since been covered with a layer of clean topsoil. Other areas along the sewer line remain contaminated but are located in rural, isolated areas. There has been no remedial action taken at these areas. The Task Force, along with the City of Oak Ridge, the DOE-Oak Ridge Operations Office, and others are studying options to address the remaining contaminated areas.

As of July 1987, several areas in Oak Ridge have had mercury-contaminated soil removed and disposed of at Y-12's Chestnut Ridge Borrow Area Waste Pile. Table 4-23 lists these areas and the estimated quantities of soil removed. In general, mercury-contaminated soil removed from the floodplain has had mercury concentrations greater than 12 ppm but below RCRA levels considered to be hazardous (see Section 4.1.2.1, Waste Management).

The Task Force is also concerned about the public who disregard public warnings and camp and picnic along scenic reaches of East Fork Poplar Creek where mercury-contaminated soil (up to 50 ppm mercury) is known to exist. Warning signs are posted along these reaches to alert the public regarding the potential health risks associated with coming in contact with the mercury-contaminated sediments (the Survey team, however, observed few signs posted). Despite public warnings, people continue to recreate along contaminated areas of East Fork Poplar Creek.

Off-Site Recipients of Contaminated Scrap Metal

Since the late 1940s, scrap metal has been sold at Y-12 and continues today. Y-12 stockpiles scrap metal (i.e., unused, unwanted, or surplus) until a sufficient quantity has accumulated for a public sale. A sale is then scheduled and advertised to the public. Potential bidders are given an opportunity to view the goods prior to sale. All sales are completed with a signed contract. Criteria for the release of scrap metal for sale are described in "Procedure for Clean Scrap Metal Sales" (MMES, 1986j).

TABLE 4-23

**OFF-SITE AREAS WHERE MERCURY-CONTAMINATED SOIL HAS BEEN REMOVED
Y-12 PLANT, OAK RIDGE RESERVATION, TENNESSEE**

Location	Soil Removed (Cubic Yards)
Civic Center	3,500
Southfield Apartments	50
Emory Valley Road	25
Tulane Avenue	75
Lincoln Avenue	25
East Fork Poplar Creek near Scarboro Road	500
TOTAL	4,175

Source: Marcus, 1987.

Scrap metal was not sold to the public if it was contaminated with visible signs of mercury (determined by smear tests). Scrap metal from former mercury production buildings was last sold to the public around 1962.

Scrap metal contaminated with low levels of radioactivity was sold to the public until 1970. This contaminated scrap metal had a low level of radioactivity probably from 5,000 to 50,000 dpm/cm² (Bailey, 1987). As a general rule, contaminated scrap metal (i.e., low-level radioactivity) was segregated from other scrap metal at public sales and was identified in some manner to alert the prospective buyer that the scrap metal was contaminated.

Sales records for scrap metal (uncontaminated and contaminated) are generally complete for the 1960s and 1970s but incomplete for earlier years; records for the 1940s and 1950s are sketchy. Sales records, where available, include the date of sale, sale number, name and address of the successful bidder, general description of goods sold, unit price bid, and the quantity of goods sold. The three principal buyers of Y-12 scrap metals have been Sam Greenfield, David Witherspoon, and Dupont Smith, all of whom are local buyers who reclaim scrap metal.

Some controversy exists between Y-12 and two of the buyers--Witherspoon and Smith. Both buyers have made allegations that Y-12 has recently sold to each of them low-level radioactive contaminated scrap metal that they claim was mixed (inadvertently or otherwise) with clean scrap metal. To date, these allegations have not been substantiated. Y-12 has examined and analyzed the alleged contaminated scrap metal. Radiological assays from both yards do not approximate radiological assays of scrap metal originating at Y-12. At this time, Y-12 does not believe that this contaminated scrap metal originated at Y-12. This matter remains unresolved.

4.5.3 Findings and Observations

4.5.3.1 Category I

None.

4.5.3.2 Category II

None.

4.5.3.3 Category III

1. Bear Creek Valley Waste Disposal Area. The Bear Creek Valley Waste Disposal Area is a source of surface water and groundwater contamination. This site is addressed as a Category III finding in Section 3.3.4.3, Surface Water and Section 3.4.4.3, Groundwater.
2. Mercury-Contaminated Areas. The mercury-contaminated areas are sources of soil contamination and possible sources of surface water contamination.

Mercury was used from the early 1950s to around 1963 in large quantities for lithium separation. Many of the key buildings that were associated with the separation process include 81-10, 9201-2, 9201-4, 9201-5, 9202, 9720-26, 9733-1, and 9733-2. As a result of past plant operations at these buildings, mercury was spilled, leaked, or was otherwise released to the environment. It has been estimated that 733,000 pounds of mercury were released to the environment at Y-12 (UCND, 1983a).

As a result of these releases, soil around many of the buildings has become contaminated with mercury. Some mercury has remained in the soil (see Section 3.2.2, Soil). Mercury analyses of soils indicate high concentrations (up to one percent by weight) of mercury. Some mercury has been washed away and has been released to streams as a result of storm-water runoff. Approximately 75 pounds of mercury per year are discharged directly from New Hope Pond into East Fork Poplar Creek. An estimated 500 pounds of mercury per year are leaving the East Fork Poplar Creek watershed (from New Hope Pond discharges and resuspension of mercury-contaminated sediments in East Fork Poplar Creek) and flowing downstream to Poplar Creek, which flows into the Clinch River.

3. Z-Oil Contaminated Areas. The Z-Oil system may be a source of soil contamination. The Z-Oil reclamation, storage, and transfer system was contaminated with PCBs during the late 1970s (up to 70 ppm PCBs) and later decontaminated in 1980 (less than 20 ppm PCBs).

Z-Oil is a heat-transfer agent used for electrical equipment at various buildings, including 9201-2 (Alpha-2) and 9204-3 (Beta-3). The Z-Oil system has been known to leak and release oil to the environment. Released oil could have contained PCBs.

Discoloration of soil and concrete pads is particularly evident around transfer valves, overflow valves, drain valves, pipe flanges, tanks, and the floors around the Z-Oil transfer pumps. At

least one inactive pump house basement contains standing water (probably groundwater that has infiltrated the basement). If this water is contaminated with Z-Oil, it becomes a possible source of groundwater contamination because the contaminated water can probably exfiltrate the basement and infiltrate the groundwater.

The Survey team has recommended sampling and analysis at this site:

4. Beta-4 Security Pits. The Beta-4 Security Pits may be a source of possible groundwater contamination. The site consists of a large earthen mound that contains buried wastes. The site was active from 1968 to 1972.

The wastes generally are classified shapes and include materials such as uranium and uranium alloys, depleted and enriched uranium-contaminated metals, organics, acids, and tungsten alloys. Approximately 2,200 tons of wastes are buried. The mound is vegetated but has no impermeable cap, liner, or a leachate control system. It does have approximately 10 to 20 feet of soil overburden. It could be possible for water to infiltrate the soil and over time, percolate into the underlying wastes. Contaminants could leach from the wastes and infiltrate the groundwater. Data from nearby groundwater monitoring wells indicate the presence of 1,2-dichloroethene (see Section 3.4.3.2, Groundwater).

Also, there is a catch basin that appears to collect surface runoff from the Beta-4 security pits. The catch basin and outlet pipe are becoming full with sediment. If the sediments are contaminated (there is no available evidence to suggest that they are) and the catch basin overflows during a storm event, the surrounding surface soil could become contaminated.

The Survey team has recommended sampling and analysis at the site.

5. S-2 Site. The S-2 Site may be a source of possible groundwater contamination. The S-2 site is a former waste chemical disposal pond that operated from 1943 to 1951. The pond consisted of an unlined earthen impoundment into which toxic and corrosive liquid wastes were disposed of for evaporation and percolation.

When the site was closed in 1951, the remaining liquids were neutralized. The pond was never dewatered or desludged. The impoundment was filled with soil and the surface was seeded. There is no impermeable cap or leachate collection system at the site. It may be possible for

water to infiltrate the soil and percolate into underlying wastes. Contaminants can leach from the wastes and infiltrate the groundwater.

The groundwater at this site is contaminated. The source of contamination is believed to be the S-3 Ponds although there could be some contribution by the S-2 Site (see Section 3.4.3.2, Groundwater).

6. Ravine Disposal Area. The Ravine Disposal Area may be a source of possible groundwater contamination. This former ravine area was used sporadically as a disposal site until the early 1950s. Buried wastes include construction spoils, uranium-contaminated scrap metal, depleted uranium, and discarded tools.

The site was landscaped and regraded in 1956. Storm sewers and water pipes were also installed. There is no impermeable cap, liner, or leachate control system at this site. The ground is well established with grass. It may be possible for water to infiltrate the soil and percolate into underlying wastes. Contaminants can leach from the wastes and infiltrate the groundwater. It also may be possible for groundwater (which may be contaminated from the buried wastes) to infiltrate the storm water pipes and discharge to a stream.

The Survey team has recommended sampling at this site.

7. Rust Engineering Spoil Area. The Rust Engineering Spoil Area may be a source of possible groundwater contamination. This is a former disposal site where the Y-12 construction contractor (Rust Engineering) buried general construction debris. Wastes included steel rebar, concrete, waste soil, and other wastes generated during construction operations at Y-12.

Photographs taken of the site while it was active show buckets and possibly drums that were included in the wastes. It is possible that contaminated wastes could have been disposed here, although there is no evidence that this occurred. The site was closed in 1984 under a closure plan approved by the Tennessee Department of Health and Safety Environment. The site is capped with a clay barrier. There is no liner or leachate control system. Because the site is located adjacent to the headwater of Bear Creek, it is possible that rising surface water causes the water table to rise under the disposal site and in turn could cause the groundwater to come in contact with the buried wastes. Contact with contaminated wastes would likely cause groundwater contamination.

However, it may be difficult or impossible to distinguish groundwater contamination due to the Rust Engineering Spoil Area from that due to known sources such as the S-3 Ponds. The spoil area is about one-half mile west of the S-3 Ponds and adjacent to the Oil Landfarm area. Groundwater contamination in this area is known to be present (see Section 3.4.3, Groundwater), but any contribution from the spoil area will not be observable until remediation of other sources is complete.

8. Building 9766 - Beryllium Contamination. Building 9766 is an active building and is known to have areas contaminated with beryllium. The building is a possible source of air and soil contamination.

The building was originally the site for process operations involving beryllium. Ventilating ductwork became contaminated with beryllium, as did a cooling tower outside the building and a 1,000-gallon steel underground storage tank. Although beryllium operations were terminated in the 1950s and the building has since been converted to an administrative office, beryllium contaminants remain in a sealed-off (inactive) air duct system, the cooling tower, and the empty underground storage tank. There is no available environmental data for beryllium concentration in the soil.

The air in the building is continuously monitored for possible releases of beryllium from the sealed duct work. No releases have been reported (see Section 3.1.2.2, Beryllium Sources and Controls). The disconnected cooling tower and underground tank may have been sources of past leaks and releases and could have contaminated the surrounding soil. The soil surrounding the tank will be analyzed for possible contamination as part of the proposed Y-12 Underground Storage Tank Survey.

9. Cesium Contamination of Railroad Tracks at East End of Y-12. Recent field data indicate that soil along railroad tracks located at the east end of Y-12 (both on-site and off-site) is contaminated with cesium-137.

A recent gamma survey conducted by ORNL identified "hot spots" of elevated gamma readings (of the order of 1 mR/hr) along two railroad spurs at the east end of Y-12. The Survey team measured one location with a dose of 3.6 mR/hr. In addition, a followup survey by the Oak Ridge Associated Universities revealed more areas of radioactive contamination along railroad tracks adjacent to Y-12 but off-site the Y-12 Plant area. Both surveys identified

cesium-137 in the soil samples. No strontium-90 was identified. The samples will also be analyzed for other contaminants.

The DOE - Area Operations Office has notified the CSX Company of the soil contamination. The railroad tracks, where the soil contamination was found, are owned by CSX but are on land leased from DOE.

The cause and source of contamination are not known. A report on the findings from both the ORNL and ORAU field surveys is expected to be available in 1987.

10. Building 9728 (Former Y-12 Laundry Operation). Recent environmental data indicate that there is evidence of radioactive soil contamination at the south side of Building 9728. Building 9728 is the site of the former Y-12 laundry operation which ceased operating in 1983.

A recent gamma survey conducted by ORNL identified radioactively contaminated soil at the area south of Building 9728. Elevated levels of radioactivity were confirmed by the Survey team (500 $\mu\text{R/hr}$, compared to a background level of 5 to 10 $\mu\text{R/hr}$). Above-background levels were detected inside a valve vault, a settling basin, and a manhole. These below-grade, concrete structures are part of the former laundry wastewater-discharge system, which at one time discharged through an underground pipe to East Fork Poplar Creek. Each of these concrete structures contains standing water and the settling basin appears to have a layer of sludge on the bottom.

In addition to radioactive contamination, there may also be other contamination in the soil and inside the concrete structures. Standing water inside the structures may be exfiltrating and contaminating the surrounding soil.

The cause of the contamination is believed to be wastewater discharged from the former laundry operation inside Building 9728.

The Survey team has recommended sampling and analysis at this site. Environmental data from the ORNL study will be available in 1987.

11. Dirt Pile North of Portal 18 and East of the S-3 Ponds. An area north of Portal 18 and east of the S-3 Ponds is a site of unauthorized dumping of soil. Environmental data from the recent

ORNL gamma survey indicate that this soil is contaminated with radioactivity. There may be other contaminants present as well.

The site is inside a fenced area and adjacent to a utility building (unnumbered). The pile of soil is upgradient of a catch basin which discharges runoff to East Fork Poplar Creek. It is possible for soil contaminants to be washed into the catch basin and eventually discharged to East Fork Poplar Creek.

The Survey team has recommended sampling and analysis at this site. Environmental data from the ORNL study will be available in 1987.

12. Underground Storage Tanks. Underground Storage tanks are addressed as a Category III finding in Section 4.1.3.3, Waste Management.

13. Unidentified Area on Chestnut Ridge. An unidentified area on Chestnut Ridge may be a source of possible soil and groundwater contamination. A 1950 aerial photograph of Chestnut Ridge indicates an area of several acres having been cleared of trees and vegetation.

The area parallels the South Patrol Road and is several hundred yards east of the present Chestnut Ridge Security Pits. It is possible that this unidentified area could have been used in the past as a waste disposal site, although no evidence other than the photograph could be found to support this idea. The area has since grown over with trees and vegetation.

If wastes have been disposed at this site, then it is possible for the soil to be contaminated. It also may be possible for water to infiltrate the soil and percolate into underlying wastes. Contaminants could leach from the wastes and infiltrate and contaminate the groundwater.

The Survey team has recommended sampling at this site.

14. Off-site Floodplain Contamination in East Fork Poplar Creek and Other Nearby Areas. Past wastewater disposal practices, along with accidental loss and spillage of process materials, have resulted in contamination of the floodplain of East Fork Poplar Creek and Bear Creek. Refer to Section 4.5.2.5, Off-Site Areas, for more information regarding contaminants in East Fork Poplar Creek and Bear Creek. Also refer to Section 3.3.4.3, Surface Water, for a Category III finding for water contamination in Bear Creek.

In addition, there is a concern about public recreational activities along scenic reaches of East Fork Poplar Creek where mercury contamination is known to be present (up to 50 ppm). There is a possible health risk for those people who come in contact with the contaminated soil.

15. Off-site Recipients of Contaminated Scrap Metal. As a result of recent public sales of scrap metal, two buyers have alleged that they purchased scrap metal from Y-12 that was contaminated with low-level radioactivity. This contaminated scrap metal could have been inadvertently mixed in with other scrap metal and sold at a public sale. To date, these charges have not been substantiated. Low-level radioactive scrap metal has not been sold to the public since 1970.

The two buyers, David Witherspoon and DuPont Smith, are local reclaimers of scrap metal who have been long-time buyers of scrap metal from Y-12. Each alleges that radioactively contaminated scrap metal (i.e., low-level) was sold to them when they recently purchased scrap metal from Y-12. They want Y-12 to take back the contaminated scrap metal and reimburse each of them for the scrap metal originally purchased.

Y-12 contends that the contaminated scrap metal did not originate from the DOE plant, primarily based on the results of radiological assays conducted by Y-12 on the scrap metal in question. The radiological assays are dissimilar to those of past and recent Y-12 contaminated scrap metal. There is speculation that the two buyers purchased (unknowingly or otherwise) the contaminated scrap metal from another seller(s) and now are looking for a means to rid themselves of this material.

Until this controversy is resolved, there remains the possibility that Y-12 contaminated scrap metal inadvertently was sold to the public and that low levels of radioactivity may be released from the scrap metal in question.

4.5.3.4 Category IV

None.

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PRELIMINARY

PRELIMINARY

APPENDIX A
SURVEY PARTICIPANTS

**Y-12 SURVEY PARTICIPANTS
NOVEMBER 10-21 AND DECEMBER 9-11, 1986**

DOE

Team Leader: T. T. Traceski
Assistant Team Leader: D. Caughey
Operations Office Representative: M. Travaglini

NUS

Coordinator: R. E. Tarbert
QA/Toxics: R. C. Gerlach
Air: T. F. Eckle
Surface Water: A. F. McClure, Jr.
Radiation: J. D. Yesso
Air/Radiation: E. R. Burd
Hydrogeology: M. S. Robison
Hydrogeology: J. Wilson

ICF

Waste Management: G. M. Kelly
Inactive Waste Sites: R. L. Scullin

PRELIMINARY

**APPENDIX B.
SURVEY PLAN**

ENVIRONMENTAL SURVEY PLAN

Y-12 PLANT

NOVEMBER 10 - 21, 1986

OAK RIDGE, TENNESSEE

1.0 INTRODUCTION

The Environmental Survey is a one time baseline inventory of existing environmental problems and environmental risks at DOE operating facilities. It will be conducted in accordance with the principles and procedures contained in the Draft Environmental Survey Manual distributed on May 16, 1986.

The Environmental Survey is an internal management tool to aid the Secretary in identifying current and potential environmental problems at all of DOE's major facilities and in prioritizing these problems for appropriate corrective actions and allocating resources.

2.0 SURVEY IMPLEMENTATION

The Environmental Survey will be managed by the Team Leader, Thomas Traceski and the Assistant Team Leader, David Caughey. Michael Travaglini will serve as the Oak Ridge Operations Office (ORO) representative on the Environmental Survey team. Technical support is provided by NUS Corporation personnel as follows:

Richard Tarbert	NUS Coordinator/Surface Water
Andrew McClure	Surface Water/Underground Tanks
Richard Gerlach	QA/TSCA
Tom Eckle	Air
David Yesso	Radiation
Gerard Kelly	RCRA/Solid Waste
Ronald Scullin	CERCLA
Mary Robison	Hydrogeology
John Wilson	Hydrogeology
Elmer Burd	Air/Radiation/TSCA

2.1 Pre-Survey Activities

Survey team members began reviewing Y-12 environmental documents that were available at the DOE office of Environmental Audit & Compliance in September, 1986. From that review, a memorandum dated September 5, 1986, was sent to the Oak Ridge Operations Office and Y-12 Plant announcing a pre-survey site visit

and requesting additional information. Documents that were assembled by site personnel in response to the memorandum announcing the pre-survey site visit and requesting environmental information of interest to the Survey Team for planning purposes were transferred to NUS Pittsburgh offices in October for use by team members during the planning stage of the survey. Classified documents were sent to the NUS secure facility in Gaithersburg, Maryland for team members to review.

Messrs. Traceski, Caughey, Tarbert, Burd (NUS Health and Safety Advisor) and Travaglini conducted a pre-survey site visit on October 7 and 8, 1986, to become familiar with the site, to identify potential areas of concern for purposes of the survey, and to coordinate plans for the upcoming survey with DOE/ORO and Martin Marietta personnel. During this pre-survey visit, the team met with representatives of DOE/ORO, Martin Marietta Y-12 and central staff, and officials of the U.S. EPA Region IV and Tennessee Department of Health and Environment. Furthermore, team representatives toured the facility and gathered some documents assembled by site personnel in response to the information request memorandum. Based upon the review of the data sent by the site just prior to the pre-survey site visit, additional information was requested during the visit and partial information has been received, to date. This survey plan is based upon the information received by the survey team as of the end of October 1986.

2.2 On-Site Activities Reports

The Environmental Survey will be conducted from November 10, 1986 through November 21, 1986. The survey will include Y-12 facilities and to the greatest extent practical, Oak Ridge National Laboratory facilities located on the Y-12 Plant sites. A tentative agenda is as shown in Table 1. It is expected that modifications will be made as appropriate to minimize disruption of site activities, to enhance survey efficiency and effectiveness, and as members of the survey team continue reviewing the documents prior to the survey, and during the actual site visit. All modifications to the agenda will be coordinated with the site officials designated as survey contacts.

The on-site activities of the survey team will consist of interviews and consultations with, among others, environmental, safety, operations, waste management, purchasing, and warehousing personnel; a review of files and documents (including classified documents) unavailable prior to the on-site portion of the survey; and process-specific and area-specific tours of the facility.

A closeout briefing will be conducted on Friday, November 21, to describe preliminary observations and initial findings of the on-site activities. A draft report of the survey will be prepared within 4 to 6 weeks from the conclusion of the survey. Subsequently, an interim report will be prepared by the survey team within 4 to 6 weeks of the completion of sample analyses. The

interim report will have the data from the sample analyses incorporated into the report. Report findings from all scheduled DOE surveys will be updated as appropriate and included in the final report to the Secretary of Energy which is scheduled for completion in 1988.

2.3 Sampling and Analysis

Based on available site environmental information and the results of the survey activities on site, the survey team will identify any sampling needs. The sampling and analysis (S&A) phase of the survey process will be implemented approximately 12 weeks after the completion of the site visit. This effort is expected to have a 2-4 week duration and will be conducted by Argonne National Laboratories (ANL). Don McCown will be the ANL Team Leader for the sampling and analysis phase of the Environmental Survey. The Argonne sampling team will draft a sampling plan based upon the sampling needs identified by the survey team. The Assistant Team Leader will coordinate the review of this sampling plan with the Oak Ridge Operations Office and EPA's Laboratory at Las Vegas (Environmental Monitoring Systems Laboratory) which has quality assurance responsibility for the survey's sampling and analysis efforts. The sampling is projected to start this winter. The sampling is expected to take between 2-4 weeks to complete. Analysis of the samples will be conducted by Argonne following protocols provided in the Survey Manual, supplemented by the Y-12 Sampling Plan. Results of the sampling and analysis will be transmitted to the survey team leader for incorporation into the interim report.

3.0 QUALITY ASSURANCE

3.1 Issue Identification

The quality assurance area of this environmental survey will primarily be an evaluation of current sampling and analysis procedures performed at the Y-12 Plant Laboratory or at any off-site laboratories conducting environmental analyses on samples from the Y-12 Plant. The intent will be to review the quality assurance procedures for collecting process effluent and environmental samples, for performing the laboratory analytical work to identify and to quantify pollutants and for evaluating and reporting the data. The goal of the quality assurance review will be to verify that appropriate procedures are being followed. Aspects of the quality assurance program relating to environmental management of the Y-12 Plant which will be examined include: analyst training; equipment/instrument calibration and maintenance; sample collection, handling and chain-of-custody procedures; blank, replicate and spiked sample results; data reduction and reporting; and, data documentation, including logbook and calculation reviews and archival data storage.

Sampling and analysis procedures will be reviewed to ensure that they conform to accepted requirements and are being properly implemented by the Y-12 Plant Laboratory. Recent available quality assurance audits of the Y-12 facility will be examined for sampling and analysis deficiencies. An overall survey of the Y-12 environmental monitoring quality assurance program will be performed.

Primary contacts at the Y-12 Plant are expected to be Plant Laboratory personnel.

3.2 Records Required

During the Y-12 Plant visit, the following records/documents regarding quality assurance should be available for review and reference:

- Quality Assurance plans for the Y-12 Plant Laboratory and any supporting analytical laboratories.
- Y-12 Plant sampling and analysis procedures manuals.
- QA audits of environmental sampling and analysis at Y-12 (1981-present).
- Periodic or annual QA summary reports for the Y-12 Plant Laboratory.
- Summaries of results of QA sample analyses on external performance evaluation samples, such as those from DOE's Environmental Measurements Laboratory (EML) and from the EPA.
- Training records for sample collection personnel and for the Y-12 laboratory staff.

- Laboratory notebooks, standard data reporting forms and sampling logbooks.
- Instrument maintenance, repair and calibration records for laboratory and field equipment.
- Results of internal (i.e., by Y-12 Plant Laboratory) precision and accuracy studies of environmental analyses.
- Results of interlaboratory analyses of standard samples (e.g., studies between Y-12 and X-10 or K-25).

4.0 SURFACE WATER/DRINKING WATER

4.1 Issue Identification

A number of documents from the Y-12 Oak Ridge facility have been reviewed with attention being given to the data and information concerning surface water. Of particular interest are the data for the various discharges. Considerable attention has been given to the radiological releases; however, in the past few years (in particular, since the Memorandum of Understanding (MOU) went into effect), there has been considerable effort to: 1) collect discharge data and; 2) reduce or eliminate discharges. Some of the new treatment systems have been constructed and placed in operation, others are in the process of being constructed while others that are proposed and are awaiting funding. A review of the present conditions of the wastewater collection and treatment systems will be made. Liquid waste treatment, process, collection and handling equipment will be examined and records of operation will be reviewed. The objective of the review is to build a survey information base for the identification of physical evidence of existing or potential environmental contamination.

The survey also will include identification of potential discharges to surface waters that may not have been mentioned in the NPDES permit or other documents from Y-12. Also, attention will be given to locate any possible cross contamination between the process and sanitary waste treatment systems as well

as process water and potable water systems. This will be accomplished by reviewing the operating procedures that have been adopted versus record reviews of operation and maintenance of treatment systems and sampling equipment; interviewing personnel; and observing procedures to determine how they are followed. A walk-thru of various plant areas will be made to review normal activities, including maintenance activities generating process wastewater and to identify hazard waste streams from plant processes and discharges to the environment. The various discharges and monitoring points will be reviewed and sampling of surface waters and plant waste waters will also be reviewed. Site surface drainage features, including culverts, channels, and ravines also will be observed.

4.2 Records Required

In addition to those documents reviewed prior to the survey, the following records should be available for review during the on-site survey.

- Analytical data used for preparation of the NPDES monitoring reports.
- NPDES discharge monitoring reports.
- Operators' logbooks and reports for treatment plant operations.
- Sampling logbooks and laboratory tracking reports.

- Treatment plant and monitoring equipment maintenance records and/or logs.
- Water balance drawings.
- Distribution and sewer drawings (process and sanitary floor drain system drawings).
- Process flow diagrams (if not already reviewed from information sent to Gaithersburg).
- Detailed drawings of the domestic and process water supply treatment, storage, and distribution systems.
- Waste system characterization studies.
- Records of drinking water quality and water quality information concerning trihalomethane, coliform bacteria, chlorine residual and asbestos fibers.
- SPCC plan.
- Analytical data on effluent process water and process waste streams.
- Procedures for the operation and/or maintenance of treatment and monitoring equipment.

- Conceptual reports on new waste treatment systems. Also, prints showing the general layout and Process and Information Diagrams (P&ID).
- Reports on recent inspections of the Plant Sewer System.
- Internal memos and correspondence relating to surface water/drinking water problems.
- Other records as determined on site.

5.0 AIR

5.1 Issue Identification

The air-related survey activities will involve an assessment of the air emission sources in the facility, the administrative and any emission controls applied to the sources, and the ambient air monitoring systems. The emphasis of the survey will be on operational and procedural practices associated with the emission sources and the emission control equipment, fugitive source of emission, both within and outside the process buildings, and mitigative procedures applied to fugitive emission sources.

The general approach to the survey will include a review of existing air permits, pending applications, and standard operating procedures. Processes and control equipment will be inspected for compliance with DOE ALARA requirements for radionuclide emissions. The survey will also review the nonradiological air contaminants from the different processes in the facility, evaluate any existing controls applied to the air contaminat emissions, and assess the need for additional monitoring or emission controls to characterize or reduce the environmental consequences of the emissions.

The ambient air monitoring system will be evaluated to assess if the existing monitoring program is adequate to characterize environmental impacts of the air emissions from the facility. The activities involved in this part of the

survey will include the inspection of the ambient air quality samplers, a review of documentation applicable to the ambient air data acquisition, and an evaluation of the processing procedures used to assure the accuracy of the data. The primary emphasis will be on assessment of the use of these data to characterize the environmental impacts of plant operations and the defensibility of the reported data.

Areas of particular interest will include emissions of the criteria pollutants (e.g., radioactive-bearing particulates, sulfur oxides, nitrogen oxides, hydrocarbons, carbon monoxide and lead) as well as regulated hazardous air pollutants (e.g., beryllium, asbestos, hydrogen fluoride and mercury).

In addition, the use of organic solvents will be assessed as a potential or actual source of emissions to determine if they are adequately characterized, monitored, and controlled. A focus of the organic emissions assessment will be directed at those substances considered to be hazardous or toxic air contaminants.

Fugitive emissions from the resuspension of contaminated soils will be evaluated as a potential means of the airborne release of radionuclides and hazardous materials from the facility. Consideration will be given to historical and current operations to determine the potential for soils contamination and windborne releases.

Several areas of specific interest have been identified during a review of available documentation:

- Visual opacity and particulate mass emission exceedances during "hot standby" operation of steam plant boilers.
- Completeness of permitting for degreasers and use of environmentally acceptable solvents.
- Control and monitoring of beryllium, HF, and fluoride emissions.
- Emission potential of fugitive dust sources such as coal-storage piles, roads, and landfill activities.
- Potential for mercury emissions during building decontamination and mercury recovery.
- Effluent sampling and monitoring operations.

A review of the ambient air monitoring system will involve inspection of the samplers for total suspended particulates, sulfur dioxide, and fluoride. Documentation applicable to operating and calibration procedures, validation, and data processing will also be reviewed.

Throughout the survey, a major emphasis will be placed on assessing the validity and utility of available data to characterize the overall environmental impact of plant operations.

5.2 Records Required

- PSD Ledger
- Air Effluent Sampling and QA Procedures
- Ambient Air Sampling and QA Procedures
- Contractor Stack Test Results (9206, 9212, Beta 4, Alpha 5)
- Effluent Beryllium Sampling Results
- Laboratory Records on TSP and Fluoride Analyses (Ambient)
- Documents pertinent to air emissions from ORNL buildings at Y-12
- Documents from Y-12 to DOE

10/16/84 Y-12 Meteorological System

3/26/85 Total Suspended Particulate Monitoring

3/28/85 Guidance Relating to Ambient Air Monitoring - Y-12 Plant

4/01/85 QA/QC Procedures for Ambient Sulfur Dioxide Monitor

5/06/85 Site Evaluation for Total Suspended Particulate (TSP)
Monitors at the Y-12 Plant

7/31/85 Open Burning Plan - Y-12 Plant

8/09/85 Asbestos and Beryllium Oxide Disposal Logs

6.0 RADIOLOGICAL

6.1 Issue Identification

The radiological aspects of the environmental survey will involve an assessment of the facility-wide radioactive emissions, control and monitoring and the associated impact on the environment. The assessment will encompass three major areas: 1) airborne radioactive emissions; 2) liquid radioactive effluents; and 3) radwaste management practices. On the basis of reviews of available documents, it may be concluded that airborne releases of radionuclides have historically been the most significant contributors to radiation exposure to members of the general public. However, the potential of risks to the environment from the other sources must be assessed. The radiological survey will be coordinated with air, water, solid waste, CERCLA and hydrogeology aspects of the survey. Specific issues requiring investigation have been identified for each of the three major areas.

- 1) Airborne radioactive emissions - The only radionuclides that can be released from Y-12 in significant quantities are those contained in depleted and enriched uranium, primarily U-234, U-235, and U-238. There is no evidence that radiological airborne releases from Y-12 have presented a significant risk to the public, but several deficiencies in the radiological emissions control and monitoring program have been observed during previous program reviews. Specific issues that will be investigated during the on-site phase of the survey include:

- Inventory and characterization of radiological release points.
- Design, placement, maintenance, and monitoring of emission control devices.
- Design, placement, maintenance, and calibration of emission monitors.
- Design, placement, maintenance, and calibration of ambient air monitors.
- Quality assurance program and records for radiological sampling and analyses.
- Details and status of plans to upgrade emission monitoring and controls.
- Criteria for determining type of monitoring to be used for a given stack.
- Off-site dose calculations, inputs, assumptions, and methodology.
- Off-site soil monitoring programs.
- Radioactive releases via unmonitored pathways.

2) Liquid radioactive effluents - The revised NPDES permit has identified 236 release points. Of these, 8 have been selected for radionuclide monitoring. Past assessments of radiation dose to members of the general public have indicated that liquid effluents contribute only a very small fraction of the total dose. The adequacy of the current measures to control and monitor radionuclide releases must be verified. Specific areas and issues to be investigated include:

- Details and status of program to upgrade liquid effluent controls and monitoring.
- Design, maintenance, and calibration of liquid effluent monitors and samplers.
- Criteria for selection of sampling locations.
- Criteria for selection release points for radioactive materials.
- Quality assurance program and records for liquid effluent sampling and analysis.
- Adequacy of sampling and analysis procedures.
- Sediment sampling and analysis programs.

3) Solid waste management - Low-level radioactive wastes are generated by Y-12 operations. The principal radioactive contaminants are depleted and enriched uranium although small quantities of wastes containing other materials may also be generated. Treatment of the wastes is limited to the conversion of depleted uranium chips to an oxide form and volume reduction. Enriched uranium scrap is recycled and bulk depleted uranium is stored for possible future recycle. Since 1955, most of the Y-12 radioactive wastes have been disposed of by shallow land burial at the Bear Creek Vally Burial Ground (BCVBG). Past practices have permitted the disposal of liquid wastes at the BCVBG, but since 1983 only solid wastes have been disposed there. Separate burial grounds have been used for the disposal of classified materials. Uranium contamination has been observed in groundwaters in the vicinity of the BCVBG. Specific issues that must be investigated include:

- Current radioactive waste management practices.
- Segregation of radioactive and non-radioactive wastes.
- Monitoring of dumpsters.
- Criteria for release of salvage yard metals for sale to the public.
- Adequacy of groundwater monitoring program.

6.2 Records Required

Records that are requested for on-site review include the following:

- Radioanalytical QA documentation.
- Radiological sampling and analysis procedures.
- Environmental monitor calibration and maintenance records.
- Radwaste management procedures.
- Bases documents for the placement and design of monitors.
- Status reports on environmental monitoring upgrades.
- Raw data from environmental monitoring.
- Status reports on stack monitoring project.
- Classified effluent monitoring reports from Y-12.

7.0 TOXIC/HAZARDOUS SUBSTANCES

7.1 Issue Identification

The toxic substances survey will address raw materials and process-related chemicals used at the Y-12 Plant as well as the usage, handling, storage and disposal of polychlorinated biphenyls (PCBs), asbestos, pesticides/herbicides/biocides and other hazardous substances. The condition and environmental monitoring of underground storage tanks used for storage of substances other than wastes will also be examined. Through interviews with key Y-12 Plant personnel and tours of plant facilities, the tracking control, and management of toxic/hazardous substances will be reviewed. This information and records of usage will be evaluated to determine the potential for environmental contamination.

Inventory control of PCB-containing and PCB-contaminated electrical equipment, hydraulic equipment and heat transfer equipment will be of special concern since large quantities of PCB fluids are known to be on-site. The condition of plant equipment containing PCBs and the potential for environmental contamination will be examined. However, the large amount of PCB containing equipment [267 transformers and 1503 large capacitors (June 30, 1986)] precludes examination of each item, so only a portion of this equipment will actually be inspected. Obsolete, stored or used PCB equipment will be checked for proper labeling, containment, packaging, protection, inventory, and

inspection controls. Plant storage records for radioactively contaminated PCBs as well as non-radioactive PCBs will be reviewed. Disposal practices for non-radioactive PCB materials will also be addressed. Progress on the construction of the incinerator at ORGDP for destruction radioactively contaminated PCB materials will be investigated.

Control of Y-12 Plant projects involving the demolition/disposal of asbestos and asbestos-containing materials will be reviewed to identify pathways of contamination. Asbestos removal and disposal practices will be evaluated, and asbestos disposal areas will be visited to define potential areas of concern.

Pesticide/herbicide/biocide usage records will be reviewed. Pesticide/herbicide purchase and application records will be checked. The applicator training program will be reviewed. Pesticide/herbicide storage areas and disposal practices will be examined to assess risk for environmental contamination.

Toxic and hazardous materials, which are apparently stored and used in large quantities at Y-12, will be examined from the perspectives of storage and handling to minimize the potential for environmental contamination. Among the areas to be examined will be the West Tank Farm, the acetonitrile drum pad, waste oil storage tank facilities (OD1 through OD6), acid and caustic storage tanks, oil and paint storage, solvent storage, flammable storage, reactive metal storage, cyanide storage and compressed gas storage.

Management, inventory and control of chlorofluorocarbons ("freons") will be examined.

Primary contacts currently unnamed, at the Y-12 Plant are expected in the following areas:

- Toxic/Hazardous Materials
- TSCA/PCBs
- Asbestos
- Pesticides/Herbicides/Biocides
- Underground Storage Tanks

7.2 Records Required

During the Y-12 Plant visit, the following records/documents regarding toxic/hazardous substances should be available for review and reference:

- Toxic/hazardous substances inventory and chemical purchase records
- Toxic substances labeling and tracking system overview.
- Procedures for purchasing, handling, storing, using and disposing of toxic substances.

- PCB transformer/capacitor inspection records (1981-present).
- Storage and inspection records for PCB contaminated equipment (1981-present) including radioactively contaminated and non-radioactive items.
- Disposal records for non-radioactive PCB items (1981-present).
- Procedures for storage, handling, and disposal of PCB fluids.
- Correspondence with Y-12 Fire Department regarding PCB electrical equipment, especially any records of fires involving PCB equipment.
- Locations of all Y-12 Plant buildings and areas containing asbestos.
- Procedures for asbestos removal, handling and disposal as well as environmental monitoring information.
- Records of asbestos use in plant equipment and support facilities.
- Maps of active and inactive asbestos disposal areas at Y-12.
- Pesticide/herbicide training, handling, storage and disposal records and standard operating procedures.

- Pesticide annual reports (1981-1985).
- Special procedures involving handling, storage, use and disposal of chlorofluoroalkanes.
- Inventory and environmental monitoring reports and procedures for underground storage tanks (1981-present).
- Other records as determined on site.

8.0 HAZARDOUS/RADIOACTIVE/SOLID WASTE

8.1 Issue Identification

The procedure for the hazardous/radioactive/solid waste survey is to review known sources or activities and identify any additional sources or activities which have the potential to result in contamination of environmental media.

The review will examine management of all waste streams, including radioactive/non-hazardous wastes, non-radioactive/hazardous wastes, radioactive/hazardous mixed wastes, and non-radioactive/non-hazardous wastes. The review will consist of four types of activities: 1) inspections; 2) interviews; 3) file reviews and; 4) comparison of findings with findings previously documented. Each of these activities will be conducted daily as various Y-12 areas are assessed.

Emphasis will be placed on those facilities seeking hazardous waste permit approval. In addition, the team will devote a significant portion of time on site to a detailed process investigation of radioactive, hazardous or mixed waste generation, treatment, storage and release points. Hazardous wastes which have been identified in existing documentation will be tracked through the system and waste related site activities and records reviewed to develop an inventory of Y-12 waste management practices. Based on our review of Martin Marietta and DOE documents, specific waste management areas that will be reviewed include:

- Waste minimization and recycling.
- Waste analysis, segregation, and tracking.
- Treatment and decontamination.
- Waste storage.
- Land application and disposal.
- Waste packaging, staging, and shipping.
- Facility permitting and closure.
- Waste management practices, including training, waste inventory control, recordkeeping, inspection protocol, and contingency planning.

Areas to be inspected include:

- Process areas.
- Waste generation and accumulation points.
- Waste handling areas (e.g., areas for waste segregation, size reduction and packaging).
- Waste treatment and decontamination facilities.
- Waste disposal areas.
- Waste storage facilities and areas.
- Waste receiving and shipping areas.

Waste management operations and practices will be studied. Facilities, operations and practices will be compared with existing descriptions. We will gather information on waste generation points and waste streams to delineate any previously unidentified sources of waste that have the potential to result in environmental contamination.

Discussions will be held with individual knowledgeable of current and past waste management practices. This will be accomplished during process tours, and in the process of reviewing facility records and documentation. The objective is to develop an understanding of past and existing waste management activities that may serve as the basis for problems identification by the survey team. Discussions will be held with personnel from the following groups.

- Environmental Management
 - Solid Waste
 - Waste Minimization
 - Audits
 - Training
 - Underground Tanks
 - RCRA
 - Computer Utilization
 - RCRA Closures

- Waste Treatment Operations
 - Waste Treatment Coordinator
 - Waste Collection, Sampling & Transfer
 - West Operations
- Waste Transportation, Storage & Disposal
 - Operations
 - Waste Disposal Control Section
- Nuclear Materials Control and Accountability

Review of hazardous/radioactive/solid waste will be coordinated with the CERCLA and hydrogeologic surveys to identify any possible releases that may pose a threat to the environment. This survey also will examine site information pertaining to Y-12 underground and above ground storage tanks. Review will focus on tank volumes, contents, construction, age, history and leak detection capabilities.

8.2 Records Required

Files on each waste management activity will be reviewed, as well as documents not previously received and reviewed (e.g., transmittal from Y-12 to DOE). Specific documents and files include:

- Administrative, Emergency, Policy and Health & Safety Procedures;
- Plans for renovations/upgrading, new facilities, and facility closure;
- Waste analysis plans and records and information regarding use of the plans by facility generators;
- Waste inventory documentation (quantities and sources);
- Waste transfer and manifest forms;
- Operating logs for storage areas;
- Site inspection records and any State or Federal inspection documentation;
- Any enforcement action documentation;
- Correspondence with regulatory agencies on solid waste issues;
- Incident and unusual occurrence reports; and
- Personnel training records.

Additional documents and updates to existing documents also will be identified and reviewed. In addition, environmental data base management systems will be studied.

PRELIMINARY

9.0 INACTIVE WASTE SITES/RELEASES (CERCLA)

9.1 Issue Identification

The survey will attempt to identify environmental problems and potential risks associated with the historical handling storage and disposal of hazardous substances at the Y-12 facility. The survey will focus on current and future risks related to the following:

- Past land disposal practices;
- Past spills/releases from tanks, ponds, pipes, pits, trenches; and
- Potential for future spills/releases.

Facilities that have handled or are currently handling hazardous, mixed and low-level radioactive substances will be inspected and assessed. These facilities include the Bear Creek Valley Waste Disposal Area, Bethel Valley Quarry, New Hope Pond and Sediment Disposal Area, Scrap Metal Yard, areas contaminated with mercury, Z-oil and thorium, abandoned tanks and former tank sites, and other areas where hazardous wastes have been or are suspected to be present. Due to past waste management and disposal practices, these facilities will be reviewed in terms of the materials that they contain, the integrity of the facilities, and past and potential releases of hazardous substances.

Sites that have undergone some type of remediation will be addressed. Records and analytical data in support of the site cleanup will be obtained for review. Also, inactive tanks or containers that may have held hazardous substances will be located and their status assessed. Former storage areas and staging locations will be included in this effort. Each of these facilities will be evaluated in terms of the potential to cause a present or future risk to workers, the neighboring population, or to the environment.

The survey team will want to review available material pertaining to the Phase I Installation Assessment report (i.e., map locations of all burial, spill, and release sites, personnel interview files and reconnaissance field data pertaining to HRS/ICHS evaluations).

The team will also want to review the environmental records pertaining to the past management, disposal, clean-up, and regulatory compliance regarding hazardous wastes. We will be equally interested in reviewing the HRS/ICHS ranking procedures used for the Phase I Installation Assessment report.

Primary contacts for this portion of the survey will include personnel from Health, Safety, Environment and Accountability.

9.2 Records Required

The following records, among others, will be reviewed at the site:

- Waste management plans (old and current)
- SOPs regarding management of hazardous substances, disposal areas and storage areas
- Hazardous substances inventories
- Listing of areas used for hazardous substances storage, receiving and shipping, and disposal
- Historical files on past operations and processes, substances used, and methods of handling and disposal
- Files on past off-site waste handling and disposal
- Records of facility expansion and building rubble disposal
- Descriptions and notifications of inactive waste sites and potential areas of contamination
- Description of all waste management facilities, including buried tanks and structures (existing and removed)

- Past aerial photographs of the facility
- "Interview files" for the draft Phase I Installation Assessment report
- Files pertaining to any radiometric surveys of the facility grounds
- Documents prepared by the Oak Ridge Task Force pertaining to potential off-site contamination associated with Y-12.
- Preliminary Assessment of Existing Contamination in Bear Creek Valley Water Shed Area and Potential Remedial Actions for Mitigating its impacts on Bear Creek; Martin Marietta Energy Systems, HSE and A Division, Y-12 Plant; June 1984.
- Martin Marietta Energy Systems Environmental Management Plan
- A plan (Y/IA-169): "Design and Operating Plan for the Extension of Y-12 Plant Burial Ground "A" for Disposal of Low-Level Radioactive Solid Waste"
- Documents pertaining to past, current, and proposed remedial actions at Y-12.
- Environmental records pertaining to past facility responses to hazardous substance spills and releases.

10.0 HYDROGEOLOGY

10.1 Issue Identification

The preliminary review of documents for the Y-12 Plant indicates that the major areas of focus will be:

- The presence of VOC, nitrate, heavy metal, and uranium contamination in groundwater in the Bear Creek Valley waste disposal area.
- The presence of area sources of mercury, uranium, zinc, lead, copper, and cadmium within the plant boundary, leading to pollution of East Fork Poplar Creek by groundwater movement or surface runoff.
- The potential of groundwater contamination from Kerr Hollow Quarry, Rogers Quarry, New Hope Pond, and the Chestnut Ridge disposal sites.

This survey effort will involve the evaluation of recent studies of site hydrogeology, determination of the status of on-going studies, assessment of the adequacy of the environmental monitoring program, and the review of plans for further investigations and remedial actions.

10.2 Records Required

Records and documents to be reviewed include the following:

- Maps of well locations and analytical data from recently installed (1985-1986) wells at Kerr Hollow Quarry and Rogers Quarry.
- Work plans for current investigations, including new well installation and rehabilitation of existing wells.
- Current sampling procedures and analytical protocols for both RCRA and historical sampling.
- Geologic map of the Oak Ridge Reservation (McMaster, 1963, ORNL-TM-713).
- Y/TS-60, Y/SUB/84 - 00206C12, Y/SUB/84 - 47974C/6, ORNL/TM-9092, ORNL/TM-9229, Ketelle and Pin (1984).

PRELIMINARY

APPENDIX C
SITE-SPECIFIC SURVEY ACTIVITIES

C.1 Pre-Survey Preparation

The DOE Office of Environmental Audit, Assistant Secretary for Environment, Safety, and Health selected a team to conduct an Environmental Survey at the Y-12 Plant at Oak Ridge, Tennessee. Y-12 is operated for DOE by Martin Marietta Energy Systems, Inc. (MMES). Mr. Thomas Traceski was designated DOE Team Leader, and Mr. David Caughey, the Assistant Team Leader. Other team members included technical specialists from NUS Corporation and ICF Technology. Argonne National Laboratory (ANL) was designated to provide a Sampling and Analysis (S&A) team for the Y-12 Survey.

A pre-Survey site visit to Y-12 at Oak Ridge, Tennessee was conducted on October 7 and 8, 1986, by the Team Leaders, the NUS technical coordinator, and representatives from the ANL Sampling and Analysis team. Following introductions, Y-12 personnel presented an overview of activities at the facility and discussed environmental issues of concern to them. The logistics of the upcoming Survey were discussed and a plant tour was provided. In addition, a meeting was held with EPA Region IV and the Tennessee Department of Health and Environment personnel to inform them of Survey activities and to hear their concerns with regard to Y-12.

Subsequently, NUS and ICF technical specialists intensively reviewed the environmental documents and reports that were provided by Y-12. Based on that review, a Survey Plan for the Y-12 site was prepared, which discussed the specific approach to the Survey for each of the technical disciplines and included a proposed schedule of activities for on-site activities. The Survey Plan was transmitted through the Oak Ridge Operations Office to MMES during the week of November 3, 1986.

C.2 On-site Activities

The on-site portion of the Survey was conducted at Y-12 during the period of November 10-21 and December 9-11, 1986. The opening meeting held on November 10, 1986 was attended by representatives from DOE Headquarters, the Oak Ridge Operations Office, Martin Marietta Energy Systems, Inc., NUS Corporation, and ICF Corporation. Discussions during this meeting centered on the purpose of the Survey, logistics at Y-12, and an introduction of the personnel involved.

During the on-site portion of the Survey, team members reviewed additional file materials including permits and applications, background studies, engineering drawings, unusual occurrence reports, and operating logbooks. The production process was thoroughly analyzed to identify existing and potential pollutants. Site operations and monitoring procedures were observed. Extensive

interviews were conducted with plant personnel regarding environmental controls, operations, monitoring and analysis, past operations, regulatory permits, and waste management.

Meetings of the Survey team members were held to report observations and compare findings. The team also coordinated daily with MMES to arrange for specific site personnel and facilities to be available, as needed, on the following day. The Sampling and Analysis requirements identified by the Survey team members were discussed as they developed with Argonne personnel.

A site closeout briefing was held on November 21, 1986, at which the DOE Team Leader presented the preliminary observations of the Survey team. These observations were classified as preliminary, because additional research and, in some cases, additional field sampling were required to positively confirm the observations.

C.3 Sampling and Analysis

Argonne National Laboratory (ANL) is evaluating the Sampling and Analysis requests made by the Survey team and is determining Sampling and Analysis logistics, costs, and schedules. The Sampling and Analysis plan being prepared by ANL will include a quality assurance plan and a health and safety plan.

C.4 Report Preparation

A Preliminary Environmental Survey Report for Y-12 was prepared to summarize the findings from the on-site survey effort. This report will be provided to the Oak Ridge Operations Office and the Y-12 contractor for review. The findings presented in the draft report are considered preliminary until comments are received and S&A results are available. At that time, the comments and S&A results will be evaluated and an interim report will be prepared.

APPENDIX D
ENVIRONMENTAL REGULATORY ACTIONS

- D.1 Federal Facilities Compliance Agreement, Y-12 Steam Plant**
- D.2 Tennessee Department of Health and Environment, Notice of Complaint, Y-12 Steam Plant**
- D.3 Memorandum of Understanding Among DOE, EPA, TDHE for the Y-12 Plant**
- D.4 Complaint and Order, EFPC**
- D.5 Complaint and Order, Bear Creek Valley and Amendment**
- D.6 Order for Correction 1**
- D.7 Order for Correction 2**
- D.8 Federal Facilities Compliance Agreement, NPDES Permit**

PRELIMINARY

APPENDIX D.1
FEDERAL FACILITIES COMPLIANCE AGREEMENT
Y-12 STEAM PLANT

U. S. ENVIRONMENTAL PROTECTION AGENCY

REGION IV

Department of Energy
and
U. S. Environmental
Protection Agency,
Region IV

Federal Facility
Compliance
Agreement

The Environmental Protection Agency, Region IV (REGION IV) and Department of Energy (DOE), Oak Ridge Operations, Oak Ridge, Tennessee, are the parties to this agreement, which is entered into pursuant to Executive Order 12088, October 13, 1978 (43 FR 47707). The Office of Management and Budget and the Department of Justice will take cognizance of this agreement pursuant to their respective duties to assure compliance with the environmental laws under Executive Order 12088 and the particular statutes herein addressed.

Scope

1. This agreement is entered into by the parties to assure compliance by the Department of Energy, Oak Ridge Operations, with the Clean Air Act (CAA) (42 USC 7401 et seq.) and implementing regulations.
2. This agreement does not modify the terms of the State Implementation Plan (SIP) governing each subject facility, nor shall it relieve the Department of Energy, Oak Ridge Operations, of such SIP responsibility under the CAA. This agreement in no way affects requirements for each facility to apply to Region IV and the appropriate local or state or regional environmental agency for all applicable air quality permits.

Authorities

3. The duties of the Department of Energy, Oak Ridge Operations, to operate its facilities in compliance with the Clean Air Act are prescribed in Section 118 of the Clean Air Act (42 USC 7418). Executive Order 12088 was promulgated to ensure Federal compliance with applicable pollution control standards. This agreement contains a "plan" as described in Section 1-601 of Executive Order 12088 to achieve and maintain compliance with applicable air pollution control standards.

Statement of Facts

4. The Oak Ridge Operations, Y-12 Steam Plant, is owned, operated, or under the control of the Department of Energy. —

5. The boilers of the Y-12 Steam Plant, Oak Ridge Operations, designated Units #1, #2, #3, and #4, are each emitting particulate matter into the ambient air in excess of the amounts allowed under Rule 1200-3-6-.02(1) of the Tennessee Air Pollution Control Regulations dealing with non-process particulate emission standards.

6. Rule 1200-3-6.02(1) of the Tennessee Air Pollution Control Regulations is part of the federally approved and federally enforceable Tennessee state implementation plan, 34 Fed. Reg. 10894 (May 31, 1972), as amended.

7. Electrostatic precipitators were installed on boiler units #1, #2, #3, and #4 in 1966 and with the removal of the ESP and the addition of fabric filter controls presently under design emission violations will be corrected.

8. The Tennessee Air Pollution Control Board has on several occasions determined the Y-12 Steam Plant to be in violation of limitations for visible emissions in accordance with Rule 1200-3-20-.07. Engineering measures now underway will correct these violations.

9. The Oak Ridge Operations received \$2.0 million in FY 1981 obligational authority to initiate design of emission controls. The estimated cost for the completed project is \$17 million.

Compliance Schedule

10. The compliance schedule for the facility named in paragraph 4 is intended to achieve compliance as expeditiously as practicable, pursuant to Section 1-601 of E. O. 12088, and is set forth as Attachment A to this agreement. The attachment is incorporated into and made a part of this agreement. The schedule was determined after consultation between the Department of Energy and Region IV. The schedule contains interim requirements reflecting design and construction milestone dates. Wherever reasonably possible, the Department of Energy will expedite the schedule.

Funding

11. The Department of Energy shall request all funds and/or authorizations from the Congress necessary to achieve the compliance schedule. This schedule is fixed and definite except to the extent that the Congress of the United States may fail to approve authorization and/or budget requests for this project. Steps to be taken in seeking funding shall be consistent with Sections 1-4 and 1-5 of Executive Order 12088 as implemented by the Office of Management and Budget Circular A-106 (as amended).

Reporting Requirements

12. The Department of Energy shall submit a progress report no later than ten days after the date for achievement of each incremental step in the compliance schedule and upon the final compliance date as set forth in the Attachment. The progress reports will be submitted to Region IV and the appropriate local or State or regional environmental agency, as identified on the Attachment. The status reports shall indicate compliance or non-compliance with the schedule. In the event of non-compliance, the report shall include the cause of non-compliance and any remedial actions taken.

If delay is anticipated in meeting any scheduled date, the Department of Energy shall immediately notify Region IV and the local or State or regional environmental agency, in writing, of the anticipated delay, and shall describe in detail as promptly as practicable the anticipated length of delay, the precise cause or causes of the delay, the measures taken and to be taken by the Department of Energy to prevent or minimize the delay and the timetable by which the measures shall be implemented. The Department of Energy will take reasonable action to minimize any delay. The Regional Administrator shall make a determination whether the compliance schedule set forth in the Attachment will be revised. If the Department of Energy disagrees with this determination, the Conflict Resolution procedure described herein shall control.

Additionally, beginning three months after the date of this agreement the Department of Energy shall submit a status report to Region IV and the local or State or regional environmental agency detailing the progress made during that quarter. These reports shall be submitted quarterly until compliance has been achieved.

13. In the event that there is an amendment of the CAA, or in the event that changes to the regulations promulgated under those statutes change the technology necessary to achieve compliance pursuant to this agreement, the schedule will be renegotiated to effect changed law or regulations. Such renegotiation shall be governed by Executive Order 12088. Any disagreements in renegotiations shall be resolved by the Conflict Resolution provisions of this agreement. During the pendency of any request for renegotiation, the attached compliance schedule, to the extent it does not conflict with statutory or regulatory changes, shall remain in effect unless specifically waived by Region IV.

14. On the date for final compliance as shown on the attachment, compliance with air standards must be demonstrable by testing and positive reporting of the achievement of compliance, rather than by the mere completion of construction of pollution abatement facilities.

Upon the Department of Energy's demonstration of compliance, there will be a continuing obligation to comply with applicable emission limitations under the CAA. These limitations are embodied in the State Implementation Plan under the CAA.

Conflict Resolution

15. Unresolved conflicts with, or alleged violations of, this agreement shall be brought to the attention of the Administrator of the U. S. Environmental Protection Agency, Washington, D. C., for resolution

by EPA and Department of Energy. If necessary, the Director, Office of Management and Budget shall be notified pursuant to Sections 1-602 and 1-603 of Executive Order 12088. The Director, Office of Management and Budget shall consider such steps as are necessary to resolve any conflicts and remedy the violation.

Sanctions

16. In the event of violations of terms of this agreement by the Department of Energy, sanctions under the authority of Section 1-604 of Executive Order 12088, as well as enforcement procedures established by the Clean Air Act are available as enforcement mechanisms in addition to the Conflict Resolution procedures cited in paragraph 15.

17. Provided that the Compliance Schedule, as attached, is met, this agreement is considered to be in lieu of any other EPA or Federal enforcement action with regard to the facility named in paragraph 4, for the pollution indicated in paragraphs 5 and 6. This agreement in no way modifies Section 303 of the CAA.

18. This agreement in no way addresses potential liability of the Department of Energy regarding non-compliance penalties under Section 120 of the CAA by the facility subject to this agreement.

4/14/82
DATE

APR 13 1982

DATE

Signed: [Signature]

DOE REPRESENTATIVE

Signed: [Signature]

REGIONAL EPA REPRESENTATIVE

AIR SCHEDULE

ATTACHMENT A

FACILITY

Department of Energy, Oak Ridge Operations
Y-12 Steam Plant

PROJECT DESCRIPTION

Electrostatic precipitators were installed in 1966. This project is to install fabric filters (a baghouse or baghouses) in the steam plant to effect control of particulates and to achieve compliance with State and Federal laws and standards for particulate emissions.

COMPLIANCE SCHEDULE

A. For Boilers 1 and 2, on or before;

1. March 15, 1982 - Submit final plans for emission control strategy and equipment.

2. May 21, 1982 - Award contract to Fixed Price Prime Contract 1 for the design, fabrication and installation of control devices.

January 1, 1983 - Award contract to Fixed Price Prime Contract 2 for the design, fabrication and installation of the ductwork, fans, etc., necessary to tie-in the control devices.

3. May 1, 1982 - Begin on-site construction and installation of control devices.

November 1, 1983 - Begin on-site construction and installation of ductwork, fans, etc., necessary to tie-in control devices.

4. November 1, 1983 - Complete construction and installation of control devices.

July 1, 1984 - Complete construction and installation of ductwork, fans, etc., and tie-in of control devices for Boilers 1 and 2.

October 1, 1984 - Complete start-up of Boilers 1 and 2.

5. December 1, 1984 - Perform stack tests and submit stack test reports and visible emission evaluations as proof that final compliance has been achieved for Units 1 and 2 with the particulate emission limits of 0.17 lbs. per million BTU heat input and 20% opacity. Copies of coal analysis data for the coal fired during each test shall be included. Coal analysis data should include, at a minimum, percent ash, percent sulfur, percent moisture, and BTU's per pound on an as-fired basis.

B. For Boilers 3 and 4, on or before;

1. March 15, 1982 - Submit final plans for emission control strategy and equipment.
2. May 21, 1982 - Award contract to Fixed Price Prime Contract 1 for design, fabrication and installation of control devices.

January 1, 1983 - Award contract to Fixed Price Prime Contract 2 for the design, fabrication and installation of the ductwork fans, etc., necessary to tie-in the control devices.

3. May 1, 1982 - Begin on-site construction and installation of control devices.

November 1, 1984 - Begin on-site construction of ductwork fans, etc., necessary to tie-in control devices.

4. November 1, 1983 - Complete construction and installation of control devices.

July 1, 1985 - Complete construction and installation of ductwork, fans, etc., and tie-in of control devices for Boilers 3 and 4.

October 1, 1985 - Complete start-up of Boilers 3 and 4.

5. December 1, 1985 - Perform stack tests and submit stack test reports and visible emission evaluations as proof that final compliance has been achieved for Units 3 and 4 with the particulate emission limits of 0.17 lbs. per million BTU heat input and 20% opacity. Copies of coal analysis data for the coal fired during each test shall be included. Coal analysis data should include, at a minimum, percent ash, percent sulfur, percent moisture, and BTU's per pound on an as-fired basis.

REMARKS

1. Completion of full design shall include obtaining all required air quality permits.

2. All progress and test reports, as required by this Agreement, shall be submitted to:

U. S. Environmental Protection Agency
Region IV
345 Courtland Street, N. E.
Atlanta, Georgia 30365

ATTN: Arthur G. Linton, Federal Activities Coordinator

Copy to: James T. Wilburn, Acting Chief
Air & RCRA Compliance Branch, EPA (Address Above)

Copy to: Harold E. Hodges, P.E., Director
Tennessee Department of Public Health
Division of Air Pollution Control
Terra Building
150 Ninth Avenue North
Nashville, Tennessee 37203

3. Department of Energy shall utilize Boilers 1 and 2 to the maximum extent possible once the control equipment is in place on these units (July 1984), in order to minimize emissions from the total facility in the interim period prior to achieving full compliance.

4. All compliance testing shall be conducted in accordance with established EPA test Reference Methods 1-5 and 9 as specified in 40 CFR Part 60, Appendix A.

5. Visible emissions evaluations shall be performed concurrently with all mass particulate compliance testing. Visible emission evaluations shall be performed by State or EPA certified smoke reader(s) in accordance with EPA test Reference Method 9, 40 CFR Part 60, Appendix A (1981) and submitted with the corresponding test reports.

6. Quarterly reporting, as addressed in Section 12 of this agreement shall include the submission of all available coal analysis data for coal received during that quarter. It is not necessary to submit a copy of the individual coal analysis data sheets for each shipment received. Summary type sheets, similar to those enclosed in the December 11, 1979, letter from J. F. Wing to A. G. Linton are acceptable providing they indicate, at a minimum, the percent ash, percent sulfur, percent moisture and BTU per pound of the fuel on an "as received" basis.

7. Department of Energy shall conduct a pre-test conference with appropriate EPA and/or Tennessee Division of Air Pollution Control (TDAPC) personnel in attendance at least 45 days prior to testing. The purpose of the conference will be to assure that the sampling procedures to be followed are appropriate and in conformance with the methods specified in 40 CFR Part 60. EPA and TDAPC must be given at least ten (10) working days advance notice of the scheduled conference.

8. Department of Energy shall notify EPA and the TDAPC in writing of the planned date or dates for compliance testing at least twenty (20) working days prior to such testing, to afford the agencies an opportunity to have representatives present to observe the testing to assure that it is done in accordance with established EPA test reference methods.

APPENDIX D.2
TENNESSEE DEPARTMENT OF HEALTH AND ENVIRONMENT
NOTICE OF COMPLAINT
Y-12 STEAM PLANT

STATE OF TENNESSEE
DEPARTMENT OF HEALTH AND ENVIRONMENT

IN THE MATTER OF:)

U. S. DEPARTMENT OF ENERGY)
OAK RIDGE, TENNESSEE,)

DIVISION OF AIR
POLLUTION CONTROL
NO. 83-415

RESPONDENT)

NOTICE OF COMPLAINT

Comes now, Harold E. Hodges, Technical Secretary of the Air Pollution Control Board, and states that:

PARTIES

I.

Harold E. Hodges, Technical Secretary of the Air Pollution Control Board, pursuant to T.C.A. Section 68-25-107, has the authority to issue a formal Notice of Complaint and prosecute such complaints before the Board.

II.

The U. S. Department of Energy (DOE) is an agency of the United States government. The Secretary of Energy is Donald Hodel. Joe La Grone is the Manager of Oak Ridge Operations, DOE, P. O. Box E, Oak Ridge, Tennessee 37831.

JURISDICTION

III.

DOE is subject to comply with the Tennessee Air Quality Act as part of a federally approved State Implementation Plan. DOE is a "person" as defined at T.C.A. Section 68-25-102(7).

FACTS

IV.

DOE owns and operates a weapons production facility known as the Y-12 Plant near Oak Ridge in Anderson County, Tennessee. As part of the production process, coal is burned in boilers to produce process steam and space heating.

V.

There are four coal-fired boilers at the Y-12 Plant. Each of these boilers have particulate emission control devices utilizing electrostatic precipitators that were installed in 1966. These electrostatic precipitators were designed for medium collection efficiency. Since their installation, their performance has deteriorated.

VI.

Division of Air Pollution Control inspections in the past have proved noncompliance with the general visible emissions standard specified in Division Rule 1200-3-5-.01(1). The in-stack opacity monitors located on the boiler stacks have documented continued noncompliance with Division Rule 1200-3-5-.01(1) from April 1, 1980 to December 31, 1981, and continued noncompliance with Division Rule 1200-3-5-.10 from January 1, 1982 to date.

VII.

Source testing by the facility proved noncompliance with the non-process mass emissions standard, specified in Division Rule 1200-3-6-.02(1) on March 31, 1978, April 1, 2, 3, 5, 6, 7 and 8, 1978 and noncompliance with the non-process sulfur dioxide mass emissions standard specified in Division Rule 1200-3-14-.02(1) on April 1, 3, 4 and 8, 1978.

VIII.

DOE is also in violation of Division Rule 1200-3-9-.02 for operating an air contaminant source without an operating permit from the Division of Air Pollution Control from June 1, 1980 to the present.

IX.

DOE has begun utilizing a better grade of coal and has demonstrated interim compliance with the sulfur dioxide standard through fuel analysis computations.

VIOLATIONS

X.

DOE has violated the following Division Rules:

- a. 1200-3-5-.01(1) General Emission Standards from April 1, 1980 to December 31, 1981.
- b. 1200-3-5-.10 General Standards for Visible Emissions from January 1, 1982 to the Present.
- c. 1200-3-6-.02(1) Non-process Mass Emissions Standards on March 31, 1978, April 1, 2, 3, 5, 6, 7 and 8, 1978.
- d. 1200-3-9-.02 Operating an Air Contaminant Source Without an Operating Permit from June 1, 1980 to the present.
- e. 1200-3-14-.02(1) Non-process Sulfur Dioxide Mass Emissions Standards on April 1, 3, 4 and 8, 1978.

ORDER

XI.

WHEREFORE, PREMISES CONSIDERED, it is ORDERED by the Technical Secretary and AGREED by DOE that the following COMPLIANCE SCHEDULE shall be adhered to by the parties:

A. For Boilers 1 and 2, DOE shall, on or before:

1. July 1, 1984 - Complete construction and installation of ductwork,

fans, and related equipment, and tie-in of control devices for Boilers 1 and 2.

2. October 1, 1984 - Complete start-up of Boilers 1 and 2.
3. December 1, 1984 - Perform stack tests for both particulates and sulfur dioxide and submit stack test reports and visible emission evaluations as proof that final compliance has been achieved for Boilers 1 and 2 with the particulate emission limits of 0.17 lbs. per million BTU heat input, the visible emissions standard of 20% opacity and the sulfur dioxide emission limit of 4.0 lbs. per million BTU heat input. Copies of coal analysis data for the coal fired during each test shall be included. Coal analysis data should include, at a minimum, percent ash, percent sulfur, percent moisture, and BTU's per pound on an as-fired basis.
4. Prior to the conducting of the stack tests a repeat of the opacity monitor performance specification test shall be conducted and a performance test report submitted for the opacity monitor serving Boilers 1 and 2. This opacity monitor shall be fully operational and data from it shall be recorded during the particulate source testing of Boilers 1 and 2. This data shall be a part of the stack test report.

B. For Boilers 3 and 4, DOE shall, on or before:

1. November 1, 1983 - Complete construction and installation of emission control devices.
2. November 1, 1984 - Begin on-site construction of ductwork, fans, and related equipment, necessary to tie-in emission control devices.
3. July 1, 1985 - Complete construction and installation of ductwork, fans, and related equipment, and tie-in of emission control devices for Boilers 3 and 4.
4. October 1, 1985 - Complete start-up of Boilers 3 and 4.

5. December 1, 1985 - Perform stack tests for both particulates and sulfur dioxide and visible emission evaluations as proof that final compliance has been achieved for Boilers 3 and 4 with the particulate emission limits of 0.17 lbs. per million BTU heat input, the visible emission standard of 20% opacity and the sulfur dioxide emission limit of 4.0 lbs. per million BTU heat input. Copies of coal analysis data for the coal fired during each test shall be included. Coal analysis data should include, at a minimum, percent ash, percent sulfur, percent moisture, and BTUs per pound on an as-fired basis.
6. Prior to the conducting of the stack tests a repeat of the opacity monitor performance specification test shall be conducted and a performance test report submitted for the opacity monitor serving Boilers 3 and 4. This opacity monitor shall be fully operational and data from it shall be recorded during the particulate source testing of Boilers 3 and 4. This data shall be part of the stack test report.

C. General Provisions:

1. DOE shall utilize Boilers 1 and 2 to the maximum extent possible once the control equipment is in place on these units (July 1984), in order to minimize total facility emissions in the interim period.
2. All source performance tests, monitoring data, notices, copies of purchase orders and executed contracts, and other items required to be submitted by this Order shall be mailed to Harold E. Hodges, Technical Secretary, Tennessee Air Pollution Control Board, TERRA Building, 150 - 9th Avenue, North, Nashville, Tennessee 37203.
3. Within ten (10) days after the completion of each increment of progress specified in Paragraph X, DOE shall notify the Technical Secretary, in writing, whether the increment of progress was achieved. If an increment of progress is not met by the required date, DOE shall explain, in writing, why the increment was not

accomplished and indicate when the increment will be achieved.
Notice to the Technical Secretary of such delays shall not be construed as indicating his approval of the delay.

4. DOE shall provide the Technical Secretary with twenty (20) days advance notice of the performance of any test required by the schedule of compliance in Paragraph X. This requirement is to afford the Technical Secretary an opportunity to evaluate the test procedure and to have an observer present during such testing.
5. This ORDER does not affect in any way the responsibility of DOE to comply with all other applicable federal, state and local regulations.

D. The Technical Secretary may initiate the assessment of CIVIL PENALTIES against DOE before the Tennessee Air Pollution Control Board for the failure of DOE to adhere to the foregoing COMPLIANCE SCHEDULE or for other violations of the Act pursuant to his authority.

ISSUED this 12TH day of July, 1984.

Harold E. Hodges
Technical Secretary
Tennessee Air Pollution Control Board

NOTICE OF RIGHTS

Respondent is hereby advised that in accordance with T.C.A. Section 68-25-108(a)(2) and 4-5-301 et seq., it may seek review of this Notice of Complaint by filing an answer to the charges set out herein within thirty (30) days of the date of this Notice. Respondent may be represented by counsel, make argument, offer testimony or cross-examine witnesses. Any hearing for review of this Notice of Complaint shall be conducted before the Tennessee Air Pollution Control Board in accordance with the Tennessee Administrative Procedures Act at T.C.A. Section 4-5-301 et seq.

All correspondence pertaining to this matter should be addressed to Mary E. Johnston, Assistant General Counsel, TERRA Building, 150 Ninth Avenue North, Nashville, Tennessee 37203, Phone (615) 741-4177.

Mary E. Johnston
Assistant General Counsel

MEJ/bjs Legal 6/Poll/Ridge

PRELIMINARY

**APPENDIX D
ENVIRONMENTAL REGULATORY ACTIONS**

- D.1 Federal Facilities Compliance Agreement, Y-12 Steam Plant**
- D.2 Tennessee Department of Health and Environment, Notice of Complaint, Y-12 Steam Plant**
- D.3 Memorandum of Understanding Among DOE, EPA, TDHE for the Y-12 Plant**
- D.4 Complaint and Order, EFPC**
- D.5 Complaint and Order, Bear Creek Valley and Amendment**
- D.6 Order for Correction 1**
- D.7 Order for Correction 2**
- D.8 Federal Facilities Compliance Agreement, NPDES Permit**

**APPENDIX D.1
FEDERAL FACILITIES COMPLIANCE AGREEMENT
Y-12 STEAM PLANT**

U. S. ENVIRONMENTAL PROTECTION AGENCY

REGION IV

Department of Energy

and

U. S. Environmental

Protection Agency,

Region IV

Federal Facility

Compliance

Agreement

The Environmental Protection Agency, Region IV (REGION IV) and Department of Energy (DOE), Oak Ridge Operations, Oak Ridge, Tennessee, are the parties to this agreement, which is entered into pursuant to Executive Order 12088, October 13, 1978 (43 FR 47707). The Office of Management and Budget and the Department of Justice will take cognizance of this agreement pursuant to their respective duties to assure compliance with the environmental laws under Executive Order 12088 and the particular statutes herein addressed.

Scope

1. This agreement is entered into by the parties to assure compliance by the Department of Energy, Oak Ridge Operations, with the Clean Air Act (CAA) (42 USC 7401 et seq.) and implementing regulations.
2. This agreement does not modify the terms of the State Implementation Plan (SIP) governing each subject facility, nor shall it relieve the Department of Energy, Oak Ridge Operations, of such SIP responsibility under the CAA. This agreement in no way affects requirements for each facility to apply to Region IV and the appropriate local or state or regional environmental agency for all applicable air quality permits.

Authorities

3. The duties of the Department of Energy, Oak Ridge Operations, to operate its facilities in compliance with the Clean Air Act are prescribed in Section 118 of the Clean Air Act (42 USC 7418). Executive Order 12088 was promulgated to ensure Federal compliance with applicable pollution control standards. This agreement contains a "plan" as described in Section 1-601 of Executive Order 12088 to achieve and maintain compliance with applicable air pollution control standards.

Statement of Facts

4. The Oak Ridge Operations, Y-12 Steam Plant, is owned, operated, or under the control of the Department of Energy. —

5. The boilers of the Y-12 Steam Plant, Oak Ridge Operations, designated Units #1, #2, #3, and #4, are each emitting particulate matter into the ambient air in excess of the amounts allowed under Rule 1200-3-6-.02(1) of the Tennessee Air Pollution Control Regulations dealing with non-process particulate emission standards.

6. Rule 1200-3-6.02(1) of the Tennessee Air Pollution Control Regulations is part of the federally approved and federally enforceable Tennessee state implementation plan, 34 Fed. Reg. 10894 (May 31, 1972), as amended.

7. Electrostatic precipitators were installed on boiler units #1, #2, #3, and #4 in 1966 and with the removal of the ESP and the addition of fabric filter controls presently under design emission violations will be corrected.

8. The Tennessee Air Pollution Control Board has on several occasions determined the Y-12 Steam Plant to be in violation of limitations for visible emissions in accordance with Rule 1200-3-20-.07. Engineering measures now underway will correct these violations.

9. The Oak Ridge Operations received \$2.0 million in FY 1981 obligational authority to initiate design of emission controls. The estimated cost for the completed project is \$17 million.

Compliance Schedule

10. The compliance schedule for the facility named in paragraph 4 is intended to achieve compliance as expeditiously as practicable, pursuant to Section 1-601 of E. O. 12088, and is set forth as Attachment A to this agreement. The attachment is incorporated into and made a part of this agreement. The schedule was determined after consultation between the Department of Energy and Region IV. The schedule contains interim requirements reflecting design and construction milestone dates. Wherever reasonably possible, the Department of Energy will expedite the schedule.

Funding

11. The Department of Energy shall request all funds and/or authorizations from the Congress necessary to achieve the compliance schedule. This schedule is fixed and definite except to the extent that the Congress of the United States may fail to approve authorization and/or budget requests for this project. Steps to be taken in seeking funding shall be consistent with Sections 1-4 and 1-5 of Executive Order 12088 as implemented by the Office of Management and Budget Circular A-106 (as amended).

Reporting Requirements

12. The Department of Energy shall submit a progress report no later than ten days after the date for achievement of each incremental step in the compliance schedule and upon the final compliance date as set forth in the Attachment. The progress reports will be submitted to Region IV and the appropriate local or State or regional environmental agency, as identified on the Attachment. The status reports shall indicate compliance or non-compliance with the schedule. In the event of non-compliance, the report shall include the cause of non-compliance and any remedial actions taken.

If delay is anticipated in meeting any scheduled date, the Department of Energy shall immediately notify Region IV and the local or State or regional environmental agency, in writing, of the anticipated delay, and shall describe in detail as promptly as practicable the anticipated length of delay, the precise cause or causes of the delay, the measures taken and to be taken by the Department of Energy to prevent or minimize the delay and the timetable by which the measures shall be implemented. The Department of Energy will take reasonable action to minimize any delay. The Regional Administrator shall make a determination whether the compliance schedule set forth in the Attachment will be revised. If the Department of Energy disagrees with this determination, the Conflict Resolution procedure described herein shall control.

Additionally, beginning three months after the date of this agreement the Department of Energy shall submit a status report to Region IV and the local or State or regional environmental agency detailing the progress made during that quarter. These reports shall be submitted quarterly until compliance has been achieved.

13. In the event that there is an amendment of the CAA, or in the event that changes to the regulations promulgated under those statutes change the technology necessary to achieve compliance pursuant to this agreement, the schedule will be renegotiated to effect changed law or regulations. Such renegotiation shall be governed by Executive Order 12088. Any disagreements in renegotiations shall be resolved by the Conflict Resolution provisions of this agreement. During the pendency of any request for renegotiation, the attached compliance schedule, to the extent it does not conflict with statutory or regulatory changes, shall remain in effect unless specifically waived by Region IV.

14. On the date for final compliance as shown on the attachment, compliance with air standards must be demonstrable by testing and positive reporting of the achievement of compliance, rather than by the mere completion of construction of pollution abatement facilities.

Upon the Department of Energy's demonstration of compliance, there will be a continuing obligation to comply with applicable emission limitations under the CAA. These limitations are embodied in the State Implementation Plan under the CAA.

Conflict Resolution

15. Unresolved conflicts with, or alleged violations of, this agreement shall be brought to the attention of the Administrator of the U. S. Environmental Protection Agency, Washington, D. C., for resolution

by EPA and Department of Energy. If necessary, the Director, Office of Management and Budget shall be notified pursuant to Sections 1-602 and 1-603 of Executive Order 12088. The Director, Office of Management and Budget shall consider such steps as are necessary to resolve any conflicts and remedy the violation.

Sanctions

16. In the event of violations of terms of this agreement by the Department of Energy, sanctions under the authority of Section 1-604 of Executive Order 12088, as well as enforcement procedures established by the Clean Air Act are available as enforcement mechanisms in addition to the Conflict Resolution procedures cited in paragraph 15.

17. Provided that the Compliance Schedule, as attached, is met, this agreement is considered to be in lieu of any other EPA or Federal enforcement action with regard to the facility named in paragraph 4, for the pollution indicated in paragraphs 5 and 6. This agreement in no way modifies Section 303 of the CAA.

18. This agreement in no way addresses potential liability of the Department of Energy regarding non-compliance penalties under Section 120 of the CAA by the facility subject to this agreement.

4/14/82
DATE

APR 14 1982

DATE

Signed: [Signature]

DOE REPRESENTATIVE

Signed: [Signature]

REGIONAL EPA REPRESENTATIVE

AIR SCHEDULE

ATTACHMENT A

FACILITY

Department of Energy, Oak Ridge Operations
Y-12 Steam Plant

PROJECT DESCRIPTION

Electrostatic precipitators were installed in 1966. This project is to install fabric filters (a baghouse or baghouses) in the steam plant to effect control of particulates and to achieve compliance with State and Federal laws and standards for particulate emissions.

COMPLIANCE SCHEDULE

A. For Boilers 1 and 2, on or before;

1. March 15, 1982 - Submit final plans for emission control strategy and equipment.

2. May 21, 1982 - Award contract to Fixed Price Prime Contract 1 for the design, fabrication and installation of control devices.

January 1, 1983 - Award contract to Fixed Price Prime Contract 2 for the design, fabrication and installation of the ductwork, fans, etc., necessary to tie-in the control devices.

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November 1, 1983 - Begin on-site construction and installation of ductwork, fans, etc., necessary to tie-in control devices.

4. November 1, 1983 - Complete construction and installation of control devices.

July 1, 1984 - Complete construction and installation of ductwork, fans, etc., and tie-in of control devices for Boilers 1 and 2.

October 1, 1984 - Complete start-up of Boilers 1 and 2.

5. December 1, 1984 - Perform stack tests and submit stack test reports and visible emission evaluations as proof that final compliance has been achieved for Units 1 and 2 with the particulate emission limits of 0.17 lbs. per million BTU heat input and 20% opacity. Copies of coal analysis data for the coal fired during each test shall be included. Coal analysis data should include, at a minimum, percent ash, percent sulfur, percent moisture, and BTU's per pound on an as-fired basis.

B. For Boilers 3 and 4, on or before;

1. March 15, 1982 - Submit final plans for emission control strategy and equipment.

2. May 21, 1982 - Award contract to Fixed Price Prime Contract 1 for design, fabrication and installation of control devices.

January 1, 1983 - Award contract to Fixed Price Prime Contract 2 for the design, fabrication and installation of the ductwork fans, etc., necessary to tie-in the control devices.

3. May 1, 1982 - Begin on-site construction and installation of control devices.

November 1, 1984 - Begin on-site construction of ductwork fans, etc., necessary to tie-in control devices.

4. November 1, 1983 - Complete construction and installation of control devices.

July 1, 1985 - Complete construction and installation of ductwork, fans, etc., and tie-in of control devices for Boilers 3 and 4.

October 1, 1985 - Complete start-up of Boilers 3 and 4.

5. December 1, 1985 - Perform stack tests and submit stack test reports and visible emission evaluations as proof that final compliance has been achieved for Units 3 and 4 with the particulate emission limits of 0.17 lbs. per million BTU heat input and 20% opacity. Copies of coal analysis data for the coal fired during each test shall be included. Coal analysis data should include, at a minimum, percent ash, percent sulfur, percent moisture, and BTU's per pound on an as-fired basis.

REMARKS

1. Completion of full design shall include obtaining all required air quality permits.

2. All progress and test reports, as required by this Agreement, shall be submitted to:

U. S. Environmental Protection Agency
Region IV
345 Courtland Street, N. E.
Atlanta, Georgia 30365

ATTN: Arthur G. Linton, Federal Activities Coordinator

Copy to: James T. Wilburn, Acting Chief
Air & RCRA Compliance Branch, EPA (Address Above)

Copy to: Harold E. Hodges, P.E., Director
Tennessee Department of Public Health
Division of Air Pollution Control
Terra Building
150 Ninth Avenue North
Nashville, Tennessee 37203

3. Department of Energy shall utilize Boilers 1 and 2 to the maximum extent possible once the control equipment is in place on these units (July 1984), in order to minimize emissions from the total facility in the interim period prior to achieving full compliance.

4. All compliance testing shall be conducted in accordance with established EPA test Reference Methods 1-5 and 9 as specified in 40 CFR Part 60, Appendix A.

5. Visible emissions evaluations shall be performed concurrently with all mass particulate compliance testing. Visible emission evaluations shall be performed by State or EPA certified smoke reader(s) in accordance with EPA test Reference Method 9, 40 CFR Part 60, Appendix A (1981) and submitted with the corresponding test reports.

6. Quarterly reporting, as addressed in Section 12 of this agreement shall include the submission of all available coal analysis data for coal received during that quarter. It is not necessary to submit a copy of the individual coal analysis data sheets for each shipment received. Summary type sheets, similar to those enclosed in the December 11, 1979, letter from J. F. Wing to A. G. Linton are acceptable providing they indicate, at a minimum, the percent ash, percent sulfur, percent moisture and BTU per pound of the fuel on an "as received" basis.

7. Department of Energy shall conduct a pre-test conference with appropriate EPA and/or Tennessee Division of Air Pollution Control (TDAPC) personnel in attendance at least 45 days prior to testing. The purpose of the conference will be to assure that the sampling procedures to be followed are appropriate and in conformance with the methods specified in 40 CFR Part 60. EPA and TDAPC must be given at least ten (10) working days advance notice of the scheduled conference.

8. Department of Energy shall notify EPA and the TDAPC in writing of the planned date or dates for compliance testing at least twenty (20) working days prior to such testing, to afford the agencies an opportunity to have representatives present to observe the testing to assure that it is done in accordance with established EPA test reference methods.

APPENDIX D.2
TENNESSEE DEPARTMENT OF HEALTH AND ENVIRONMENT
NOTICE OF COMPLAINT
Y-12 STEAM PLANT

STATE OF TENNESSEE
DEPARTMENT OF HEALTH AND ENVIRONMENT

IN THE MATTER OF:)
)
U. S. DEPARTMENT OF ENERGY) DIVISION OF AIR
OAK RIDGE, TENNESSEE,) POLLUTION CONTROL
) NO. 83-415
)
RESPONDENT)

NOTICE OF COMPLAINT

Comes now, Harold E. Hodges, Technical Secretary of the Air Pollution Control Board, and states that:

PARTIES

I.

Harold E. Hodges, Technical Secretary of the Air Pollution Control Board, pursuant to T.C.A. Section 68-25-107, has the authority to issue a formal Notice of Complaint and prosecute such complaints before the Board.

II.

The U. S. Department of Energy (DOE) is an agency of the United States government. The Secretary of Energy is Donald Hodel. Joe La Grone is the Manager of Oak Ridge Operations, DOE, P. O. Box E, Oak Ridge, Tennessee 37831.

JURISDICTION

III.

DOE is subject to comply with the Tennessee Air Quality Act as part of a federally approved State Implementation Plan. DOE is a "person" as defined at T.C.A. Section 68-25-102(7).

FACTS

IV.

DOE owns and operates a weapons production facility known as the Y-12 Plant near Oak Ridge in Anderson County, Tennessee. As part of the production process, coal is burned in boilers to produce process steam and space heating.

V.

There are four coal-fired boilers at the Y-12 Plant. Each of these boilers have particulate emission control devices utilizing electrostatic precipitators that were installed in 1966. These electrostatic precipitators were designed for medium collection efficiency. Since their installation, their performance has deteriorated.

VI.

Division of Air Pollution Control inspections in the past have proved noncompliance with the general visible emissions standard specified in Division Rule 1200-3-5-.01(1). The in-stack opacity monitors located on the boiler stacks have documented continued noncompliance with Division Rule 1200-3-5-.01(1) from April 1, 1980 to December 31, 1981, and continued noncompliance with Division Rule 1200-3-5-.10 from January 1, 1982 to date.

VII.

Source testing by the facility proved noncompliance with the non-process mass emissions standard, specified in Division Rule 1200-3-6-.02(1) on March 31, 1978, April 1, 2, 3, 5, 6, 7 and 8, 1978 and noncompliance with the non-process sulfur dioxide mass emissions standard specified in Division Rule 1200-3-14-.02(1) on April 1, 3, 4 and 8, 1978.

VIII.

DOE is also in violation of Division Rule 1200-3-9-.02 for operating an air contaminant source without an operating permit from the Division of Air Pollution Control from June 1, 1980 to the present.

IX.

DOE has begun utilizing a better grade of coal and has demonstrated interim compliance with the sulfur dioxide standard through fuel analysis computations.

VIOLATIONS

X.

DOE has violated the following Division Rules:

- a. 1200-3-5-.01(1) General Emission Standards from April 1, 1980 to December 31, 1981.
- b. 1200-3-5-.10 General Standards for Visible Emissions from January 1, 1982 to the Present.
- c. 1200-3-6-.02(1) Non-process Mass Emissions Standards on March 31, 1978, April 1, 2, 3, 5, 6, 7 and 8, 1978.
- d. 1200-3-9-.02 Operating an Air Contaminant Source Without an Operating Permit from June 1, 1980 to the present.
- e. 1200-3-14-.02(1) Non-process Sulfur Dioxide Mass Emissions Standards on April 1, 3, 4 and 8, 1978.

ORDER

XI.

WHEREFORE, PREMISES CONSIDERED, it is ORDERED by the Technical Secretary and AGREED by DOE that the following COMPLIANCE SCHEDULE shall be adhered to by the parties:

A. For Boilers 1 and 2, DOE shall, on or before:

- 1. July 1, 1984 - Complete construction and installation of ductwork,

fans, and related equipment, and tie-in of control devices for Boilers 1 and 2.

2. October 1, 1984 - Complete start-up of Boilers 1 and 2.
3. December 1, 1984 - Perform stack tests for both particulates and sulfur dioxide and submit stack test reports and visible emission evaluations as proof that final compliance has been achieved for Boilers 1 and 2 with the particulate emission limits of 0.17 lbs. per million BTU heat input, the visible emissions standard of 20% opacity and the sulfur dioxide emission limit of 4.0 lbs. per million BTU heat input. Copies of coal analysis data for the coal fired during each test shall be included. Coal analysis data should include, at a minimum, percent ash, percent sulfur, percent moisture, and BTU's per pound on an as-fired basis.
4. Prior to the conducting of the stack tests a repeat of the opacity monitor performance specification test shall be conducted and a performance test report submitted for the opacity monitor serving Boilers 1 and 2. This opacity monitor shall be fully operational and data from it shall be recorded during the particulate source testing of Boilers 1 and 2. This data shall be a part of the stack test report.

B. For Boilers 3 and 4, DOE shall, on or before:

1. November 1, 1983 - Complete construction and installation of emission control devices.
2. November 1, 1984 - Begin on-site construction of ductwork, fans, and related equipment, necessary to tie-in emission control devices.
3. July 1, 1985 - Complete construction and installation of ductwork, fans, and related equipment, and tie-in of emission control devices for Boilers 3 and 4.
4. October 1, 1985 - Complete start-up of Boilers 3 and 4.

5. December 1, 1985 - Perform stack tests for both particulates and sulfur dioxide and visible emission evaluations as proof that final compliance has been achieved for Boilers 3 and 4 with the particulate emission limits of 0.17 lbs. per million BTU heat input, the visible emission standard of 20% opacity and the sulfur dioxide emission limit of 4.0 lbs. per million BTU heat input. Copies of coal analysis data for the coal fired during each test shall be included. Coal analysis data should include, at a minimum, percent ash, percent sulfur, percent moisture, and BTU's per pound on an as-fired basis.
6. Prior to the conducting of the stack tests a repeat of the opacity monitor performance specification test shall be conducted and a performance test report submitted for the opacity monitor serving Boilers 3 and 4. This opacity monitor shall be fully operational and data from it shall be recorded during the particulate source testing of Boilers 3 and 4. This data shall be part of the stack test report.

C. General Provisions:

1. DOE shall utilize Boilers 1 and 2 to the maximum extent possible once the control equipment is in place on these units (July 1984), in order to minimize total facility emissions in the interim period.
2. All source performance tests, monitoring data, notices, copies of purchase orders and executed contracts, and other items required to be submitted by this Order shall be mailed to Harold E. Hodges, Technical Secretary, Tennessee Air Pollution Control Board, TERRA Building, 150 - 9th Avenue, North, Nashville, Tennessee 37203.
3. Within ten (10) days after the completion of each increment of progress specified in Paragraph X, DOE shall notify the Technical Secretary, in writing, whether the increment of progress was achieved. If an increment of progress is not met by the required date, DOE shall explain, in writing, why the increment was not

accomplished and indicate when the increment will be achieved. Notice to the Technical Secretary of such delays shall not be construed as indicating his approval of the delay.

4. DOE shall provide the Technical Secretary with twenty (20) days advance notice of the performance of any test required by the schedule of compliance in Paragraph X. This requirement is to afford the Technical Secretary an opportunity to evaluate the test procedure and to have an observer present during such testing.
5. This ORDER does not affect in any way the responsibility of DOE to comply with all other applicable federal, state and local regulations.

D. The Technical Secretary may initiate the assessment of CIVIL PENALTIES against DOE before the Tennessee Air Pollution Control Board for the failure of DOE to adhere to the foregoing COMPLIANCE SCHEDULE or for other violations of the Act pursuant to his authority.

ISSUED this 12TH day of July, 1984.

Harold E. Hodges
Technical Secretary
Tennessee Air Pollution Control Board

NOTICE OF RIGHTS

Respondent is hereby advised that in accordance with T.C.A. Section 68-25-108(a)(2) and 4-5-301 et seq., it may seek review of this Notice of Complaint by filing an answer to the charges set out herein within thirty (30) days of the date of this Notice. Respondent may be represented by counsel, make argument, offer testimony or cross-examine witnesses. Any hearing for review of this Notice of Complaint shall be conducted before the Tennessee Air Pollution Control Board in accordance with the Tennessee Administrative Procedures Act at T.C.A. Section 4-5-301 et seq.

All correspondence pertaining to this matter should be addressed to Mary E. Johnston, Assistant General Counsel, TERRA Building, 150 Ninth Avenue North, Nashville, Tennessee 37203, Phone (615) 741-4177.

Mary E. Johnston
Assistant General Counsel

MEJ/bjs Legal 6/Poll/Ridge

PRELIMINARY

**APPENDIX D.3.
MEMORANDUM OF UNDERSTANDING
AMONG
DOE, EPA, TDHE
FOR THE
Y-12 PLANT**

MEMORANDUM OF UNDERSTANDING
BETWEEN THE
U.S. DEPARTMENT OF ENERGY
AND THE
U.S. ENVIRONMENTAL PROTECTION AGENCY AND
STATE OF TENNESSEE DEPARTMENT OF HEALTH AND ENVIRONMENT
CONCERNING COMPLIANCE WITH POLLUTION CONTROL
STANDARDS AT THE DEPARTMENT OF ENERGY Y-12
PLANT, ANDERSON AND ROANE COUNTIES, TENNESSEE

This Memorandum of Understanding (MOU) is intended to clarify the compliance objectives agreed upon by the parties during a meeting held in Atlanta on April 8, 1983. Analysis of information received from the Department of Energy (DOE) along with information gathered as a result of a February 23, 1983, Compliance Evaluation Inspection by the Tennessee Department of Health and Environment (TDHE) revealing serious environmental problems associated with past and present waste disposal practices at the Department of Energy (DOE) Y-12 facility, necessitate that expeditious and thorough investigative and remedial measures be taken. To this end, this MOU provides the actions agreed upon by the parties as constituting preliminary measures toward DOE achieving full compliance with all federal and state pollution control laws at its Y-12 facility. It is understood and agreed to by the parties that this MOU serves as a work plan for obtaining information, from which it is anticipated, further plans, actions and remedial programs will be developed. The plans, actions and remedial programs encompassed by this MOU shall be implemented in accordance with applicable regulatory requirements.

It is further understood and agreed that the compliance measures to be taken at Y-12 include but are in no way limited to those outlined herein. Furthermore, no party to this MOU in any way waives its rights to any other action or remedy available to it by law, nor is precluded from taking or requiring additional action with respect to environmental problems presently known to exist, or which may later be found to exist at this facility, nor shall the MOU constitute an admission of liability or a waiver of any defense.

To carry out the intent of this MOU the parties agree to take action with respect to each of the areas of the Y-12 facility, as those areas are further described in the March 8, 1983, TDHE Notice of Noncompliance with which all parties hereto are familiar.

1. Upper East Fork of Poplar Creek (EFPC) - also known as the "Industrial ditch"

1. DOE agrees to submit to TDHE and to the Environmental Protection Agency (EPA), on or before May 31, 1983, a preliminary report containing the following information:
 - a. A map showing all Y-12 discharges to upper EFPC;
 - b. The effluent description of all Y-12 discharges to upper EFPC, including process description and flow quantification (process and cooling water); and
 - c. Interim treatment/control measures - including treatment and/or elimination (provide plans and specifications as necessary as well as schedule for same).
2. DOE agrees to submit to EPA and TDHE an assessment of coal storage and steam plant management plans to include water quality impacts on or by July 29, 1983.
3. TDHE and EPA agree to review the preliminary report and meet on site to determine further needs and to submit comments to DOE on or before July 1, 1983.

4. DOE agrees to submit a final report on/or before September 15, 1983, verifying the information described in 1.a. and b. above and designating the discharge points to be eliminated. A progress meeting will be held on or before September 15, 1983, to discuss waste water characterizations.
5. DOE agrees to provide to EPA and TDHE a final detailed waste water characterization by November 15, 1983.
6. DOE agrees to submit plans and specifications for all proposed interim treatment or control measures on or before December 15, 1983.
7. DOE agrees to submit all permit applications for the remaining discharges to EFPC on/or before December 15, 1983.

II. Pollutants Discharged from New Hope Pond (NHP)

1. DOE agrees to immediately take steps as outlined below to eliminate NHP as an NPDES discharge point.
2. DOE agrees to submit a report to EPA and TDHE on/or before July 1, 1983, containing:
 - a. characterization of sediments in NHP;
 - b. assessment of active sources of mercury contamination;
 - c. plans and specifications for the NHP by-pass and its use for spill prevention and control; and

- d. plans and specifications for cleaning out NHP.

III. New Hope Sludge Disposal Area

1. DOE agrees to submit to EPA and TDHE on/or before July 29, 1983, results of leachability tests.
2. DOE agrees to submit a report, on/or before August 31, 1983, evaluating site suitability and management practices.

IV. S-3 Ponds

The defined objective of the MOU is to cease all waste contributions to the S-3 ponds, and to eliminate the S-3 ponds as sources of contamination to surface and groundwater.

1. Elimination of waste contributions to S-3 ponds

On or before July 1, 1983, DOE agrees to submit to EPA and TDHE a proposal to cease all discharge of waste to the S-3 ponds. The proposal will include source description, waste stream characterization including chemical and radiological parameters, and volume/frequency of discharge. This proposal will include a management strategy for treatment elimination and/or containment of all waste currently entering the S-3 ponds with an implementation schedule for each descriptive category. Where appropriate, waste contribution elimination proposals will be implemented in an expedient manner.

2. Close out of S-3 ponds.

- a. DOE agrees to perform a definitive characterization of the S-3 ponds to be completed on or before July 15, 1983.
 - b. On or before September 1, 1983, DOE agrees to submit a closeout proposal to include plans and specifications and implementation schedule.
3. Upon elimination of the S-3 ponds as a source of contamination to surface waters, DOE agrees to submit a plan and schedule for rehabilitation of Upper Bear Creek.
4. DOE shall establish on/or before July 1, 1983, a monitoring point at the discharge from the S-3 Ponds and establish the parameters to be monitored.

V. Burial Ground Oil Pond

1. DOE agrees to submit to EPA and TDHE on/or before November 1, 1983, a report to characterize wastewaters discharged from the pond and submission of NPDES application for the discharge.
2. DOE agrees to submit to EPA and TDHE on/or before January 31, 1984, a report to include:
 - a. An inventory of waste deposited in the pond watershed;

- c. Submit an evaluation of alternative actions at this site, including establishment of an NPDES discharge point or ultimate cleanup and closure.
2. DOE agrees that, in the event it selects the alternative of establishing an NPDES discharge point under 1.c. above, it will submit, on or before December 31, 1983, an NPDES permit application for this site.
3. DOE agrees to submit to EPA and TDHE, on or before January 31, 1984, a report that will include an inventory of material deposited in this area and an inventory of existing contamination.

IX. Contamination of East Fork Poplar Creek and Bear Creek

1. EPA, DOE and TDHE agree to establish and organize a Task Force to include representatives of TDHE, (with the Division of Water Management, TDHE, as lead), TVA, EPA, and DOE for the purpose of studying contamination and formulating a remedial plan if it is determined by EPA, DOE and TDHE that one is necessary. The roles and responsibilities of the task force members will be determined and agreed upon by the parties on/or before July 1, 1983.
2. The contamination study will include but not be limited to the following items:
 - a. Definitive sediment and fishery study for Bear Creek and EFPC;
 - b. Assessment and inventory of flood plain contamination;
 - c. Multiparameter Pu, Hg, Pb, U, Th, Be, PCB Sediment Transport Study;

- d. Ambient air sampling for Hg;
- e. Assessment and management plan regarding urban development disturbance areas adjacent to EFPC and Bear Creek including:
 - i. Distribution of dredge material for home landscaping, fill material and gardening.
 - ii. List of commercial developers, including Corps §404 permittees; and
- f. Public notification.

X. Groundwater Study for Y-12 Facility

- 1. On or before May 31, 1983, DOE, through its operating contractor, will award a contract to investigate the hydrologic characteristics of the Bear Creek Valley disposal areas (isolation area, disposal pits, oil pond and trenches and oil landform), the S-3 Ponds and the New Hope Pond sludge disposal basin. The purpose of the study is to evaluate the groundwater flow, monitoring data and the adequacy of the existing Y-12 groundwater monitoring program. It is expected that the results of this investigation will provide information to assess site conditions, determine if significant contamination to the groundwater has resulted from operations and assess the need and feasibility of corrective measures. If the contractor evaluates DOE's monitoring well network as being inadequate to fulfill the requirements of 40 CFR 264, 265 and 122.25, the contractor will recommend locations for additional wells and provide sketches and criteria for installation of the wells.

2. On or before June 30, 1983, DOE will submit to TDHE and EPA the contractor's plan of study.
3. EPA and TDHE will submit comments on the plan of study by July 15, 1983.
4. On or before December 31, 1983, DOE shall submit to TDHE and EPA the final groundwater study report.

XI. Master Monitoring Plan for Y-12

DOE agrees that, on or before July 31, 1983, it will submit to TDHE and EPA a master monitoring plan for groundwaters and surface waters of the entire Y-12 facility, indicating all present sampling locations and all parameters analyzed.

In the process of characterizing existing wastewaters, wastewater discharges, sediment and sludges of the areas mentioned, DOE will include sufficient analyses to determine whether or not such wastewaters discharged to, or sludges and wastewaters contained in, the areas are hazardous wastes as defined in EPA regulations at 40 C.F.R. Part 261. For those areas which are determined to contain hazardous wastes and which are to be closed, the plan for closure will incorporate the technical requirements for closure contained in Subparts G, K, L, M and N of 40 C.F.R. 264 and 40 C.F.R. 265, as appropriate.

The parties agree that all information required to be submitted by this MOU, and any other correspondence with respect to this MOU, is required to be given in writing, and mailed to each party as follows:

Mr. Howard D. Zeller
Assistant Regional Administrator
for Policy and Management
U.S. Environmental Protection Agency
345 Courtland Street, N.E.
Atlanta, Georgia 30363

Dr. Michael T. Bruner
Assistant Commissioner
Tennessee Department of Health and Environment
T.E.R.R.A. Building
2nd Floor
150 Ninth Avenue, North
Nashville, Tennessee 37203

Mr. Joe La Grone
Manager, Oak Ridge Operations
U.S. Department of Energy
P.O. Box E
Oak Ridge, Tennessee 37830

Howard D. Zeller
U.S. Environmental Protection Agency

May 26, 1983
Date

Joe La Grone
U.S. Department of Energy

May 26, 1983
Date

Michael T. Bruner
Tennessee Department of Health and Environment

May 26, 1983
Date

ADM/kev D/3

PRELIMINARY

**APPENDIX D.4
COMPLAINT AND ORDER
EFPC**

RESPONDENT

COMPLAINT AND ORDER

Cum now James E. Word, Commissioner of the Tennessee Department of Health and Environment, and states that:

The U.S. Department of Energy ("DOE") is an agency of the U.S. Government. The Secretary of Energy is Donald Hodel, U.S. Department of Energy, Washington, D.C. 20585. Joe Le Grone is the Manager of Oak Ridge Operations, U.S. Department of Energy, P.O. Box E, Oak Ridge, TN 37831.

I.

Pursuant to T.C.A. 569-3-107, the Commissioner has the authority to exercise general supervision and control over the quality of all State waters and enforce laws relating to pollution of these waters. Also, pursuant to T.C.A. 569-3-109, the Commissioner may cause a written complaint to be served upon the "person" believed to be in violation of the Tennessee Water Quality Control Act of 1977 (the "Act"), T.C.A. 569-3-101 et seq. The Complaint may direct that necessary corrective action be taken within the time prescribed in the Order.

III.

Pursuant to T.C.A. §89-3-115, the Commissioner may initiate proceedings for assessment of civil penalties by the Water Quality Control Board. The Commissioner reserves the right to initiate such proceedings against the Respondent at a later date.

IV.

The Respondent is a "person" as defined at T.C.A. 569-3-103(19), and subject to regulation under the Act. Respondent has violated and remain in violation of the Act and regulations issued thereunder.

V.

The DOE owns a facility in Anderson County, Tennessee known as the Y-12 Plant. As part of the plant's materials production, it performs substantial metal working (including plating, coating and precision machinery), metallurgical and chemical processing, and similar activities.

VI.

On or about February 23, 1983, officials of the Division of Water Quality Control (the "Division") conducted a Compliance Evaluation Inspection of the Y-12 Plant's past and present waste disposal practices. As a result of this information and subsequent discussions, a document entitled "Memorandum of Understanding between the U.S. Department of Energy and the U.S. Environmental Protection Agency and State of Tennessee Department of Health and Environment Concerning Compliance with Pollution Control Standards at the Department of Energy Y-12 Plant, Anderson and Roane Counties, Tennessee" (the "M.O.U.") was entered into on May 26, 1983. One purpose of the M.O.U. was to establish "preliminary measures toward DOE achieving full compliance with all federal and state pollution control laws at its Y-12 facility." Information provided as a result of the M.O.U. has necessitated the establishment of more definite deadlines for pollution abatement and investigation, and has revealed several additional environmental problems which must be addressed.

VII.

The Upper East Fork of Poplar Creek (hereinafter referred to as "UEFPC" or the "Creek") constitutes waters of the State within the meaning of T.C.A. 569-3-103(29). Near UEFPC's origin on Chestnut Ridge, the Respondent maintains a coal pile, the runoff from which adversely affects the Creek.

VIII.

As the Creek flows through the Y-12 plant some eighty (80) or more pipes discharge waste containing elevated levels of mercury, polychlorinated biphenyls (PCB's) and other pollutants into the Creek. Further, an unknown number of other discharge points contain these or other pollutants. None of these discharges has appropriate discharge permits, nor is there adequate treatment prior to discharge.

IX.

The discharge of wastes, except under conditions of a permit, into the waters of the State is a violation of T.C.A. § 69-3-108(b)(6). These unpermitted discharges alter the physical, chemical, biological and/or bacteriological properties of the waters of the State in violation of T.C.A. § 69-3-108(b)(1).

X.

The discharges of the above-mentioned substances are also causing pollution in violation of T.C.A. § 69-3-114. The UEFP, immediately downstream from these discharges, is devoid of aquatic life. These discharges have caused harm to fish by accumulation of toxic materials in the fish, will likely result in harm to the health of animals, fish and aquatic life, and will likely render the waters substantially less useful for domestic, municipal, agricultural, recreational or other reasonable uses. Such discharges which cause pollution are considered a public nuisance in violation of T.C.A. § 69-3-114.

XI.

Certain water quality uses have been established for the waters of the State by the Water Quality Control Board (the "Board") pursuant to T.C.A. § 69-3-105 and Division Rule 1200-4-4. The Board has established standards for UEFP to protect these uses found in Division Rule 1200-4-4.01, which include: recreation; fish and aquatic life; irrigation; livestock watering and wildlife. The discharges into UEFP have violated these standards for all four (4) uses.

XII.

The above-described discharges into the UEFPD flow into New Hope Pond, which is heavily sedimented with elevated levels of mercury and PCB. Respondent has periodically dredged and placed the sediment in the New Hope Sludge Disposal Area — an unapproved site from which the sediment has entered the groundwater. According to T.C.A. §69-3-114, it is "unlawful to place or cause any substance to be placed in any location where such substances, either by themselves or in combination with others, cause any damages as defined in T.C.A. §69-3-103(21). . ." No precautions were taken to prevent these substances from moving into the groundwater, which is waters of the State. These substances will likely result in potential harm or detriment to the public health, safety, or welfare and to the health of animals, fish and aquatic life in violation of T.C.A. §69-3-114 and this practice is, therefore, a public nuisance.

RELIEF

THEREFORE, pursuant to the authority vested by T.C.A. §69-3-109, I, James E. Ward, Commissioner of the Tennessee Department of Health and Environment, hereby ORDER the U.S. Department of Energy to take certain action as described below. The Respondent does not admit to the allegations of this Complaint, but agrees to the Relief as ORDERED below, as evidenced by its signature below:

1. That DOE shall submit to TDHE a preliminary report by September 15, 1983 which shall include a complete map of all discharge pipes from Y-12 into UEFPD; an effluent description of said discharges, defined as process source description and flow estimates for all cooling waters and process waters and a preliminary determination of which discharge points will be eliminated from further use. That a final report including the information described above shall be provided as soon as it is reasonably practical.
2. a) DOE shall provide to TDHE an effluent sampling proposal including analytical parameters for the steam plant, laundry, and cooling towers by October 1, 1983.

- b) DOE shall submit an NPDES permit application for these same effluents by December 15, 1983.
3. a) DOE shall submit to TDHE by October 1, 1983 an implementation schedule to include dates for submission of a sampling proposal and NPDES applications for area source and process source discharges. It is anticipated by the parties that NPDES permits for these area and process sources shall be applied for by February 15, 1984, unless otherwise agreed upon, in writing, by TDHE.
- b) That any remaining process or area source discharges for which NPDES permits are not applied for shall cease.
4. a) That DOE shall submit to TDHE proposals and implementation schedules for interim management of process waste streams, including the laundry, steam plant and cooling towers, by December 15, 1983.
- b) That DOE shall submit to TDHE proposals and implementation schedules for interim management of area sources by February 15, 1984.
5. a) That DOE shall submit to TDHE a report on the New Hope Sludge Disposal area, including a characterization of waste deposited, a site suitability evaluation and management practices by August 31, 1983.
- b) That DOE shall submit to TDHE by September 15, 1983 a preliminary report on the UNC disposal site including a characterization of all waste, site suitability evaluation, and management practices. That a final report shall be submitted to TDHE by January 1, 1984.

- c) That DOE shall submit to TDHE by October 3, 1983 a report on the unclassified material in the Classified Burial Ground, located on Chesnut Ridge, including a characterization of all waste and an implementation plan for submittal of a site suitability evaluation and management practices. That access to information on the classified material in said Burial Ground shall be freely given at the DOE facility to such TDHE employees who have proper security clearance as required by DOE.
- d) That DOE shall submit to TDHE by May 1, 1984 a characterization of waste in all other classified disposal sites in the UETPC watershed area.
6. That TDHE has the exclusive right to determine whether information provided to TDHE pursuant to paragraphs 1-5 of this Order satisfies the requirements of this Order.

Issued by the Commissioner of the Tennessee Department of Health and Environment this the 15th day of September, 1983.

JAMES E. WORD, Commissioner
Tennessee Department of Health and Environment

D. ELMO LUNN, Director
Division of Water Quality Control

Relief agreed to by the U. S. Department of Energy this 15th day of

September, 1983.

UNITED STATES OF AMERICA
BY: DEPARTMENT OF ENERGY

Joe La Grone, Manager
Oak Ridge Operations by

William R. Hill
Acting Assistant Manager
Safety and Environment

Correspondence regarding this document should be sent to:
Mary E. Johnston, Assistant General Counsel, Tennessee Department of Health and
Environment, Cordell Hull Building, Nashville, Tennessee 37219.

Mary E. Johnston
Assistant General Counsel

NOTICE OF RIGHTS

The U.S. Department of Energy is hereby advised that in accordance with
T.C.A. § 49-3-109 and -110 and T.C.A. § 4-5-307, it may appeal this ORDER by
filing an appropriate Petition with the Commissioner. The Petition, however, must
be filed no later than thirty (30) days from service of this ORDER or it shall
become final and not subject to review (T.C.A. § 49-3-109 and -116). That said
Petition for Review shall be heard by the Board of Water Quality Control.

Further, the Respondent has the right to be represented by counsel, to
submit responsive pleadings, to subpoena witnesses on its behalf and to present
evidence and argument on all issues involved.

MEJ/jeb H-19

**APPENDIX D.5
COMPLAINT AND ORDER
BEAR CREEK VALLEY
AND AMENDMENT**

STATE OF TENNESSEE
DEPARTMENT OF HEALTH AND ENVIRONMENT

IN THE MATTER OF

U.S. DEPARTMENT OF ENERGY

DIVISION OF WATER
QUALITY CONTROL
NO. 83-728

RESPONDENT

COMPLAINT AND ORDER

Comes now James E. Ward, Commissioner of the Tennessee Department of Health and Environment, and states that:

PARTIES

I.

The U.S. Department of Energy (DOE) is an agency of the U.S. Government. The Secretary of Energy is Donald Hodel, U.S. Department of Energy, Washington, D.C. 20585. Joe La Grone is the Manager of Oak Ridge Operations, U.S. Department of Energy, P.O. Box E, Oak Ridge, TN 37931.

JURISDICTION

II.

Pursuant to T.C.A. Section 69-3-107, the Commissioner has the authority to exercise general supervision and control over the quality of all State waters and enforce laws relating to pollution of these waters. Also, pursuant to T.C.A. Section 69-3-109, the Commissioner may cause a written complaint to be served upon the "person" believed to be in violation of the Tennessee Water Quality Control Act of 1977 (the "Act"), T.C.A. Section 69-3-101 et. seq. The Complaint may direct that necessary corrective action be taken within the time prescribed in the Order.

III.

Pursuant to T.C.A. Section 69-3-115, the Commissioner may initiate proceedings for assessment of civil penalties by the Water Quality Control Board. The Commissioner reserves the right to initiate such proceedings against the Respondent at a later date.

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The Respondent is a "person" as defined at T.C.A. Section 69-3-103(19), and subject to regulation under the Act. Respondent has violated and remains in violation of the Act and regulations issued thereunder.

PAGE

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S-3 PONDS

VII.

The Bear Creek (hereinafter referred to as "Creek") constitutes waters of the State within the meaning of T.C.A. Section 69-3-103(29). The Creek flows through

the area owned by Respondent. Near the headwaters of the Creek, the Respondent has constructed and maintains four (4) diked holding ponds known as the "S-3" ponds. Various wastes are disposed of in these ponds, including slurry slurries and solutions, nitric and hydrochloric acids, stripping and cleaning solvents, uranium, cerium, thorium, halogenated solvents and non-halogenated solvents. Some of these wastes are disposed of in the ponds without the benefit of any treatment to remove or reduce the levels of these contaminants. The ponds are unlined and purposely designed to leak and/or evaporate. Significant amounts of leachate flows into the Bear Creek from these ponds.

VIII.

Respondent has never applied for or been granted a NPDES or other discharge permit for the S-3 ponds. The leakage from the ponds is a "discharge of a pollutant" as defined as T.C.A. Section 69-3-103(9). The discharge of wastes, except under conditions of a permit, into the waters of the State is a violation of T.C.A. Section 69-3-103(6). These unpermitted discharges alter the physical, chemical, biological, and/or bacteriological properties of the waters of the State in violation of T.C.A. Section 69-3-103(1).

IX.

The discharge of contaminated wastes from the S-3 ponds is causing pollution in violation of T.C.A. Section 69-3-11(a). The discharges will likely result in harm, potential harm or detriment of the public health, safety or welfare and to the health of animals, birds, fish or aquatic life. Such discharges which cause pollution are declared to be a public nuisance.

BURIAL GROUND OIL POND

X.

Respondent has constructed and maintains a small pond near the Anderson-Russell County line known as the Burial Ground Oil Pond. This pond was created by damming a small tributary of the Bear Creek. This tributary constitutes waters of the State within the meaning of T.C.A. Section 69-3-103(29). The Oil Pond has a continuous point source discharge into the Bear Creek.

XI.

Respondent has disposed of solid and liquid wastes in the area of the tributary and the Bear Creek watershed. Some of the solid and liquid wastes are contaminated with polychlorinated biphenyls (PCB's) and other unknown contaminants, and have leached from the ground into the Oil Pond. These contaminants in the Oil Pond flow into a pipe and then to the Creek.

XII.

Respondent has never applied for or been granted an NPDES or other discharge permit for the continuous point source discharge from the Oil Pond into the Creek. This discharge is a "discharge of a pollutant" as defined at T.C.A. Section 69-3-103(9). The discharge of wastes, except under conditions of a permit, into the waters of the State is a violation of T.C.A. Section 69-3-103(b)(6). These unauthorized discharges alter the physical, chemical, biological, and/or bacteriological properties of the waters of the State in violation of T.C.A. Section 69-3-103(b)(1).

XIII.

By placing liquid and solid wastes, contaminated with hazardous, toxic or other substances, in or on the ground in the watershed of the Creek without a valid permit, Respondent has violated T.C.A. Section 69-3-103(b)(6). This section states that the discharge of sewage, industrial wastes or other wastes into waters, or a location from which it is likely that the discharged substance will move into waters is unlawful without a valid permit.

XIV.

The discharge of contaminated wastes from the Oil Pond is causing pollution in violation of T.C.A. Section 69-3-11(a). The discharges will likely result in harm, potential harm or detriment of the public health, safety or welfare and to the health of animals, birds, fish or aquatic life. Such discharges which cause pollution are declared to be a public nuisance.

XV.

Respondent has dammed a tributary of the Creek to create the Oil Pond which functions as a pollution treatment unit. This construction, without a valid permit, has resulted in the alteration of the physical, chemical, radiological, biological or bacteriological properties of waters of the state, a violation of T.C.A. Section 69-3-103(b)(1). Respondent's conduct also violates T.C.A. Section 69-3-103(b)(2), which prohibits the construction, installation, modification or operation of a wastewater treatment works without a permit.

XVI.

Respondent has constructed trenches in the watershed area of Bear Creek. These trenches are known as the Serial Ground Disposal Pits. Respondent has disposed of various solid wastes including clothing, air conditioning filters, metal strips, shoe covers, cardboard boxes and other general industrial waste in these trenches. The wastes are contaminated with uranium and/or other radioactive material. Groundwater, which is waters of the State within the meaning of T.C.A. Section 69-3-103(29), flows into the disposal trenches. Respondent continues to dispose of these wastes in this manner. No precautions have been taken to prevent the flow of pollutants into the groundwater.

XVII.

By placing contaminated waste in a location from which the substance has and likely will continue to move into the waters of the State, without a valid permit, Respondent has violated T.C.A. Section 69-3-103(b)(6). This conduct has also violated T.C.A. Section 69-3-103(b)(1) because pollutants have been allowed to flow into the waters of the State and altered the physical, chemical, radiological, biological or bacteriological properties of these waters.

OIL FARM, ISOLATION AREA AND STAND PIPE AREA

XVIII.

Respondent has also deposited PCB - contaminated oil and other waste in or on the ground in at least three (3) locations near Bear Creek - The Oil Farm, Isolation

Area and the Stand Pipe Area - from which the PCB's have leached into the ground water and are likely to (if it has not already) move into Bear Creek.

XIX.

By these actions, Respondent has altered, without a permit, the various properties of these waters, placed pollutants in a location from which they have and will likely continue to seep into the waters of the state and causes pollution so as to create a public nuisance, all of which have violated T.C.A. Section 69-3-103(a)(1) and -114, respectively.

XX.

Respondent's conduct of placing contaminated waste near or in the groundwater is a violation of T.C.A. Section 69-3-114(a) because it will likely result in harm, potential harm or detriment of the public health, safety or welfare and to the health of animals, birds, fish or aquatic life. Such conduct, which causes pollution, is declared to be a public nuisance.

XXI.

Certain water quality uses have been established for the waters of the State by the Water Quality Control Board pursuant to T.C.A. Section 69-3-103 and Division Rule 1200-4-4. The Board has established criteria for Bear Creek to protect these uses which are found at Division Rule 1200-4-4.01. The use classifications for Bear Creek include fish, recreation, irrigation, livestock watering and wildlife. The discharges into Bear Creek at the S-3 ponds and the Serial Ground Oil Pond have violated these criteria for all four (4) uses.

RELIEF

THEREFORE, pursuant to the authority vested by T.C.A. Section 69-3-109, I, James E. Ford, Commissioner of the Tennessee Department of Health and Environment, hereby ORDER the U.S. Department of Energy to take certain action as described below. The Respondent does not admit to the allegations of this Complaint, but agrees to the Relief as ORDERED below, as evidenced by its signature below:

1. Within fifteen (15) days of the issuance of the NPDES permit to DOE K-25 facility, DOE shall cease the disposal and/or discharge into the S-3 ponds of all materials (including liquid or solid materials) except for those materials necessary for treatment of the S-3 ponds. It is anticipated by the parties that said NPDES permit will be issued by January 1, 1984. DOE shall eliminate methods of disposal and/or discharge into the S-3 ponds including the sand transfer line and dumping stations to eliminate all access to the S-3 ponds except access necessary for treatment of the ponds.
2. That DOE shall immediately cease further contamination of the groundwater by the disposal of solid wastes in the current Burial Ground Disposal Pits. The State recognizes that DOE has since on or about July 30, 1983 adopted new management practices regarding these sites with the intent to cease further contamination of the groundwater. Such recognition does not constitute approval by the State of these disposal practices. The parties agree that further corrective action or other changes in these disposal practices may be necessary in the future.
3. That DOE shall submit to TDHE a plan and schedule for the rehabilitation of the Bear Creek within thirty (30) days of the effective date of this Order. Rehabilitation shall include the removal of precipitates.
4. That DOE shall submit to TDHE on or before November 1, 1983, a report to characterize wastewaters discharged from the Burial Ground Oil Plant and submit an NPDES permit application for the discharge. The parties agree that this report and permit application have been submitted to TDHE prior to the effective date of this Order.
5. That DOE shall submit to TDHE on or before January 31, 1984 a report to include
 - a. An inventory of waste deposited in the Burial Ground Oil Plant watershed access to any classified information contained in this inventory shall be freely given at the DOE facility to those TDHE employees with proper security clearance as required by DOE.

5. A sediment assessment and inventory of existing contamination together with biological information regarding this area.

6. That DOE shall submit to TDRHE a written proposal, with supporting data and rationale, and schedule for remedial action for the Bear Creek watershed area, including, but not limited to, the Oil Farm Area, Isolation Area, Burial Ground Disposal Pits and Stand Pipe Area, by July 1, 1984. Said remedial action may include the elimination of the source ^{of} PCB and other contaminants from the area.
7. That TDRHE has the exclusive right to determine whether information provided to TDRHE pursuant to paragraphs 4-6 of this Order satisfies the requirements of this Order.

Issued by the Commissioner of the Tennessee Department of Health and Environment this the 1st day of December, 1983.

JAMES E. WOODS, Commissioner
Tennessee Department of Health and Environment

D. ELMO LUNN, Director
Division of Water Quality Control

Relief agreed to by the U.S. Department of Energy this 1st day of December, 1983.

UNITED STATES OF AMERICA
BY: DEPARTMENT OF ENERGY

JOE LA GRONE, Manager
Oak Ridge Operations

Correspondence regarding this document should be sent to: Mary E. Johnston,
Assistant General Counsel, Tennessee Department of Health and Environment, 150
Ninth Avenue, North, T.E.R.R.A. Building, Nashville, Tennessee 37203.

Mary E. Johnston
Assistant General Counsel

NOTICE OF RIGHTS

The U.S. Department of Energy is hereby advised that in accordance with
T.C.A. Section 69-3-109 and -110 and T.C.A. Section 4-5-307, it may appeal this
ORDER by filing an appropriate Petition with the Commissioner. The Petition,
however, must be filed no later than thirty (30) days from service of this ORDER
or it shall become final and not subject to review (T.C.A. Section 69-3-109 and -
116). That said Petition for Review shall be heard by the Board of Water Quality
Control.

Further, the Respondent has the right to be represented by counsel, to submit
responsive pleadings, to subpoena witnesses on its behalf and to present evidence
and argument on all issues involved.

MEJ/bec Legal 2

STATE OF TENNESSEE
DEPARTMENT OF HEALTH AND ENVIRONMENT
CORDELL HULL BUILDING
NASHVILLE, TENNESSEE 37219

JAMES E. WOOD
COMMISSIONER

May 10, 1984

Mr. Joe LaGrone, Manager
Oak Ridge Operations
Post Office Box E
Oak Ridge, Tennessee 37831

Re: Complaint and Order No. 83-223

Dear Mr. LaGrone:

On April 27, 1984, discussions were held between our respective staffs regarding the information required by Paragraph 6 in the Relief section of the above-referenced Order.

These discussions included review of the existing situation and currently available information. We are of the opinion that investigation of the Bear Creek burial ground area needs to be coordinated with other on-going projects and that significant additional information may need to be obtained. Given this concern, it is our understanding that the subject information required will consist of the following:

1. a definitive statement on the existing and potential impact(s) to surface and ground waters from Bear Creek disposal practices (including, but not limited to, the Oil Land Farm Area, Isolation Area, Burial Ground Disposal Pits and Stand Pipe Area, but exclusive of the S-3 ponds) based on currently available information;
2. an assessment of any imminent environmental hazard(s), with a description of possible interim remedial measures, including those already taken;
3. a preliminary assessment of applicable long-term remedial action alternatives, including a preliminary evaluation of technical feasibility and mitigation of any environmental impact(s);
4. identification of additional information needed to effect evaluation of long-term remedial action alternatives; and

Mr. Joe LaGrone, Manager
May 10, 1984
Page Two

5. an implementation schedule for progressing to a final decision with respect to long-term remedial action alternatives, including dates for obtaining additional information needed and for submission of a report, containing appropriate data summaries and supporting rationale, for evaluation of remedial action alternatives in accordance with applicable statutes.

If further discussion of this matter is in order, feel free to contact me or members of my staff.

Sincerely,

JAMES E. WORD
Commissioner

JEW/TKC/dkh 2/3

cc: Mr. N. Wayne Thibault

**APPENDIX D.6
ORDER FOR CORRECTION 1**

STATE OF TENNESSEE
DEPARTMENT OF HEALTH AND ENVIRONMENT

IN THE MATTER OF:
U. S. DEPARTMENT OF ENERGY,
RESPONDENT.

) DIVISION OF SOLID WASTE
) MANAGEMENT
) NO. 84-374-II
)

ORDER FOR CORRECTION

Comes now James E. Word, Commissioner of the Tennessee Department of Health and Environment ("T.D.H.E.") and states that:

PARTIES

I.

James E. Word is the duly appointed Commissioner of T.D.H.E.

II.

The U. S. Department of Energy ("D.O.E.") is an agency of the U. S. Government. The Secretary of Energy is Donald Hodel. Joe LaGreco is the Manager of Oak Ridge Operations, D.O.E., P. O. Box 8, Oak Ridge, Tennessee.

JURISDICTION

III.

Pursuant to T.C.A. Section 68-46-107, the Commissioner has the authority to exercise general supervision over the construction, operation and maintenance of hazardous waste storage facilities, treatment facilities and disposal facilities throughout the state.

Pursuant to T.C.A. 68-46-111, when the Commissioner, upon investigation, finds that any provisions of the Tennessee Hazardous Waste Management Act ("THWMA") are not being carried out, and that effective measures are not being taken to comply with the Act, he may issue an order for correction to the responsible person and this order shall be complied with within the time limit specified in the order.

IV.

D.O.E. is a "person" within the meaning of the Act at T.C.A. 68-46-104(11). D.O.E. is in violation of the provisions of the Act and the regulations promulgated thereunder.

V.

The State of Tennessee and specifically, TDHE and its Division of Solid Waste Management, has been granted interim authorization by the U.S. Environmental Protection Agency ("E.P.A.") to operate Phase I of the hazardous waste program under Subtitle C of the Resource Conservation and Recovery Act ("RCRA"), 42 U.S.C. Section 6901 et seq. Pursuant to this authorization, TDHE has the authority to conduct compliance evaluation inspections of Subtitle C facilities, including federal facilities, and to pursue enforcement against alleged violators.

VI.

Pursuant to Section 6001 of RCRA, federal facilities "shall be subject to, and comply with, all Federal, State, interstate and local requirements, both substantive and procedural (including requirements for permits or reporting or any provisions for injunctive relief and such sanctions as may be imposed by a court to enforce such relief), respecting control and abatement of solid waste or hazardous waste disposed in the same manner, and to the same extent as any person is subject to such requirements, . . ."

VII.

D.O.E. owns a facility in Oak Ridge, Anderson County, Tennessee known as the Y-12 Plant. As part of the plant's weapons materials production, it performs substantial metal parts fabrication and metal plating. These operations generate hazardous wastes including, but not limited to, spent solvents, spent plating bath solutions and treatment sludges containing heavy metals (i.e., mercury), waste acids and caustics, pickling liquors, and cyanides.

FACTS

VIII.

D.O.E. has operated various hazardous waste treatment, storage and disposal facilities at the Y-12 Plant at least since at least November 19, 1980. D.O.E. did not notify the State or E.P.A. of these facilities or apply for interim status for all these facilities (to allow for continued operation of these facilities while the agency considered final permit applications).

IX.

D.O.E. constructed four evaporation/percolation ponds, known as the S-1 ponds, in approximately 1951. These ponds are located near the headwaters of the Bear Creek on the D.O.E. reservation. The ponds are unlined surface impoundments (as defined at Rule 1200-1-11-01(2)(a)) designed to hold liquid hazardous wastes including solvents, plating/pickling wastes, nitric and hydrochloric acids, and halogenated and non-halogenated solvents. The ponds are subject to regulation and standards set out in Rule 1200-1-11-03, Rule 1200-1-11-06, and Rule 1200-1-11-07. The wastes disposed of in these ponds are hazardous wastes. D.O.E. has never requested nor been granted a permit from T.D.H.E. to dispose of hazardous wastes in these surface impoundments.

X.

D.O.E. constructed another surface impoundment known as New Hope Pond located near the Y-12 Plant. New Hope Pond is a surface impoundment as defined by Rule 1200-1-11-01(2)(a) and is subject to regulation and standards set out in Rule 1200-1-11-03, Rule 1200-1-11-06 and Rule 1200-1-11-07. Hazardous wastes containing mercury have been discovered in the sediment of the pond by officials from the Division of Water Quality. Discharges containing other hazardous wastes have flowed directly into New Hope Pond in the past. D.O.E. has never requested nor been granted a permit from T.D.H.E. to dispose of hazardous wastes in this surface impoundment.

XI.

An area known as the Bear Creek Burial Grounds have been used by D.O.E. to dispose of hazardous wastes such as spent halogenated and non-halogenated solvents, plating bath sludges, treated sludges containing cyanides, caustic and acid wastes. This facility is a landfill and regulated by the standards set out in Rule 1200-1-11-03, Rule 1200-1-11-06 and Rule 1200-1-11-07. D.O.E. has never requested nor been granted a permit from T.D.H.E. to dispose of hazardous wastes at this facility.

XII.

An area known as the Oil Land Farm has been used by D.O.E. to dispose of hazardous wastes such as oil containing spent halogenated solvents. This facility is a landfill and regulated by standards set out in Rule 1200-1-11-03, Rule 1200-1-11-

.06 and Rule 1200-1-11-.07. D.O.E. has never requested nor been granted a permit from T.D.H.E. to operate these hazardous waste storage facilities.

VIOLATIONS

XIV.

D.O.E., by its actions, has violated T.C.A. 68-46-103(3) and (4) which states:

"It shall be unlawful to:

(3) Construct, alter, or operate a hazardous waste processing or disposal facility or site in violation of the rules or regulations established under the provisions of this chapter, notwithstanding the provisions of Section 68-46-103(1) and (2);

(4) Store, communicate, label, transport, treat or dispose of hazardous waste or fail to provide information in violation of the rules, regulations, or orders of the commissioner, or in such a manner as to create a public nuisance or a hazard to the public health;

XV.

D.O.E., by its conduct, has not complied with Rule 1200-1-11-.03, Interim Status Standards for Owners and Operators of Existing Hazardous Waste Treatment, Storage and Disposal Facilities.

XVI.

D.O.E., by its conduct, has not complied with Rule 1200-1-11-.04, Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities.

XVII.

D.O.E., by its conduct, has not complied with the requirements of Rule 1200-1-11-.07, Permitting of Hazardous Waste Treatment, Storage, and Disposal Facilities.

RELIEF

XVIII.

THEREFORE, pursuant to the authority vested in me by T.C.A. 68-46-111, 1, James E. Word, hereby ORDER the U. S. Department of Energy to take certain action as described below:

1. D.O.E. shall submit to T.D.H.E. a Part A of the Hazardous Waste permit application for each facility described herein by January 1, 1985, that has not been submitted prior to that date.

2. D.O.E. shall submit closure and post-closure plans for each of the facilities described herein as required by Rule 1200-1-11-05(7) by January 31, 1985, to T.D.H.E., Division of Solid Waste Management.

Issued in the office of the Commissioner of the Tennessee Department of Health and Environment this 6th day of December, 1984.

JAMES E. WORD, Commissioner
Tennessee Department of Health and
Environment

NOTICE OF RIGHTS

The U. S. Department of Energy is hereby advised that in accordance with T.C.A. 58-46-113 it may secure a review of the necessity for or reasonableness of this Order by filing with the Commissioner, a written petition setting forth the grounds and reasons for objection and asking for a hearing in the matter involved before the Solid Waste Disposal Control Board. The Order shall become final and not subject to review unless the person or persons named herein shall file such petition for a hearing no later than thirty (30) days after the date such Order is secured. Hearings will be conducted in accordance with the Tennessee Uniform Administrative Procedures Act.

Please direct all correspondence in this matter to Mary E. Johnston, Assistant General Counsel, 150 9th Avenue North, TERRA Building, Nashville, TN 37203, (615) 741-4177.

Mary E. Johnston
Assistant General Counsel

MEJ/bjs/legal 12/Energy

PRELIMINARY

**APPENDIX D.7
ORDER FOR CORRECTION 2**

STATE OF TENNESSEE
DEPARTMENT OF HEALTH AND ENVIRONMENT

IN THE MATTER OF:

U. S. DEPARTMENT OF ENERGY,

RESPONDENT.

) DIVISION OF SOLID WASTE
) MANAGEMENT
) NO. 84-374
) No. 84-2121AG
)

ORDER FOR CORRECTION

Comes now James E. Word, Commissioner of the Tennessee Department of Health and Environment ("T.D.H.E.") and states that:

PARTIES

I.

James E. Word is the duly appointed Commissioner of T.D.H.E.

II.

The U. S. Department of Energy ("D.O.E.") is an agency of the U. S. Government. The Secretary of Energy is Donald Model. Joe LaGrone is the Manager of Oak Ridge Operations, D.O.E., P. O. Box E, Oak Ridge, Tennessee.

JURISDICTION

III.

Pursuant to T.C.A. Section 68-46-107, the Commissioner has the authority to exercise general supervision over the construction, operation and maintenance of hazardous waste storage facilities, treatment facilities and disposal facilities throughout the state.

Pursuant to T.C.A. 68-46-111, when the Commissioner, upon investigation, finds that any provisions of the Tennessee Hazardous Waste Management Act ("THWMA") are not being carried out, and that effective measures are not being taken to comply with the Act, he may issue an order for correction to the responsible person and this order shall be complied with within the time limit specified in the order.

IV.

D.O.E. is a "person" within the meaning of the Act at T.C.A. 68-46-104(11). D.O.E. is in violation of the provisions of the Act and the regulations promulgated thereunder.

V.

The State of Tennessee and specifically, TDHE and its Division of Solid Waste Management, has been granted interim authorization by the U.S. Environmental Protection Agency ("E.P.A.") to operate Phase I of the hazardous waste program under Subtitle C of the Resource Conservation and Recovery Act ("RCRA"), 42 U.S.C. Section 6901 et seq. Pursuant to this authorization, TDHE has the authority to conduct compliance evaluation inspections of Subtitle C facilities, including federal facilities, and to pursue enforcement against alleged violators.

VI.

Pursuant to Section 6001 of RCRA, federal facilities shall be subject to, and comply with, all Federal, State, interstate and local requirements, both substantive and procedural (including requirements for permits or reporting or any provisions for injunctive relief and such sanctions as may be imposed by a court to enforce such relief), respecting control and abatement of solid waste or hazardous waste disposal in the same manner, and to the same extent as any person is subject to such requirements, . . ."

VII.

D.O.E. owns a facility in Oak Ridge, Anderson County, Tennessee known as the Y-12 Plant. As part of the plant's weapons materials production, it performs substantial metal parts fabrication and metal plating. These operations generate hazardous wastes including, but not limited to, spent solvents, spent plating bath solutions, and treatment sludges containing heavy metals (i.e., mercury), waste acids and caustics, pickling liquors, and cyanides.

FACTS

VIII.

D.O.E. has operated various hazardous waste treatment, storage and disposal facilities at the Y-12 Plant at least since at least November 19, 1980. D.O.E. did not notify the State or E.P.A. of these facilities or apply for interim status for all of those facilities (to allow for continued operation of these facilities while the agency considered final permit applications).

IX.

During the various production activities carried out at the Y-12 Plant, hazardous wastes may become contaminated with radioactive material. The degree or level of contamination varies depending on the production process involved. For the purpose of this Order, this waste will be described as "mixed waste."

X.

The above described mixed wastes, have been generated, treated, stored, and disposed of at approximately eleven (11) facilities on the Y-12 property. These facilities manage approximately thirty-seven (37) mixed waste streams. D.O.E. has not previously applied for or been granted permits from T.D.H.E. to generate, treat, store or dispose of mixed waste in these facilities. These facilities are subject to various standards set out in Division Rules 1200-1-11-.05, 1200-1-11-.06 and 1200-1-11-.07.

XI.

On or about June 25, 1984, D.O.E. submitted a draft Part A of the hazardous waste permit application. This permit application was submitted for the above-described waste streams.

VIOLATIONS

XII.

D.O.E., by its actions, has violated T.C.A. 68-46-105(3) and (4) which states:

"It shall be unlawful to:

(3) Construct, alter, or operate a hazardous waste processing or disposal facility or site in violation of the rules or regulations established under the provisions of this chapter, notwithstanding the provisions of Section 68-46-1 and Disposal Facilities.

(4) Store, containerize, label, transport, treat or dispose of hazardous waste or fail to provide information in violation of the rules, regulations, or orders of the commissioner, or in such a manner as to create a public nuisance or a hazard to the public health;"

XIII.

D.O.E., by its conduct, has not complied with Rule 1200-1-11-.05, Interim Status Standards for Owners and Operators of Existing Hazardous Waste Treatment, Storage and Disposal Facilities.

XIV.

D.O.E., by its conduct, has not complied with Rule 1200-1-11-.06, Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities.

XV.

D.O.E., by its conduct, has not complied with the requirements of Rule 1200-1-11-.07, Permitting of Hazardous Waste Treatment, Storage, and Disposal Facilities.

RELIEF

XVI.

THEREFORE, pursuant to the authority vested in me by T.C.A. 68-46-111, I, James E. Word, hereby ORDER the U. S. Department of Energy to take certain action as described below:

1. D.O.E. shall comply with the interim status standards of Rule 1200-1-11-.05 for all mixed waste facilities described herein until hazardous waste permits are issued by T.D.H.E.

2. D.O.E. shall comply with the hazardous waste permits and conditions thereon as such permits are issued by T.D.H.E.

3. D.O.E. shall submit a schedule within fifteen (15) days of this Order for submittal of all Part B's of the hazardous waste permit applications for all D.O.E. mixed waste facilities. T.D.H.E. will request changes in this schedule, if necessary and D.O.E. shall resubmit said schedule accordingly.

Issued in the office of the Commissioner of the Tennessee Department of Health and Environment this 22nd day of September, 1984.

JAMES E. WORD, Commissioner
Tennessee Department of Health and
Environment

NOTICE OF RIGHTS

The U. S. Department of Energy is hereby advised that in accordance with T.C.A. 68-46-113 it may secure a review of the necessity for or reasonableness of

this Order by filing with the Commissioner, a written petition setting forth the grounds and reason for objection and asking for a hearing in the matter involved before the Solid Waste Disposal Control Board. The Order shall become final and not subject to review unless the person or persons named herein shall file such petition for a hearing no later than thirty (30) days after the date such Order is secured. Hearings will be conducted in accordance with the Tennessee Uniform Administrative Procedures Act.

Please direct all correspondence in this matter to Mary E. Johnston, Assistant General Counsel, 150 9th Avenue North, TERRA Building, Nashville, TN 37203, (615) 741-4177.

Mary E. Johnston
Assistant General Counsel

MEJ/bjs/legal 12/Energy

APPENDIX D.8
FEDERAL FACILITIES COMPLIANCE AGREEMENT
NPDES PERMIT

**United States Environmental Protection Agency - Region IV
Federal Facility Compliance Agreement**

between the

1247

**United States Department of Energy
Oak Ridge Operations, Y-12 Plant
Post Office Box "E"
Oak Ridge, Tennessee 37831**

and the

**United States Environmental Protection Agency - Region IV
345 Courtland Street, N.E.
Atlanta, Georgia 30365**

APR 17 1985

Federal Facility Compliance Agreement

I. Scope

- A. The United States Environmental Protection Agency - Region IV (U.S. EPA), and the United States Department of Energy (U.S. DOE), Oak Ridge Operations, Y-12 Plant, Oak Ridge, Tennessee, are parties to this agreement which is entered into pursuant to Executive Order 12088, October 13, 1978 (43 FR 47707). The Office of Management and Budget and the Department of Justice will take cognizance of this agreement pursuant to their respective duties to assure compliance with the environmental laws under Executive Order 12088 and the particular statutes herein addressed.
- B. This agreement is entered into by the parties to assure compliance by the U.S. DOE, Oak Ridge Operations, Y-12 Plant, with the Clean Water Act (CWA) (33 USC 1251 et seq.), and implementing regulations.
- C. This agreement is not and shall not be construed as a permit under the CWA nor shall it relieve the U.S. DOE of any legal obligations under the CWA which are in addition to or different from matters covered in this agreement. This agreement in no way affects requirements for each facility to apply to the U.S. EPA Region IV for applicable wastewater discharge permits under the National Pollutant Discharge Elimination System (NPDES) permitting program.

II. Authorities

- A. The duties of the U.S. DOE to operate its facilities in compliance with the Clean Water Act are prescribed in Section 313 of the Clean Water Act (33 USC 1323). Executive Order 12088 was promulgated to ensure Federal compliance with applicable pollution control standards. This agreement contains a "plan" as described in Section 1-601 of Executive Order 12088 to achieve and maintain compliance with water pollution control standards.

III. Statement of Facts

- A. The following facilities provide treatment to the wastewaters generated by the different process operations at the Oak Ridge Y-12 Plant and are owned, operated, or are under the control of the U.S. DOE:
 - 1. Kerr Hollow Quarry
 - 2. Rogers Quarry
 - 3. New Hope Pond

B. The following facilities will provide treatment for the Oak Ridge Y-12 Plant wastewaters in the near future:

1. Central Pollution Control Facility - CPCF-I
2. Central Pollution Control Facility - CPCF-II
3. West End Treatment Facility
4. Steam Plant Wastewater Treatment Facility
5. Plating Rinse Water Treatment Facility
6. Oak Ridge National Laboratory
 - o Biology Complex
 - o Isotope Separation Process Collection Tank
 - o Building 9204-3 Sump Pump Oil Separator
 - o Ion Resin Regeneration Waste Collection Tank
7. S-3 Ponds Liquid Treatment Facility
8. Waste Coolant Processing Facility
9. East End Waste Facility

C. Category III Outfalls - Process Wastewaters will eventually receive treatment as specified by the Category III Discharge Elimination Plan (Attachment B).

Wastewaters generated by the facilities listed below will not receive treatment:

1. Leaking Burial Ground
2. Seepage from Burial Pit
3. Category IV Outfalls - Untreated Wastestreams

D. Miscellaneous source discharges which may receive treatment include:

1. Potable and industrial water treatment facilities
2. Cooling systems
3. Boilers
4. Vehicle and equipment cleaning facilities
5. Vehicle and equipment maintenance facilities
6. Photographic laboratories
7. Firefighter training areas
8. Storm sewers

E. The Y-12 facility has at times failed to achieve compliance with the limitations stipulated in the National Pollutant Discharge Elimination System (NPDES) permit. Other wastewater treatment plant management practices have also resulted in NPDES permit violations i.e., high zinc concentrations. Of particular concern is the mercury contamination of the East Fork Poplar Creek, Bear Creek, and of New Hope Pond.

IV. Compliance Schedules

A. The Compliance Schedules for the facilities named in Paragraph III are intended to achieve compliance as expeditiously as practicable, pursuant to Section 1-601 of Executive Order 12088, and are set forth as Attachment A. The Attachment is incorporated into and made a part of this agreement. The schedules were determined after consultations between the U.S.

DOE, the U.S. EPA-Region IV and the Tennessee Department of Health and Environment (TDHE). Wherever reasonably possible, the U.S. DOE will expedite the schedules.

V. Funding

- A. The U.S. DOE shall request all funds and/or authorizations from the Congress necessary to achieve the compliance schedules. These schedules are fixed and definite except to the extent that the Congress of the United States may fail to approve authorization and/or budget requests for these projects. Steps to be taken in seeking funding shall be consistent with Sections 1-4 and 1-5 of Executive Order 12088 as implemented by the Office of Management and Budget Circular A-106 (as amended).

VI. Reporting Requirements

- A. The U.S. DOE shall submit a progress report no later than 14 days after the date of achievement of each incremental step in the Compliance Schedule and upon the final compliance date as set forth in the Attachment. The progress reports will be submitted to the U.S. EPA-Region IV and to the TDHE. The status report shall indicate compliance or non-compliance with the schedule. In the event of non-compliance, the report shall include the cause of non-compliance and any remedial actions taken.
- B. If the U.S. DOE has knowledge of any event which causes or may cause a delay in meeting any schedule date, the U.S. DOE shall immediately notify U.S. EPA-Region IV and the TDHE, in writing, of the anticipated delay. The U.S. DOE shall describe the anticipated length of delay, the cause or causes of the delay, the measure taken and to be taken to prevent or minimize the delay, and the timetable by which the measures shall be implemented. The U.S. DOE will take reasonable action to minimize any delay. The Regional Administrator shall make a determination whether the Compliance Schedule set forth in the Attachment shall be revised. If the U.S. DOE disagrees with this determination, the Conflict Resolution procedure described herein shall control.
- C. Additionally, beginning three months after the date for achievement of the first milestone specified for each proposed construction in Attachment A, the U.S. DOE shall submit a status report to the U.S. EPA-Region IV and the TDHE detailing the progress made during that quarter. The report shall be submitted quarterly until compliance has been achieved.
- D. In the event that there is an amendment of the CWA, or in the event that changes to the regulations promulgated under those statutes change the technology necessary to achieve compliance pursuant to this agreement, the schedules will be renegotiated to effect changed law or regulations. Such renegotiation shall be governed by Executive Order 12088 or any successive

Executive Orders governing such renegotiation. Any disagreements in renegotiation shall be resolved by the Conflict Resolution provisions of this agreement. During the pendency of any request for renegotiation, the attached Compliance Schedule, to the extent it does not conflict with statutory or regulatory changes, shall remain in effect unless specifically waived by the U.S. EPA-Region IV.

- E. On the dates for final compliance as shown on the attachment, compliance with NPDES permit requirements must be demonstrable by testing and positive reporting of the achievement of compliance, rather than by the mere completion of construction of pollution abatement facilities.
- F. Upon the U.S. DOE's demonstration of compliance, there will be a continuing obligation to comply with applicable discharge limitations under the CWA.

VII. Conflict Resolution

- A. Anticipated non-compliance with, or alleged violations of, this agreement shall be brought to the attention of the Administrator, U.S. Environmental Protection Agency, Washington, D.C., for resolution by the U.S. EPA and the U.S. DOE. If necessary, the Director, Office of Management and Budget shall be notified pursuant to Sections 1-602 and 1-603 of Executive Order 12088 and shall consider such steps as are necessary to resolve any conflicts and remedy the violations.

VIII. Sanctions

- A. In the event of violations of the terms of this agreement by the U.S. DOE, sanctions under the authority of Section 1-604 of Executive Order 12088, as well as enforcement procedures established by the CWA are available as enforcement mechanisms in addition to the Conflict Resolution procedures cited in Section VII - Conflict Resolution.
- B. Provided that the Compliance Schedule, as attached, is met, this agreement is considered to be in lieu of any other U.S. EPA or Federal enforcement action with regard to the facilities in Paragraph III-Statement of Fact. This agreement in no way modifies Section 504 of the CWA.

The parties agree that all information required by this Federal Facility Compliance Agreement, shall be submitted in writing and mailed to each party as follows:

Mr. Howard D. Teller
Assistant Regional Administrator
for Policy & Management
United States Environmental Protection Agency
345 Courtland Street, NE
Atlanta, Georgia 30365

Mr. Joe La Grone, Manager
Oak Ridge Operations
United States Department of Energy
Post Office Box "E"
Oak Ridge, Tennessee 37831

Howard Teller

United States Environmental Protection Agency

April 15, 1985
Date

Joe La Grone

United States Department of Energy

April 17, 1985
Date

ATTACHMENT A

Proposed Constructions:

Project Description and Compliance Schedule

Proposed Construction

1. Facility Name

Central Pollution Control Facility - CPCF-I

2. Project Description

The Central Pollution Control Facility - CPCF-I will provide treatment for the non-nitrate wastewaters generated by the Y-12 plant process operations. The treatment plan includes sedimentation, pH adjustment, chemical and/or electrical reduction, precipitation, solids removal, and carbon adsorption.

3. Compliance Schedule

Completion of Final Plans:	07/18/83
Commence Construction:	10/03/83
Completion of Construction:	06/30/85
Compliance Level Attained:	12/30/85

1. Facility Name

Central Pollution Control Facility - CPCF-II

2. Project Description

The Central Pollution Control Facility (CPCF-II) will treat for release nitrate-contaminated wastewaters that have received head end treatment and neutralization at Oak Ridge Gaseous Diffusion Plant (ORGDP) followed by insitu biological denitrification in existing 500,000 gallon biological reactor tanks at Y-12. The effluent will then be passed through a rotary vacuum filter before undergoing final effluent polishing steps (including carbon adsorption in existing equipment). Chlorination will be accomplished prior to discharge to one of three equalization basins where sampling will take place prior to discharge to East Fork Poplar Creek.

3. Compliance Schedule

Completion of Final Plans:	03/30/85
Commence Construction:	01/01/85
Completion of Construction:	11/30/85
Compliance Level Attained:	03/30/85

Proposed Construction

1. Facility Name

Steam Plant Wastewater Treatment Facility

2. Project Description

The Steam Plant Wastewater Treatment Facility will provide treatment for acidic and caustic discharges from the Y-12 Coal Yard and Steam Plant. The wastewaters include coal yard runoff, boiler blow down, drain water, demineralizer and ion exchange regeneration water, flyash sump overflow, and carbon backwash wastewater. The treatment facility includes concrete lined collection ditches, neutralization system, lamella tray settlers for solid/liquid separation, and a monitoring/sampling discharge station.

3. Compliance Schedule

Completion of Final Plans:	10/31/85
Commence Construction:	02/01/86
Completion of Construction:	09/30/87
Compliance Level Attained:	03/30/88

1. Facility Name

Plating Rinse Water Treatment Facility

2. Project Description

The Plating Rinse Water Treatment Facility will treat rinse water from the electroplating areas, printed circuit board fabrication area, and from the ultrasonic cleaning area. The facility's ultimate goal is to remove trace metals, organics, and cyanide from plating shop rinse waters.

3. Compliance Schedule

Completion of Final Plans:	06/30/85
Commence Construction:	10/01/85
Completion of Construction:	12/30/86
Compliance Level Attained:	02/28/87

Proposed Construction

1. Facility Name

Oak Ridge National Laboratory - Biology Wastewater Treatment Facility

2. Project Description

The Oak Ridge National Laboratory - Biology Complex's wastewater treatment plant will treat discharges from research laboratories, offices, utility areas, a biology library, storage areas, and animal holding and handling facilities. The treatment system will include pH adjustment, organic removal via carbon bed, and solids handling equipment.

3. Compliance Schedule

Completion of Final Plans:	10/30/86
Commence Construction:	02/28/87
Completion of Construction:	10/30/88
Compliance Level Attained:	03/30/89

1. Facility Name

Oak Ridge National Laboratory - Isotope Separation Process Wastewater Collection Tank

2. Project Description

The Oak Ridge National Laboratory - Isotope Separation Process wastewater collection tank will collect the wastewaters at this facility for transportation to an approved treatment system.

3. Compliance Schedule

Completion of Final Plans:	01/31/85
Commence Construction:	03/31/85
Completion of Construction:	01/31/86
Compliance Level Attained:	04/30/86

Proposed Construction

1. Facility Name

Oak Ridge National Laboratory - Building 9204-3 Sump Pump Oil Separator

2. Project Description

The Oak Ridge National Laboratory - Building 9204-3 Sump Pump Oil Separator treatment system will remove oil and grease from the sump wastewater. The treatment system includes an oil and grease separator to be placed in the discharge line between the sump and the receiving stream.

3. Compliance Schedule

Completion of Final plans:	12/31/85
Commence Construction:	02/28/86
Completion of Construction:	01/31/87
Compliance Level Attained:	04/30/87

1. Facility Name

Building No. 9201-2 Ion Resin Regeneration Waste Collection Tank

2. Project Description

Wastewater now goes to East Fork Poplar Creek as a Category III discharge. The proposed tank will collect the waste for subsequent transport to a treatment plant.

3. Compliance Schedule

Completion of Final Plans:	10/31/84
Commence Construction:	02/28/85
Completion of Construction:	09/30/85
Compliance Level Attained:	10/31/85

Proposed Construction

1. Facility Name

Category III Outfalls - Process Wastewaters

2. Project Description

Category III Outfalls are those discharge pipes which have been tentatively identified to contain process wastewaters. These pipes presently discharge into the headwaters of the East Fork Poplar Creek (the industrial ditch). A sampling program has been completed to characterize the wastewaters in each pipe. Category III wastewaters will eventually be treated by various pollution control facilities. Category III wastewaters will be allowed to continue to discharge into the East Fork Poplar Creek until treatment facilities are constructed. The East Fork Poplar Creek discharges into Serial Number Discharge 303, New Hope Pond which has been assigned interim discharge limitations. The interim discharge limitations and monitoring requirements will remain in effect until all the facilities are constructed and become operational.

3. Compliance Schedule

The Category III Outfalls with the exception of those which are permitted will cease to discharge process wastewaters to the headwaters of the East Fork Poplar Creek in accordance with Attachment B - Category III Discharge Elimination Plan.

Proposed Construction

1. Facility Name

S-3 Ponds Liquid Treatment Facility

2. Project Description

Liquid wastes to be treated by the S-3 Ponds Liquid Treatment Facility include liquid residual contents of the ponds and any contaminated precipitation which may be collected during the facility's closure. The liquids are inorganic but they may contain trace levels of organic compounds. Liquid from the ponds will be treated through six basic steps. Alum and sulfuric acid will be added to lower the pH for breaking oil emulsion. Both lighter and heavier than water oils shall be removed from the liquid phase by phase separation. The treated effluent is filtered using a back-wash pre-coat filter prior to discharges.

The effluent from the filters will be discharged into concrete lined equalization basins. The discharge from these basins will be monitored and sampled in accordance with the NPDES permit. There are three basins with sufficient capacity for holding a 12-hour collection of treated pond effluent. Each basin has the capability to chlorinate prior to discharge.

3. Compliance Schedule

Completion of Final Plans:	09/15/84
Commence Construction:	07/01/84
Completion of Construction:	03/31/85
Compliance Level Attained:	Upon initial discharge (projected to be around May 1985)

1. Facility Name

Waste Coolant Processing Facility (WCPF)

2. Project Description

This facility will treat the biodegradable, water soluble waste machine coolants by extended aeration. Oily, floating solids will be fed to a sludge dryer/ribbon blender to remove free liquid. After dewatering, sludges will be emptied into drums then incinerated or buried. Liquid effluent will be pumped to an aerated holding tank and transferred to the West End Treatment Facility. Settleable sludge (biomass) from the biological reactor also will be transferred to the West End Treatment Facility.

3. Compliance Schedule

Completion of Final Plans	08/30/84
Commence Construction:	11/30/84
Completion of Construction:	09/30/85
Compliance Level Attained:	12/31/85

Proposed Construction

1. Facility Name

West End Treatment Facility (WETF)

2. Project Description

The West End Treatment Facility will improve the treatment processes as provided in the Central Pollution Control Facility II (CPCF II). Head end treatment including cyanide destruction, heavy metal precipitation, neutralization, and biological nutrient addition will all be accomplished in a new process building. The WETF will discharge to CPCF II.

3. Compliance Schedule

Completion of Final Plans:	03/30/85
Commence Construction:	07/01/85
Completion of Construction:	09/30/86
Compliance Level Attained:	01/31/87

1. Facility Name

East End Waste Facility

2. Project Description

East End Waste Facility will provide a collection system for wastewater from car cleaning operations in and near Building 9712. The project includes a new sump pump, secondary containment, storage tank, and appropriate pumps and piping for transportation to the Oak Ridge Gaseous Diffusion Plant or appropriate Y-12 facility for wastewater treatment.

3. Compliance Schedule

Completion of Final Plans:	05/31/85
Commence Construction:	09/03/85
Completion of Construction:	07/31/86
Compliance Level Attained:	08/31/86

ATTACHMENT B

Category III Discharge Elimination Plans

PRELIMINARY

ATTACHMENT B

CATEGORY III DISCHARGE ELIMINATION PLANS

<u>Outfall Number</u>	<u>Wastewater Description</u>	<u>Elimination Plan</u>	<u>Elimination* Date</u>
71	Garage Wastewater, Building 9712	Collect, store, and/ or treat at an approved facility upon completion of East End Waste Facility	08/31/86
71	Hydroform Facility	Will be further charac- terized, and a schedule for permitting for direct discharge or collection facility design and construction will be submitted by July 1, 1985	To be deter- mined
135	Decontamination Pad, Building 9206	Collection and treatment ment at WETF	01/31/87
147	Isotope Separation Process, Building 9204-3	Collect, store, and/or treat at an approved facility upon comple- tion of Isotope Sepa- ration Process Waste- water Collection Tank	04/30/86
150	Zirconium-Contaminated Wastewater, Building 9212	Collection and treat- ment at Central Pollution Control Facility-I (CPCF-I)	12/30/85
157	Plating Rinse Water, Building 9401-2	Collection and treat- ment at Plating Rinse Water Treatment Facility (PRWTF)	02/28/87
160	Boiler drains, regene- ration wastes, cooling water, and flow around Building 9201-4	Treatment at Steam Plant Wastewater Treatment Facility (SPWTF)	03/30/88
162	Boiler blowdown and cooling water from outdoor auxiliaries	Treatment at SPWTF	03/30/88

Outfall Number	Wastewater Description	Elimination Plan	Elimination* Date
163	Cooling water from indoor auxiliaries, waste condensate, deareator and floor drains	Treatment at SPWTF	03/30/88
163	Shop Wastewater, Building 9808	Collection and treatment at CPCF-I	12/30/85
166,168	Coal Pile Runoff	Treatment at SPWTF	03/30/88
169	Coolant Degradation Treatment System, Building 9204-4	Collected and treated upon completion of Waste Coolant Processing Facility (WCPF)	12/31/85
181	Plating rinse waters, ultrasonic rinse waters, Building 9201-5N	Collected and treated at PRWTF	02/28/87
191,192	Shop Wastewater, Building 9720-13	Collection and treatment at CPCF-I	12/30/85

*For wastewater treatment facilities, this date represents the "compliance level attained" milestone date stated elsewhere in this agreement. ..

APPENDIX E
OAK RIDGE OPERATIONS RESPONSES
TO THE STATUS REPORT OF THE ENVIRONMENTAL SURVEY - Y-12 PLANT

memorandum

DATE: September 14, 1987

REPLY TO:

ATTN OF: SE-31:Gist

SUBJECT: RESPONSES TO THE STATUS REPORT OF THE ENVIRONMENTAL SURVEY - Y-12 PLANT

→ TO: Thomas T. Traceski, Office of Director for Environmental Audit, EH-24,
Room 3E-094, Forrestal Building, Washington D.C. 20585

Attached are our comments regarding the Y-12 Plant environmental survey status report. We would appreciate their consideration in the preparation of the preliminary report. If you have any questions or require additional information, please contact Clayton Gist of my staff at FTS 626-6821.

H. Wayne Hibbitts, Director
Environmental Protection Division

Attachment:
Environmental Survey Comments

cc w/attachment:
D. M. Caughey, EH-24, FORSTL
J. W. Culpepper, DP-22.1, GTN
C. W. Billups, DP-226.1, GTN
T. R. Butz, 9704-1, Y-12
L. W. Long, 1000, ORNL
T. S. Tison, DP-812

COMMENTS ON DOE HEADQUARTERS
ENVIRONMENTAL SURVEY FINDINGS

CATEGORY II

Finding

1. The Oil and Solvent Drum Storage Area within the northern section of the salvage yard (south of Building 9114) contains several leaking drums of oil and RCRA listed solvents. Some of the drums' contents are also known to be contaminated with low levels of depleted uranium. The soil and standing water in the immediate area are discolored, and other drums in this storage area appear to be in a serious state of deterioration. Weekly inspection logs for the area confirm the presence of leaking drums over several consecutive entries. This situation represents a related and more immediate aspect of a larger (storage) problem included in Category III.

Comment

A documented program for identifying and replacing deteriorating and leaking drums has been in place at the Y-12 Oil and Solvent Drum Yard since 1984. This procedure involves weekly inspections of the drum yard with written, follow-up actions to be taken to correct deficiencies. This procedure has been revised to ensure that leaking drums are replaced within 24 hours. Drums not yet leaking, but found to be in deteriorating condition, shall be replaced within five working days. As a result of regular inspections over the last two years, approximately 750 drums of solvents and oils have been repackaged.

Drums arriving at the salvage yard are inventoried and sampled to determine the appropriate disposal option. Based on analytical results, drums are marked and segregated for pumping into bulk tanks. The Y-12 Plant has historically generated 1200-1500 drums of oil on an annual basis. In addition, oils generated at the Oak Ridge Gaseous Diffusion Plant (ORGDP) were transported and stored at the Y-12 Plant prior to 1980. Solvent storage at the Salvage Yard was initiated in 1981.

The Salvage Yard has been used for oil drum storage since 1974. The Y-12 Plant has used oil landfarming and local waste oil recycle vendors as disposal outlets for uranium-contaminated and clean oils, respectively. In 1981, the landfarming option was closed creating a backlog of uranium and beryllium contaminated oils at the Salvage Yard. The TSCA incinerator at ORGDP should begin receiving wastes by the second quarter of FY 1988. Until that time, the plant must continue to store contaminated waste oils and solvents in drums and bulk tank storage. A total of 80,000 gallons of tank storage capacity has been added since 1981 to assist in the removal of drummed oils and solvents from the Salvage Yard. A total of 226,000 gallons of new tank capacity will be available by the end of FY 1987.

Current disposal options for clean waste oils and solvents include commercial incineration and recycle. Both options are being pursued by the plant. However, commercial release of these materials requires extensive sampling, verification, and approval prior to release resulting in delays and further increases in waste oil and solvent inventories.

Partial closure of the facility (western diked area) in 1986 resulted in the removal of 2,130 drums of oil and solvents from the yard through sampling, bulk storage, and commercial disposal. The Tennessee Department of Health and Environment (TDHE) accepted the closure of the west diked area. In addition, as part of the Perimeter Intrusion Detection Assessment System (PIDAS) project, the oil stained gravel and soil have been removed. The east diked area will remain in operation until new replacement facilities expected in the 1988/1989 time frame are constructed. At that time, all hazardous will be removed and closure of the east diked area will be conducted in accordance with a Tennessee Department of Health and Environment (TDHE) approved closure plan.

Finding

2. A potential mixed waste is being treated and disposed of without required notifications and approvals. Contaminated depleted uranium chips is a suspected mixed waste being handled at the site as low-level waste. The chips are contaminated with very small amounts of an aqueous coolant known as "Trim-sol." While this coolant is not a listed waste, minute quantities of listed solvents (F002 & F005) are known to end up mixed in with the coolant. The facilities that handle the chips are intended to manage only low-level waste. Therefore, these facilities are not currently permitted, neither do they have interim status under RCRA, and are operated without controls, monitoring, and operating practices normally associated with RCRA facilities to prevent the release of hazardous constituents into the environment. The facilities in question include the uranium chip pits/trenches at the Bear Creek Waste Disposal Area and the Uranium Chip Oxidizer (incinerator). In addition, the uranium chips mixed waste has not been included in the annual hazardous waste generation summary report submitted to the state. (Note: Plant personnel have indicated that the state has been notified that uranium chips containing "Trim-sol" coolant are being disposed of at Bear Creek, however, the state is not aware that the coolant may be contaminated with listed solvents).

Comment

Depleted uranium chips have and are being sent to Bear Creek Burial Ground (BCBG) for disposal. The depleted uranium is machined using a coolant consisting of 4 percent Trim-sol (a biodegradable oil) and 96 percent

water. After machining, waste metal chips are drained and collected in 55 gallon drums containing water. The filled drums are moved from the shipping area to the dock and transferred into a metal dumpster containing water for storage (up to 24 hours) prior to transport to BCBG for disposal. The burial ground is not used for the disposal of the coolant to machine the metal. The state is aware of the above procedure.

Trace quantities of Trim-sol may adhere to the surface of the chips being disposed. Incidental amounts of degreasing solvents may reach the coolant since freon is applied to chem wipes or via use in a squirt bottle for spot cleaning the parts in some of the shops. Based upon opinions rendered by the TDHE in a September 1984 meeting with TDHE, EPA Region IV, the DOE and Martin Marietta Energy Systems, Inc., it was understood that while coolants mixed with large amounts of halogenated degreasing solvents are considered to be hazardous, mopwaters containing trace amounts of degreasing solvent from incidental drippings are not.

The circumstances presented by the disposal of the depleted uranium chips appeared to be comparable to those of the mopwater scenario. As a result, the disposal of the chips was not considered to be a RCRA activity.

In response to this finding, this issue has been revisited. In a recent discussion with the TDHE, the determination that the chips do not constitute a hazardous waste was reinforced. Therefore, the corrective actions stated in the finding (i.e., the permitting of the chip handling facilities) are not required.

Finding

3. A backflow preventer at Building 9201-3 was found unsatisfactory on every six month inspection since June 1981. Delay in repairing defective backflow preventers could allow potentially hazardous process waters to contaminate the potable water system.

Comment

The backflow preventer noted in this finding was repaired after the deficiency was identified. In addition, a procedure has been implemented which categorizes necessary repairs on backflow preventers as a "safety action," automatically giving high priority to their maintenance.

CATEGORY III

Finding

4. Mercury contaminated groundwater within the plant site is entering the surface water of East Fork Poplar Creek (EFPC) through outfalls which are not currently monitored. Additionally, there is a potential for uranium, nitrates, solvents, copper, iron, and sulfate contaminants on-site to be transported to the surface water through the groundwater. Polychlorinated biphenyl (PCB) contamination on-site also may be entering the groundwater, but transport into EFPC is more likely through surface runoff.

Comment

The evidence for contamination of groundwater at the Y-12 Plant is minimal. As noted by Rothschild et al., (ORNL/TM-9029), some high concentrations of mercury do occur in soil and fill at several areas within the plant; but mercury analysis of groundwater in that area indicate that mercury does not appear to be moving in significant quantities in an aqueous phase. The highest soluble concentrations found (about 1 ug/L) were limited to three wells. The occurrence of elevated mercury levels, mainly in shallow soils and fill (less than 10 feet), and the background concentrations of mercury observed in most of the wells indicates that the metal has been generally immobilized/retained in upper earth materials. It is true that groundwater which enters the subsurface storm drainage system via sumps and pipe infiltration can become contaminated with mercury before reaching EFPC. The presence of metallic mercury-contaminated sediment in many storm drains, in concert with chlorinated raw water (once-through cooling system), can lead to significant export of both soluble and particulate mercury to EFPC. Efforts underway to alleviate this situation include the cleaning and relining of pipes and the rerouting of water flow. These activities are part the Reduction of Mercury in Plant effluents Line Item project.

The subsurface storm drains from springs and groundwater seeps in Buildings 9201-1, -2, -3, and -4 are permitted on the Y-12 NPDES permit as Category I and II discharges. Due to the ubiquitous nature of the groundwater entering the surface stream, the Tennessee Department of Health and Environment/Environmental Protection Agency (EPA) agreed to instream monitoring for mercury rather than compliance monitoring at each of these outfalls. Mercury is monitored at the New Hope Pond inlet and outlet.

With respect to uranium, nitrate, and heavy metal contamination: It is known that the plume of the S-3 Ponds extends toward the southeast and contains uranium, nitrate, and heavy metals. Use of the S-3 Ponds as a disposal site was discontinued in March 1984. The potential exists for these materials to enter the surface water through springs and also infiltration into storm sewers. The extent and movement of the plume of the S-3 Ponds and plumes potentially generated by other sites is addressed by the Comprehensive Groundwater Study Plan for the Y-12 area which is currently being prepared by a subcontractor. The plan is expected to be completed in September 1987.

With respect to PCB contamination: The Y-12 Plant recognizes the possibility of PCB contamination in groundwater; however, sample results do not support this. As acknowledged by the survey team, the potential for the transport of PCBs is more likely via surface runoff to EFPC. Monitoring programs being implemented include state-of-the-art biological monitoring techniques, conventional water quality monitoring, and a PCB monitoring plan developed in accordance with the Y-12 Plant NPDES permit. Existing sample indicate a downward trend in PCB concentration with increasing distance downstream of New Hope Pond. Soil Sampling is also scheduled for sites with the Z-oil system to identify possible PCB-contaminated areas. Until this sampling effort is complete, it cannot be determined whether or not the Z-oil system is a source of PCB contamination to EFPC.

In addition to the sampling programs in place, preventive actions are being taken to eliminate potential sources of PCB contamination. Such action include the closure of several storage areas under RCRA where there have been historical releases of PCBs and the evaluation of other sites for cleanup under the 3004(u) program. The removal of Askarel transformers and the retrofilling of PCB mineral oil transformers are also in progress.

Added note (general scope): The general Source Pollution Assessment and Control Plan for EFPC is currently evaluating some of the issues raised by this finding. This study is using the assistance of an engineering contractor, and its objective is to evaluate nonpoint source discharges to EFPC. Nonpoint source discharges include surface water runoff and groundwater infiltration which discharge into EFPC. The program is looking at all pollutants which may be entering EFPC as a result of nonpoint pollution sources. Pollutants being evaluated include all the nutrients such as nitrates, phosphates, and ammonia; heavy metals such as copper, zinc, mercury, uranium, iron, and cadmium; and the priority pollutant organic fractions such as volatiles, acid/base neutrals, and contamination, mercury is of secondary importance to this program. Preliminary sampling and surface water modeling has already been conducted, and full scale implementation is scheduled for the summer of 1987 and will likely continue through the spring of 1988.

Finding

5. Untreated process water discharges to EFPC are causing elevated metal concentrations, oil, grease, and other organic contamination and high/low pHs. This problem was recognized in a Memorandum of Understanding (MOU) signed in 1983.

Comment

Approximately 160 discharges to EFPC have been eliminated or permitted since May 1983. A Federal Facilities Compliance Agreement has been developed for the Y-12 Plant in conjunction with the NPDES permit. This agreement established compliance schedules for planned waste water treatment facilities and mandates the collection followed by treatment prior to discharge of selected waste streams. To date 10 of the 12 collection and treatment facilities have been completed. With the exception of the discharges associated with the Steam Plant Wastewater Treatment Facility (scheduled to attain compliance with the NPDES permit in March 1988), all discharges have been eliminated as required. The Federal Facilities Compliance Agreement also establishes a compliance schedule for the Biology Wastewater Treatment Facility.

Finding

6. Past, and to a lesser extent current, waste water disposal practices along with the accidental loss/spillage of process materials have contaminated the floodplain of EFPC. The Oak Ridge Interagency Task Force is studying the extent of mercury, other heavy metal, radionuclide and organic contamination in the soils, and sediments of EFPC and the potential effects on the groundwater.

Comment

Preliminary results by the Interagency Task Force indicate that ingestion of the contaminated soil, the major pathway of concern, is not likely to result in adverse health effects to the public. Therefore, the extent of the contamination and subsequent removal actions can best be evaluated in a careful, systematic manner. While the Interagency Task Force will continue to evaluate the results of the study, the primary responsibility for this effort has been determined by the EPA to be pursuant to the RCRA 3004(u) permit.

One action taken to reduce the off-site contamination is the removal of mercury contaminated soil from the Oak Ridge Civic Center area. To date, approximately 4200 Cubic Yards of soil have been removed.

Finding

7. Radionuclides, VOCs, heavy metals, nitrates, and PCBs have contaminated soils and groundwater at the Bear Creek Valley Waste Disposal Area and have caused degradation of the surface waters and sediments of Bear Creek.

Comment

The Disposal Area Remedial Action (DARA) is a funded subproject of the Environmental Improvements Line Item project aimed at the mitigation of the contaminants stated associated with Bear Creek. It should be noted that PCBs have not been detected in the groundwater wells although some mitigation of PCBs in the Bear Creek Valley has been observed around the oil retention ponds and oil land farm via soil land farming. DARA will provide for the closure of the Oil Retention Ponds and capping for part of the burial grounds. Closure plans are being developed for the waste management units in the Bear Creek watershed. Investigations have been underway to evaluate the extent of the contamination and future remediation requirements. There have been major revisions to disposal practices at the Bear Creek Burial Grounds which include greater awareness of characterization, careful screening for suspected contaminants by lab analysis and other techniques, and segregation of waste streams based upon acceptance criteria at Y-12 facilities.

Finding

8. Indications of organic and nitrate contamination exist in soil and select groundwater monitoring locations south of the plant from disposal sites in the Chestnut Ridge area.

Comment

Five networks of groundwater wells used to demonstrate compliance with RCRA regulations and for the purpose of characterization have been established in the Chestnut Ridge area. Data from four quarters have shown indications of organics in the groundwater at one site, the Chestnut Ridge Security Pits. However, the wells are new, the levels are less than 1 mg/l, and the levels have decreased during the one calendar year for which data has been collected. The site continues to be monitored, and a closure plan has been submitted for the Chestnut Ridge Security Pits. Nitrates found in the groundwater are below the drinking water standards.

Finding

9. Twenty-nine waste disposal (inactive), leak, and spill sites are known or suspected of being sources of environmental contamination. Twenty-one of these sites have been identified through Phase I Installation Assessment for Y-12. Studies to assess the nature and extent of environmental contamination are underway for the major sites and are starting at some of the smaller sites. An additional eight sites have been identified since the Phase I draft report was prepared. These include the radioactive, possibly thorium, contaminated site south of Alpha 5 (Building 9201-5), identified through the recently completed Oak Ridge National Laboratory (ORNL) Radiological Survey; radioactive, possibly uranium, contamination at Building 9728, site of the former laundry operation; elevated radiation levels at a site located north of Portal 18 and east of the S-3 Ponds that was possibly used as an unauthorized soil spoils dumping area; Rogers and Kerr Hollow Quarries where a wide range of materials, including hazardous wastes, have been disposed of in the past; Cesium-137 and possibly Strontium-90 contamination along the CSX railroad tracks east of the plant, which is being monitored by DOE through ORNL and Oak Ridge Associated Universities (ORAU); a potential site east of Chestnut Ridge Security Pits identified through a 1950 aerial photograph of the area; and finally, off-site contamination in the floodplain of East Fork Poplar Creek which is also being monitored and studied by DOE through the Oak Ridge Interagency Task Force. Additional sites of environmental concern may be identified once analysis and interpretation of the data collected in the ORNL Radiological Survey has been completed.

Comments

The Y-12 Long-Range Environmental Management Plan contains funding for evaluation and prioritization of CERCLA sites. As stated, additional sites have been identified since the issuance of the Phase I Installation Report. Of the sites mentioned above, the only sites not recognized by the Y-12 Plant prior to the survey are the sites north of Portal 18 and the disturbed area located in the 1950s photograph.

Specifics include:

South side of Building 9201-5 - Area was determined to be contaminated with thorium by the Y-12 Radiological Survey. Site has been remediated by plant personnel.

Area north of Portal 18 and laundry site - Above background levels of radiation were observed at these sites. Since these areas are within the plant (outdoors where there are no regularly occurring operations, and the radiation levels are of a low magnitude), the potential health hazards to plant personnel are low. These sites will be prioritized and incorporated into a broader remedial actions plan for the plant.

Rogers Quarry - Please note that any disposal of materials now considered hazardous would have occurred long before November 1980. Since that time, Rogers Quarry has not been used for the disposal of hazardous waste.

Finding

10. In the event of an accident, the potential exists for an uncontrolled, unmonitored atmospheric release of uranium through nonprocess room exhausts. These areas are not usually equipped with either emission controls or radiological samplers. Y-12 estimates that 23 percent of the total release of uranium from a December 27, 1985, chip fire in building 9212 was through such an exhaust portal.

Comment

Although a potential exists for uncontrolled accidental releases as identified in the survey findings, several factors minimize the probability of a release which would result in a significant environmental impact. Enriched uranium is about 150 times more radioactive than depleted uranium. For this reason, a release of enriched uranium would more likely result in a significant radiological dose to the public. The chances of such a release is minimized by safety procedures, criticality control measures, and special equipment to contain enriched uranium. These mitigating factors are described in FSARs and OSARs for the facilities where enriched uranium is processed and handled. Also, an evaluation of potential releases from both enriched and depleted uranium processing was made recently to determine the potential for contamination of nearby air intakes (Y/EN-1769 and Y/EN-1634). Accidental releases to the work areas have been monitored in the past using an extensive network of health physics samplers. These data have also been used to estimate the quantity of uranium released through room exhausts, as was done in the referenced December 27, 1985, fire incident. To date, none of these evaluations has indicated the need to modify the uranium processing area to achieve more containment or monitoring for room exhausts. Sample results from the 11 Y-12 Plant perimeter air monitors and ORNL perimeter air monitoring network have shown emissions at the plant boundary and off-site areas to be well below acceptable dose levels.

Finding

11. Soils have been, and are being, contaminated by inadequate waste storage practices. Past practices of storing open drums at the Interim Drum Storage Yard adjacent to Buildings 9720-32 and 9720-33 (south of the Salvage Yard) have resulted in contamination of the soil with uranium and chromates. Leaking drums and spillage of drum contents during past transfer operations at the Oil and Solvent Drum Storage Area within the Salvage Yard (south of Building 9114) may have resulted in groundwater and

surface water contamination. Additionally, due to the leaking drums and crowded drum storage, this storage area does not fully comply with RCRA requirements. Per 40 CFR 265, Subpart I, all hazardous waste drums must be inspectable; and hazardous waste in leaking and deteriorated drums must be transferred to containers in good condition or managed in some other way that complies with RCRA storage requirements. The yard contains approximately 1700 drums of oils and solvents, some of which are uranium contaminated. PCB contamination of soil/gravel also has been documented by Y-12 in the Line Yard west of Building 9720-8 and has probably occurred in the transformer storage yard east of Building 9204-1 and in the old PCB oil storage area in the Salvage Yard.

Comment

The Interim Drum Yard is inspected weekly, and leaking drums are repackaged. These activities are documented in the inspection log. Also, drums are being removed from the yard for disposal or indoor storage as space permits. Within the next few months, partial closure of the southern portion of the Interim Drum Storage Yard is scheduled to be conducted in accordance with a closure plan approved by the TDHE. The remaining portion of the drum yard is scheduled for closure in 1989. The yard has never had more than 1000 drums at one time, and it is standard practice to keep the drums closed except during transfer operations. With respect to the Salvage Yard - Oil and Solvent Drum Storage Yard: The eastern diked portion of the Oil and Solvent Drum Storage Area is still in operation. As a result of partial closure of this facility, a number of drums from the western (closed) area were moved into the eastern (active) portion creating temporary crowded conditions. However, of the 20 to 30 rows of drums within the active portion, only two rows have insufficient aisle space for adequate inspections. The Waste Transportation, Storage, and Disposal Department is working towards reducing the number of drums in this area through utilization of increased bulk liquid storage capacity, commercial disposal, and indoor storage at the Oak Ridge Gaseous Diffusion Plant (ORGDP) to make sufficient aisle space for inspections. Improved handling capabilities are also expected once the TSCA incinerator becomes operational. It should be noted that soil sampling and analysis in that salvage yard PCB area showed PCB contamination to be well below levels of concern.

Finding

12. The deteriorating drums at the United Nuclear Company (UNC) Disposal Site on Chestnut Ridge will ultimately release wastes to the soil which could eventually migrate to the groundwater and increase nitrate concentrations in the immediate vicinity above drinking water standards. There are approximately 29,000 drums disposed at the site containing approximately 300 tons of nitrates.

Comment

There are approximately 29,000 drums of waste storage at the UNC site on Chestnut Ridge containing approximately 53 metric tons of nitrate as nitrogen. A detailed sampling program and pathways analysis has been completed which indicates that the wastes can be closed in place using available capping technology without exceeding drinking water standards for nitrates in the groundwater. Regulatory approval is being sought for the capping option. The UNC site is under the RCRA 3004(u) program and will be closed consistent with state requirements.

Finding

13. Reliable and defensible estimates of radionuclide emissions cannot be made because the current stacks preclude the proper location of samplers in accordance with recognized guidelines. A stack radiological monitoring project is underway to combine and modify stacks to permit proper sampler location and to provide for accurate continuous sampling for radionuclides and periodic stack flow-rate measurement. Real-time monitors will also be provided for certain stacks to indicate control device failure.

Comment

Since the time of the survey, a major project to upgrade the radiological monitoring capabilities of plant process exhausts from uranium handling areas has been completed. Eighty-five process exhaust stacks have been upgraded to meet EPA stack sampling criteria for particulate sampling (40 CFR Part 60, Appendix A, Method 1). New continuous stack sampling and monitoring equipment has been installed on the modified exhaust stacks and has been operational since February 27, 1987. Reliable continuous data on the Y-12 Plant radionuclide emissions from these stacks is now being collected.

Finding

14. Uranium processing operations at Y-12 have released significant amounts (14,000 Kg to 22,000 Kg per year during the period 1981 to 1985) of hydrogen fluoride to the atmosphere impacting on the ambient air quality of the surrounding area. A hydrogen fluoride scrubber has been installed in Building 9206 and is scheduled for start-up early this year. Additional scrubbers are under construction at Building 9212.

Comment

Although the start-up of the Building 9206 scrubber has been postponed due to safety considerations, it has not been shown that releases of HF from the Y-12 Plant have had an adverse impact on ambient air quality of the

surrounding area. Results of ambient air sampling for fluoride conducted within and around the Y-12 Plant by the Environmental Monitoring Group have consistently shown that ambient HF levels are within the state of Tennessee ambient air standards. The Building 9212 scrubber has been installed, and both scrubbers are expected to be operational by late fall 1987.

Finding

15. The holding capacity of New Hope Pond has been reduced by the accumulation of volumes of sediment over time and now may not provide sufficient containment for a large spill of hazardous material. The shorter retention time may also decrease its effectiveness as a large sedimentation basin, resulting in release of heavy metals, such as mercury into East Fork Poplar Creek. Y-12 has proposed dredging of New Hope Pond but is presently waiting solution of regulatory differences of opinion between the state of Tennessee and EPA, Region IV, regarding disposition of the dredged material.

Comment

A meeting was held with the state and EPA-IV on April 9, 1987, to discuss alternatives for New Hope Pond. Samples taken by the Y-12 Plant show that the sediment passes the EP Toxicity test. The EPA and the TDHE are reviewing the information presented, and indications are that a joint decision will be made concerning the disposition of the sludge and future status of New Hope Pond.

Finding

16. The use of fuel-oil ignition on boilers 3 and 4 will continue to require baghouse bypass resulting in opacity and mass emission limitation exceedances, which can cause or contribute to exceedances of the 24-hour primary health based on total suspended particulate standard. These boilers are scheduled for conversion to natural gas ignition during the summer of 1988.

Comment

Boilers 1 and 2 were converted to natural gas ignition (No. 2 started of natural gas on November 12, 1986, and No. 1 started on natural gas on January 19, 1987). Excess opacity due to hot standby firings have reduced to below the 1 percent operating time deminimus level since the outage for conversion began in October 1986. In April 1987, excess opacity emissions occurred for only 6 minutes in the entire month. Hot standby firings on the two oil ignition boilers are kept as low as possible by using them as the base load boilers and operating the two gas ignition boilers for standby and load swing conditions. The remaining two boilers will be converted to natural gas ignition during the summer of 1988.

Finding

17. Suspended solids are entering McCoy Branch from the filled and overflowing fly ash impoundment, potentially affecting aquatic life in this state designated "blue line" stream. Groundwater also may be contaminated by infiltration/percolation of leachate from the fly ash impoundment, McCoy Branch, and/or Rogers Quarry.

Comment

The Y-12 Plant has contracted an architect-engineer to conduct a feasibility study to investigate alternatives to provide for the treatment or elimination of this discharge. The recommended alternative is expected by July 31, 1987. In addition, a proposed Steam Plant Ash Disposal Facility Project has been submitted as an FY 1990 Line Item project. Wells were installed around Rogers quarry in 1985. Preliminary data suggest that groundwater in the vicinity of Rogers Quarry exhibits elevated concentrations of some constituents which are characteristic of ash disposal. Studies are underway to determine whether there is a net flow into or out of the quarry.

Rogers Quarry and the filled impoundment are solid waste management units and the potential release of contaminants to groundwater and surface waters will be investigated as part of the RCRA 3004(u) program. Any requirements for remedial action will be conducted as a result of those investigations. Additional wells will be installed as part of the DOE Environmental Survey sampling program.

Finding

18. Volatile organic compounds are being emitted to the atmosphere through standpipes and vents at the Bear Creek Valley Waste Disposal Area. A sampling and characterization program is being conducted by ORNL.

Comment

Volatile organic compounds have been detected in air in the standpipes which were used to vent underground trenches. However, preliminary results have not detected the compounds in the ambient air in the Bear Creek Valley Waste Disposal Area. Surveys have been conducted by the Y-12 Industrial Hygiene group in the area of the standpipes and vents, as well as other areas of known organic contamination, and have not found levels which are of concern for human health.

Finding

19. Uncontrolled, unquantified emission of coal dust to the atmosphere can occur when coal is dropped from the conveyor into open hoppers at the steam plant. This situation could potentially contribute to exceedances of the 24-hour total suspended particulate air quality standard. Y-12 has plans to close the hoppers to minimize dust emissions.

Comment

Current plans are to submit an FY 1990 Line Item Project to convert the Y-12 steam plant primary fuel from coal to natural gas. If this project is not authorized, funding will be made available in FY 1991 FCAP Project, Steam Plant Service Life Extension to provide covers for hoppers and a filtered room exhaust.

Finding

20. Gasoline vapors vented from the underground storage tank at the Y-12 gas station contribute to the ozone nonattainment problem in Anderson County. An equivalent volume of vapor is emitted each time a tank is filled. During 1986, 435,000 gallons of gasoline were purchased.

Comment

The TDHE rules for gasoline storage tanks at service stations require vapor vent controls except under certain conditions spelled out in paragraph 1200-13-18-.10(3). Exemption (c) in this list of exemptions states that the rule does not apply to rural counties. Since Anderson County is considered rural per paragraph 1200-3-18-.02(a) and (b) of the TDHE rules, these controls are not required. Also, per recent verbal communication with TDHE, Anderson County is attainment for ozone (VOCs). The 40 CFR 81 Subpart C-Section 107 Attainment Status Designations referred to in the survey are out of date and incorrect.

Finding

21. The incinerator and shredder at Building 9811 both emit particulate matter to the atmosphere, adding to the air total ambient suspended particulate load. The two chamber incinerator is not equipped with emission controls, and visible emissions have been observed.

Comment

The incinerator is designed for the burning of documents. Work is in the planning stage to upgrade emission controls for the shredder located at Building 9811. The exhaust system modification will include the installation of a new cyclone and bag filter. The project is presently unfunded. Emissions from the incinerator will be controlled in the future by limiting the material burned in the incinerator.

CATEGORY IV

Finding

22. Machine and product cleaning wipes need to be considered and handled as mixed waste. The wipe contain listed solvents and are disposed of at the Bear Creek Valley Waste Disposal Area as low-level waste. Plant personnel have indicated that EPA-IV and the state are aware of this practice and have approved it because the wipes do not produce "free standing liquids." However, RCRA does not regulate liquid wastes in terms of free standing liquids or quantities: RCRA regulates wastes merely in terms of presence. Furthermore, EPA has proposed to go beyond regulation of free standing liquids and will regulate all free liquids (i.e., liquids that could be released during a filter test or compression test). As a point of reference, similar wipes used at another DOE facility, the Rocky Flats Plant in Colorado, have been labeled as a mixed waste by the regional EPA and state and are no longer allowed to be disposed of onsite in their nonhazardous landfill.

Comment

The Y-12 Plant has previously obtained approval from the TDHE and EPA-IV to dispose of uranium-contaminated gloves without free standing liquid in the Bear Creek Valley. This approval was extended to uranium-contaminated wipes. In light of this finding, this situation has again been brought to the attention of TDHE who endorsed the approval previously granted.

Rocky Flats procedures are not a proper point of reference since the Y-12 plant is subject to state of Tennessee regulation, not state of Colorado regulations. State of Colorado hazardous waste regulations are more stringent than EPA regulations. (For additional input, refer to comment for Finding #2).

Finding

23. The incinerator at Building 97-1 has been used in trial runs to burn solids, liquids (some chlorinated), and animal carcasses; however, the permit application indicates that only "liquid waste solvents" will be incinerated.

Comment

It should be noted that this incinerator is not presently in use. While it is true that, during a trial burn (less than 16 hours), animal carcasses were used to obtain design data for an incinerator for the Biology Division and that a test burn (less than 40 hours) was conducted using organics, including dibutyl carbitol, tributyl phosphate, and trioctyl phosphine oxide, the incinerator has not been used for chlorinated solvents as stated.

Finding

24. Hazardous waste storage practices in some areas of Buildings 9720-31 and 9720-9 do not meet current standards. Inadequate aisle space does not allow for the inspection of waste identification labels on drums or container integrity. The lack of impervious secondary containment at building 9720-9 also constitutes an inadequate hazardous waste storage practice (i.e., the present means of providing secondary containment for PCBs stored in the building entails the use of wooden structures that are not sealed to the floor).

Comment

In building 9720-31 recent shipments of waste have lessened crowding of drums. In Building 9720-9, an upgrade of the entire facility is in the design stage. The modifications include installation of permanent, concrete diking. Recent shipments of waste have lessened the crowded condition of Building 9720-9 as well.

Finding

25. Data obtained in ambient air sampling for total suspended particulates may not be accurate and defensible because of siting and quality assurance deficiencies. Relocation of the west monitor is currently under way. Additionally, the filter media being used on the high volume sampler for total Suspended Particulates (TSP) does not meet reference method requirements (40 CFR 50, Appendix B) for filter efficiency.

Comment

The west TSP monitor has been relocated based on review of meteorological data. The filter media presently being used is the Watman 41 filter. Glass filters are recommended in 40 CFR 50, Appendix B; however, glass filters tried in the past did not maintain structural integrity (i.e., they splintered, resulting in the loss of sample in some cases). There may be a new glass filter introduced to the market which we plan to try. A third TSP monitor will be added for quality assurance purposes next fiscal year.

Finding

26. Two small (15 gallon) degreasers in Building 9201-1 are not covered under a current air permit.

Comment

The degreasers in question are small mobile cold solvent cleaning units which are not connected to an exhaust fan or duct system. The Tennessee Air Pollution Control Permits for the Building 9201-1 fabrication shops

are due to expire on January 1, 1988. A resubmittal of the application is due to the TDHE by November 1, 1987, and will include any modifications to the facility. At this time, these permit application renewals are being prepared and will be reviewed for accuracy and completeness. The degreasers are being added to the application.

Finding

27. The required number of bacteriological samples are not being run on the Y-12 water distribution system, and the analysis records are not being retained for the required length of time.

Comment

This situation has been corrected. The required number of bacteriological samples are being run and records will be maintained for a period of at least five years.

Finding

28. Cooling water discharges to EFPC exceed the NPDES upper pH limit of 8.5 due to the natural alkalinity in the makeup water and the corrosion inhibitor being used. Tests on reformulating the corrosion inhibitor to meet the required pH and at the same time meet toxicity criteria have been undertaken and, to date, appear to be successful.

Comment

The Y-12 cooling towers operate at pH values of 8.5 to 9.0 standard units primarily because of evaporation tends to concentrate alkaline components of the make-up water. Additionally, carbon dioxide which is acidic when dissolved in water is removed during recycle.

Operational testing and evaluation of a new corrosion inhibitor formulated to help control the pH of cooling towers are underway. Preliminary results of its effectiveness appear promising although a few parameters are marginal. It should be noted that data demonstrates that instream water quality standards are not being violated as a result of slightly elevated pH discharges from the Y-12 cooling towers. Toxicity results using both fathead minnows and *Ceriodaphnia* demonstrates that cooling tower blowdown does not adversely affect instream aquatic biota.

Finding

29. While the state has permitted the disposal of asbestos materials at the sanitary landfill, uranium-contaminated asbestos materials are being disposed of at the Bear Creek Valley Waste Disposal Area without state notification or approval.

Comment

Even though state permits and approvals have not been required for disposals in Bear Creek Burial Ground, the operation of the facility is patterned after operating requirements from the State Solid Waste Management regulations to ensure proper disposal. Contaminated asbestos is disposed in special waste cells under conditions which meet TDHE requirements.

In June 1984, approval was given by the State Solid Waste Management Division for disposal of asbestos waste at the Y-12 Centralized Sanitary Landfill. One of the requirements of the approval was that copies of disposal logs for the asbestos waste be submitted to the TDHE. Since that time, copies of disposal logs for asbestos disposals in the Bear Creek Burial Grounds as well as the Sanitary Landfill have been submitted to TDHE monthly.

Finding

30. The trash radiation monitor operation does not have sufficient quality assurance controls to verify that the analyses used to determine if the trash is contaminated or not are reliable.

Comment

Prior to start-up in 1986, the Trash Monitor Station was calibrated on trash-filled, 12-cubic-yard dumpsters that are in common use throughout the plant. The statistically designed calibration study consisted of placing known masses of depleted uranium chips at various positions within an empty dumpster and a trash-filled dumpster. The results of the study indicate that the monitoring instrumentation can monitor quantities of depleted uranium as low as 200 grams in a trash-filled, 12-cubic-yard dumpster.

The issue addressed during the Environmental Survey was the lack of quality controls needed to assure that instrumentation was not degrading over time. In response to this concern, quality control charts were developed and are used on a weekly basis to ensure the reliability of the detector crystals, photomultiplier tubes, and associated electronics at the trash monitoring station.

Finding

31. An open drain valve was discovered on a spill containment structure for a PCB transformer located outside on the south side of Building 9201-5N. Leaving drain valves open on such structures defeats the purpose of providing secondary containment.

Comment

The drain valve for this transformer dike has been closed. It is standard practice to keep such valves closed. In the future, drain valves will be checked during the quarterly inspections for PCB transformers to ensure they are kept in the closed position.

Finding

32. Three discarded 55-gallon drums were observed at the fly ash impoundment. Drum contents are unknown. These may be remnants of a formerly used floatation device or evidence of improperly disposed of materials in an area having a direct pathway to the McCoy Branch, a nearby stream.

Comment

Upon return to this area, four additional drums were found. All seven of the drums were empty and have been removed and disposed of properly. The drums are believed to be those used as flotation devices for a catwalk which extended from the side of the impoundment to the overflow pipe.

Finding

33. Not all groundwater monitoring wells are secured against tampering. A potential exists for vandals to damage the unlocked wells and possibly contaminate the groundwater. A number of wells with cracked slabs and insufficient protection with bumper posts also exist.

Comment

Several hundred groundwater monitoring wells are in place in the Y-12 area. The wells are under a maintenance program which identifies, repairs, and replaces damaged slabs, caps, and locks. The wells are exposed to the weather, and the slabs are subjected to freeze-thaw conditions and are occasionally cracked. Locks and hasps on wells also break through use and are replaced; wells currently used for monitoring are locked.

Protective bumper posts are in place around wells in traffic areas. Isolated wells which are accessed only for sampling may not require bumper post for damage protection.

Finding

34. The Environmental Laboratory Quality Assurance (QA) program does not entirely meet commonly accepted QA program requirements. In particular, a formal analyst qualification program has not been implemented; there is no current QA program for asbestos analyses; work station logbooks are not used in the environmental radiochemistry laboratory (Building 9720-6); the environmental radiochemistry laboratory also lacks formal written procedures for conducting quality control checks of the radiation counting equipment; and a number of buffers in use have exceeded expiration dates.

Comment

An existing procedure outlining the qualification of analysts is now being rewritten. It is scheduled to be issued by October 1, 1987.

The laboratory is now participating in the NIOSH PAT program which includes asbestos counting. In addition, an exchange program is being set up among ORO laboratories for the analysis of samples for asbestos. A program has begun for comparison of results between analysts within the Y-12 Laboratory as well.

Where appropriate, logbooks will be used to record quality data such as spike recovery and duplicate samples. Implementation will begin by August 28, 1987.

A program began to provide a monthly review of chemicals having expiration dates in the laboratories. This was done by the laboratory supervisor or his/her representative. Implementation began June 12, 1987.

PRELIMINARY

APPENDIX F

CHEMICAL SYMBOLS, ABBREVIATIONS, AND ACRONYMS

α	-	Alpha
ACN	-	Acetonitrile
Ag	-	Silver
Al	-	Aluminum
ALARA	-	As Low as Reasonably Achievable
ANL	-	Argonne National Laboratory
As	-	Arsenic
ASTM	-	American Society for Testing and Materials
β	-	Beta
B	-	Boron
Ba	-	Barium
BCBG	-	Bear Creek Burial Grounds
BCVWDA	-	Bear Creek Valley Waste Disposal Area
Be	-	Beryllium
BeO	-	Beryllium Oxide
BOD	-	Biological Oxygen Demand
Btu	-	British Thermal Unit
Ca	-	Calcium
CaCO ₃	-	Calcium Carbonate
CAA	-	Clean Air Act
Cd	-	Cadmium
Ce	-	Cesium
CERCLA	-	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	-	Code of Federal Regulations
Ci	-	Curie
Cl	-	Chlorine
cm	-	Centimeter
CN	-	Cyanide
Co	-	Cobalt
COD	-	Chemical Oxygen Demand
CPCF-I	-	Central Pollution Control Facility - I
CPCF-II	-	Central Pollution Control Facility - II
CRK	-	Clinch River Kilometer

Cr	-	Chromium
CRSDB	-	Chestnut Ridge Sediment Disposal Basin
CRBAWP	-	Chestnut Ridge Borrow Area Waste Pile
Cu	-	Copper
Cu ft	-	Cubic Foot
1,2-DCE	-	1,2-dichloroethene
DCG	-	Derived Concentration Guide
DOE	-	Department of Energy
DOT	-	Department of Transportation
d/min/100cm ²	-	Disintegrations per minute per 100 square centimeters
dpm/cm ²	-	Disintegrations per minute per square centimeter
EC	-	Electrical Conductivity
EFPC	-	East Fork Poplar Creek
EIS	-	Environmental Impact Statement
EP	-	Extraction Procedure
EPA	-	U.S. Environmental Protection Agency
F	-	Fluorine
Fe	-	Iron
ft	-	foot
ft ³ /min	-	Cubic feet per minute
FR	-	Federal Register
FUSRAP	-	Former Utilized Sites Remedial Action Program
g	-	gram
Ga	-	Gallium
GE	-	General Electric Co.
G&M	-	Geraghty and Miller, Inc.

HCDA	-	Hazardous Chemical Disposal Area
HEPA	-	High Efficiency Particulate Air Filter
HF	-	Hydrogen Fluoride
Hg	-	Mercury
HLW	-	High Level Waste
H&R	-	H&R Technical Associates
HSE&A	-	Health, Safety, Environmental, and Accountability
ICRP	-	International Commission for Radiation Protection
IH	-	Industrial Hygiene
K	-	Potassium
kg	-	kilogram
km	-	kilometer
l	-	liter
La	-	Lanthanum
lb	-	Pound
lb/10 ⁶ Btu	-	pound per million Btu
Li	-	Lithium
LLW	-	Low Level Waste
LLWDDD	-	Low Level Waste Disposal Development Demonstrations
m	-	meter
Mg	-	Magnesium
mg	-	milligram
mg/l	-	milligram per liter
mg/kg	-	milligram per kilogram
mg/m ³	-	milligram per cubic meter
ml	-	milliliter
mho	-	unit of electrical conductance
mil	-	inch x 0.001
mm	-	millimeter
MMES	-	Martin Marietta Energy Systems, Inc.
Mn	-	Manganese

Mo	-	Molybdenum
MOU	-	Memorandum of Understanding
MSDS	-	Material Safety Data Sheet
mR/hr	-	milliroentgen per hour
mrem/yr	-	millirem per year
N	-	Nitrogen
Na	-	Sodium
NAAQS	-	National Ambient Air Quality Standards
Nb	-	Niobium
NCRP	-	National Council on Radiation Protection and Measurement
NESHAP	-	National Emission Standards for Hazardous Air Pollutants
NH ₃ -N	-	Ammonia Nitrogen
Ni	-	Nickel
Np	-	Neptunium
NPDES	-	National Pollutant Discharge Elimination System
NPDWS	-	National Primary Drinking Water Standards
NO ₃	-	Nitrate
NRC	-	Nuclear Regulatory Commission
ORAU	-	Oak Ridge Associated Universities
ORGDP	-	Oak Ridge Gaseous Diffusion Plant
ORM	-	Other Regulated Material
ORNL	-	Oak Ridge National Laboratory
ORO	-	Oak Ridge Operations
ORR	-	Oak Ridge Reservation
OSHA	-	Occupational Safety and Health Act
P	-	Phosphorus
Pb	-	Lead
PCB	-	Polychlorinated Biphenyl
PCE	-	Perchloroethene (Tetrachloroethene)
pCi	-	pico Curie
PDM	-	Project Description Memorandum
PIDAS	-	Perimeter Intrusion Deterrent Alarm System
ppb	-	parts per billion

ppm	-	parts per million
PSD	-	Prevention of Significant Deterioration
Pu	-	Plutonium
PVC	-	Polyvinyl Chloride
QA	-	Quality Assurance
QC	-	Quality Control
Ra	-	Radium
RCRA	-	Resource Conservation and Recovery Act
Ru	-	Ruthenium
S&A	-	Sampling and Analysis
Sc	-	Scandium
SDWA	-	Safe Drinking Water Act
Se	-	Selenium
SFMP	-	Surplus Facilities Management Plan
Si	-	Silicon
SPCCC	-	Spill Prevention Control, Countermeasure, and Contingency
SO ₄	-	Sulfate
Sq ft	-	Square Foot
Sr	-	Strontium
Tc	-	Technetium
TCMP	-	Toxicity Control and Monitoring Program
TDHE	-	Tennessee Department of Health and Environment
Th	-	Thorium
Ti	-	Titanium
TKN	-	Total Kjeldahl Nitrogen
TLD	-	Thermoluminescent Dosimeter
TMS	-	Trash Monitoring Station
TOC	-	Total Organic Carbon
TSCA	-	Toxic Substances Control Act
TSP	-	Total Suspended Particulates
TVA	-	Tennessee Valley Authority

μCi	-	micro Curie
μg	-	microgram
μm	-	micrometer
$\mu\text{mho/cm}$	-	micro mho per centimeter
$\mu\text{R/hr}$	-	micro Roentgen per hour
$\mu\text{S/cm}$	-	micro Siemen per centimeter
U	-	Uranium
U-234	-	Uranium-234
U-235	-	Uranium-235
U-238	-	Uranium-238
UCND	-	Union Carbide Corporation - Nuclear Division
UEFPC	-	Upper East Fork Poplar Creek
UF_4	-	Uranium tetrafluoride
UNC	-	United Nuclear Corporation
UO_2	-	Uranium Dioxide
UO_3	-	Uranium Trioxide
USGS	-	U.S. Geological Survey
UST	-	Underground Storage Tank
V	-	Vanadium
VOC	-	Volatile Organic Compound
WCPF	-	Waste Coolant Processing Facility
WTSD	-	Waste Transportation, Storage, and Disposal
Y	-	Yttrium
Yd^3	-	Cubic Yard
Zn	-	Zinc
Zr	-	Zirconium
<	-	less than
>	-	greater than

PRELIMINARY

APPENDIX G

DISCHARGES FROM Y-12 BUILDINGS TO THE STORM DRAIN SYSTEM

TABLE G-1

BUILDING DISCHARGES TO STORM DRAIN SYSTEM

Building	Water k gal/yr	Heating and Cooling Condensate k gal/yr	Tower Blow Down Or Treated Water k gal/yr	Photo Lab (Diluted) k gal/yr	Photo Lab (Undiluted) k gal/yr	Lab Acid Waste (Oil) k gal/yr	Lab Basic Waste (Oil) k gal/yr	Lab Organic Waste (Oil) k gal/yr	Actual Lab Waste (Undiluted) gal/yr	Contaminated Wash/Mop Wastes (Oil) k gal/yr	Total k Gallons Per Year	Gallons Per Day
9103		10,445									10,445	28,616
9202	4,000	6,953		2	(20)	35	7	9	(500)	3 11	11,008	30,160
9203 and 9203A	4,000	3,086		12 8	(128)						7,098	19,448
9205		695									695	1,904
9206	58,105	54,983								424 72	113,513	310,993
9207	105	27,811	8	2 5	(25)			6	(60)		27,932	76,527
9208		2,582									2,582	7,073
9210	10	4,196									4,206	11,523
9211		1,370	8								1,378	3,775
9212	91,815	26,501	0 6							234 5	118,551	324,797
9215	42,543	10,150		36	(360)	149			(149)	25 9	82,903	144,942
9224		0 5									0 5	1
9201-1	78,872	3,153								149 3	82,174	225,135
9201-2	76,558	10,542								0 2	87,100	238,630
9201-3	172,359	15,768		24	(240)		26		(26 kg)		188,177	515,553

TABLE G-1
BUILDING DISCHARGES TO STORM DRAIN SYSTEM
PAGE TWO

Building	Water k gal/yr	Heating and Cooling Condensate k gal/yr	Tower Blow Down Or Treated Water k gal/yr	Photo Lab (Diluted) k gal/yr	Photo Lab (Undiluted) gal/yr	Lab Acid Waste (Oil) k gal/yr	Lab Basic Waste (Oil) k gal/yr	Lab Organic Waste (Oil) k gal/yr	Actual Lab Waste (Undiluted) gal/yr	Contaminated Wash/Mop Wastes (Oil) k gal/yr	Total k Gallons Per Year	Gallons Per Day
9201-4	15,620	7,884								50.1	23,554	64,531
9201-5	30,662	1,800		54	(540)				(600)	67.8	32,583	89,270
9201-5N	11,348	10,080		146	(1,460)					17.0	21,591	59,153
9201-5W	37,308										37,308	102,213
9204-1	138,761	1,008								1.1	139,770	382,931
9204-2	7,884	16,690								624.6	25,198	69,037
9204-2E	15,192	91,476		360	(3,600)						107,028	293,227
9204-3	8,000	29,900				384	6	5	(19 kg) (369 Gal)		38,295	104,917
9204-4	135,081	11,980		180	(1,800)					444.7	147,685	404,618
9401-2	12,125									8,870.0	20,995	57,520
9401-3	26,000	140								43,520.0	69,660	190,849
9404-1	3,453										3,453	9,460
9404-2		19.7								0.025	19.7	54
9404-3	0.4										0.4	1
9404-5		6.5								5.4	11.9	33
9404-9	1,602	5,507									7,109	19,476

**TABLE G-1
BUILDING DISCHARGES TO STORM DRAIN SYSTEM
PAGE THREE**

Building	Water k gal/yr	Heating and Cooling Condensate k gal/yr.	Tower Blow Down Or Treated Water k gal/yr.	Photo Lab. (Diluted) k gal/yr.	Photo Lab. (Undiluted) gal/yr	Lab Acid Waste (Oil) k gal/yr	Lab Basic Waste (Oil) k gal/yr	Lab Organic Waste (Oil) k gal/yr.	Actual Lab Waste (Undiluted) gal/yr	Contaminated Wash/Mop Wastes (Oil) k gal/yr	Total k Gallons Per Year	Gallons Per Day
9404-11		438									438	1,200
9404-18										12	12	32
9409-2			5,700								5,700	15,616
9409-4			14,000								14,000	38,356
9409-6			4,700								4,700	12,876
9409-10			8,500								8,500	23,287
9409-12			8,000								8,000	21,917
9409-13			23,000								23,000	63,014
9409-15			2,800								2,800	7,671
9409-16			2,800								2,800	7,671
9409-17			5,000								5,000	13,698
9409-18/31			9,000								9,000	24,658
9409-19			5,000								5,000	13,698
9409-22			3,800								3,800	10,410
9409-23			7,600								7,600	20,822
9409-24			7,200								7,200	19,726

TABLE G-1
BUILDING DISCHARGES TO STORM DRAIN SYSTEM
PAGE FOUR

Building	Water k gal/yr	Heating and Cooling Condensate k gal/yr	Tower Blow Down Or Treated Water k gal/yr	Photo Lab (Diluted) k gal/yr	Photo Lab (Undiluted) k gal/yr	Lab Acid Waste (Oil) k gal/yr	Lab Basic Waste (Oil) k gal/yr	Lab Organic Waste (Oil) k gal/yr	Actual Lab Waste (Undiluted) gal/yr	Contaminated Wash/Mop Wastes (Oil) k gal/yr	Total k Gallons Per Year	Gallons Per Day
9409 26			8,500								8,500	22,287
9409-27			4,000								4,000	10,958
9409-28/29			4,200								4,200	11,506
9409 30			2,800								2,800	7,671
9409 32			2,800								2,800	7,671
9409 33			700								700	1,918
All Towers			5,000								5,000	13,698
9610		31									31	8
9620-2		13									13	36
9704-2	1,518	788									2,306	6,317
9706-1	1,051	1,576									2,627	7,197
9706-1A	525	1,576	2,600								4,701	12,879
9706-2	2,102	4,665	2,600	12	(12)	2			(2)		9,370	25,671
9709		12,614		34	(340)						12,648	34,652
9710-2		36									36	10
9711-1		3,942	2,600								6,542	17,923

**TABLE G-1
BUILDING DISCHARGES TO STORM DRAIN SYSTEM
PAGE FIVE**

Building	Water k gal/yr.	Heating and Cooling Condensate k gal/yr	Tower Blow Down Or Treated Water k gal/yr	Photo Lab (Diluted) k gal/yr	Photo Lab (Undiluted) k gal/yr	Lab Acid Waste (Oil) k gal/yr	Lab Basic Waste (Oil) k gal/yr	Lab Organic Waste (Oil) k gal/yr	Actual Lab Waste (Undiluted) k gal/yr	Contaminated Wash/Mop Wastes (Oil) k gal/yr	Total k Gallons Per Year	Gallons Per Day
9711-5		2,600	2,600								5,200	14,246
9712		6,306								52	6,358	17,419
9720-1		10									10	3
9720-2		4,706									4,706	12,892
9720-4		4,706									4,706	12,892
9720-6	9,332	15,768	2,600							52.15	27,752	76,033
9720-7		4,706									4,706	12,893
9720-8		6,051									6,051	16,578
9720-13									12		12	33
9723-4		4,730									4,730	12,959
9723-5		1,576									1,576	4,318
9723-8		4,730									4,730	12,959
9723-11A		131									131	359
9723-14		43									43	118
9723-24	790										790	2,164
9728	5,256									6,000	11,256	30,838

**TABLE G-1
BUILDING DISCHARGES TO STORM DRAIN SYSTEM
PAGE SIX**

Building	Water k gal/yr.	Heating and Cooling Condensate k gal/yr.	Tower Blow Down Or Treated Water k gal/yr.	Photo Lab (Diluted) k gal/yr.	Photo Lab (Undiluted) gal/yr.	Lab Acid Waste (Oil) k gal/yr.	Lab Basic Waste (Oil) k gal/yr.	Lab Organic Waste (Oil) k gal/yr.	Actual Lab Waste (Undiluted) gal/yr.	Contaminated Wash/Mop Wastes (Oil) k gal/yr.	Total k Gallons Per Year	Gallons Per Day
9731	6,307	1,554		30	(600)					316	7,922	21,705
9733-1		3,153	2,600								5,753	15,761
9733-2		3,153									3,153	8,638
9733-3		3,153									3,153	8,638
9733-4	52,560	1,576									54,136	148,317
9734	2,102	2,365									4,467	12,238
9735	4,204	2,369	2,600								9,169	25,120
9736		7,884									7,884	21,543
9737	577	15,768				76			(76)	122	16,543	45,323
9738		3,153									3,153	8,640
9739		2,365	4,200								6,565	17,986
9744	52										52	14
9764	2,628	1,555									4,183	11,460
9766	21,029	9,460	5,200	0.1	(100)						35,689	97,178
9767-1										1	1.0	3
9767-2		65									65.0	178

**TABLE G-1
BUILDING DISCHARGES TO STORM DRAIN SYSTEM
PAGE SEVEN**

Building	Water k gal/yr	Heating and Cooling Condensate k gal/yr	Tower Blow Down Or Treated Water k gal/yr	Photo Lab (Diluted) k gal/yr	Photo Lab (Undiluted) gal/yr	Lab Acid Waste (Oil) k gal/yr	Lab Basic Waste (Oil) k gal/yr	Lab Organic Waste (Oil) k gal/yr	Actual Lab Waste (Undiluted) gal/yr	Contaminated Wash/Mop Wastes (Oil) k gal/yr	Total k Gallons Per Year	Gallons Per Day
9767-5	7,776										7,776	21,304
9767-7		4,000									4,000	10,959
9767-8		66									66	18
9805-1	2,844										2,844	7,791
9808										6,000	6,000	16,438
9818	18,400									600	19,000	52,054
9976		788									788	2,159
9980				360	(3,600)						360	986
9981				360	(3,600)						360	986
9995	2,103	7,889				4,279	650	13	(4,995)		14,934	40,915
9996	6,451	4,733									11,184	30,641
9998	14,727	8,328								500	23,555	64,534
TOTALS	1,133,690	519,713	162,716.6	1602.6	(16,425)	4,924	689	33	(6,811)	67,821.2	1,891,189	5,181,311

Note: Undiluted wastes indicated in () are not included in totals.

TABLE G-2

DETAILED BUILDING CONTAMINATED PROCESS DISCHARGE DATA

BUILDING 9202

UNDILUTED LABORATORY CHEMICALS

Gallons/Year	Description
11	Acetone
17	Alcohols (ethanol and isopropanol)
3	Ammonium Hydroxide (58%)
60	Hydrochloric Acid (concentrated)
162	Nitric Acid (70%), traces of metals
12	Phosphoric Acid (85%)
1	Sodium Carbonate (3%), Hydrogen Peroxide (10%) Solution
10	Sodium Chloride Solution
42	Sodium Hydroxide Solution
10	Sodium Nitrate Solution
57	Sulfuric Acid (98%)
3	Sulfuric Acid, Sodium Dichromate Etch Solution
13	Calcium Carbonate (1%) Denitrification Bacteria (0.1%)
10	Wash Solution, < .1% Lithium Hydroxide
1	Chromic Acid
6	2-Methoxyethyl Ether
1	Etch Solutions, HF, H ₂ O ₂ , Lactic Acid, Oxalic Acid
1	Phosphoric Acid (81%), Nitric Acid (3%) Cleaning Solution
2	Phosphoric Acid (97%), Chromic Acid (3%) Electropolishing Solution
25	Zirconium Oxynitrate
50	Trichloroethane, Trace Uranium Oxide
3	Methylene Chloride

TABLE G-2
DETAILED BUILDING CONTAMINATED PROCESS DISCHARGE DATA
PAGE TWO

BUILDING 9202
PHOTOGRAPHIC DEVELOPING SOLUTIONS (UNDILUTED)

Gallons/Year	Description
6	Hypo-Clear Solution
2	Sodium Sulfite, Sodium Carbonate Solution
12	Sodium Thiosulfate, Acetic Acid Solution

BUILDING 9202
WASH SOLUTIONS

3,110	Water, Sulfonated Detergent (2%), Trace Oil, Uranium
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BUILDING 9203
PHOTOGRAPHIC DEVELOPING SOLUTIONS (UNDILUTED)

12	Dupont Cronex Developer
12	Dupont Fixer
20	Print Processor, Contains Sodium Hydroxide
40	Print Processor, Contains Sulfurous Acid
20	Print Processor, Contains Acetic Acid
12	Developer, Kodak D-19, 21 oz./gallon
12	Fixer, Contains Boric Acid

BUILDING 9206

130,000	Decon Solution Detergent, Trace Thorium, Uranium
24,000	Cleaning Solution - Detergent (nacconol - 1 lb/200 gal), Trace Uranium
240,000	Wash Solution - Sodium Carbonate, Laundry Soap, Detergent, Trace Uranium
720	Mop Water - Detergent, Trace Uranium
30,000	Scrubber Waste - <250 ppm Uranium

TABLE G-2
DETAILED BUILDING CONTAMINATED PROCESS DISCHARGE DATA
PAGE THREE

BUILDING 9207, 9210, 9211, 9220, AND 9224

Gallons/Year	Description
60	Undiluted Organics - Ethanol, Methanol, Butanol, Ethers, Chloroform, Trace of Chromic and Hydrochloric Acids
25	Developer and Activator Rinse (undiluted)

BUILDING 9212

2,400	Mop Water - Detergent, <100 ppm Uranium
10,000	Scrubber Solution - Sodium Hydroxide (10%) Sodium Nitrate (10.5%), BaO (8%), <9 ppm Uranium
60,000	Caustic Solution - Sodium Hydroxide (3.5%) Barium Oxide (3%), <2 ppm Uranium
120,000	Caustic Solution - Sodium Hydroxide (10%), <8 ppm Uranium
41,600	Water with Trace Zirconium Silicate Powder
500	Compressor Blowdown - Water, Oil

BUILDING 9215

1,500	Wash - Vestal LPH Germacidol Detergent (10%)
10,000	Quench Water - UCON "A" Cooling Medium (1%)
14,400	Mop Water - Detergent, <140 ppm Uranium

BUILDING 9215

UNDILUTED LABORATORY CHEMICALS

6	Hydrochloric Acid
12	Nitric Acid
6	Sulfuric Acid
12	Phosphoric Acid
2	Fluoroboric Acid
7	Chromic Trioxide Solution
5	Cupric Ammonium Chloride Solution

TABLE G-2
DETAILED BUILDING CONTAMINATED PROCESS DISCHARGE DATA
PAGE FOUR

BUILDING 9215
UNDILUTED LABORATORY CHEMICALS - Continued

Gallons/Year	Description
5	Ammonium Chloride Solution
5	Potassium Ferricyanate Solution
5	Potassium Dichromate Solution
3	Hydrogen Peroxide
3	Methylene Chloride
12	Kerosene - Polishing Solution
3	Methanol
6	Trichloroethylene
24	Ethanol
3	Oxalic Acid in Water
2	Lactic Acid in Water
12	Acetic Acid in Water
6	Sodium Hydroxide in Water
5	Sodium Cyanide in Water
5	Potassium Hydroxide and Ammonium Hydroxide in Water

BUILDING 9215
PHOTOGRAPHIC DEVELOPERS (UNDILUTED)

120	Fixer - Water, Sodium Sulfite, Sodium Thiosulfate, Acetic Acid, Boric Acid, Potassium Alum.
120	Developer - Water, Sodium Sulfite, Sodium Carbonate, Elon, Potassium Bromide.
120	Developer - Water, Elon, Sodium Sulfide, Potassium Bromide.

BUILDING 9201-1

128,500 10,800	Water, Sodium Silicate (1%), Trace Metals Cleaning Solution - Detergent (alconox), Trace Oil
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TABLE G-2
DETAILED BUILDING CONTAMINATED PROCESS DISCHARGE DATA
PAGE FIVE

BUILDING 9201-2

Gallons/ Year	Description
30,000	Regeneration Solution – 50 Pounds Caustic Soda and 50 Gallons of Sulfuric Acid per 3,000 Gallons of Solution.
200	Sandblaster Waste – Water, Beads, Dirt

BUILDING 9201-3

180	Undiluted Photographic Fixer – Water, Sodium Sulfite, Sodium Thiosulfite, Boric Acid, Potassium Alum.
60	Undiluted Photographic Developer – Water, Sodium Sulfite, Sodium Carbonate, Elon, Potassium Bromide, Hydroquinone.
(26 kg)	Sodium, Sodium Hydroxide, Trace Uranium Oxide

BUILDING 9201-4

50,000	Water – Detergent, Trace of Oil, and Sodium Nitrate from ECM Operation
100	Compressor Blowdown – Water, Oil

BUILDING 9201-5

1,800	Electropolishing Rinse, Trace Phosphoric Acid, Chromic Acid, Uranium
180	Undiluted Photographic Developer – Water, Sodium Sulfite, Sodium Carbonate, Elon, Potassium Bromide
360	Undiluted Fixer – Water, Sodium Sulfite, Sodium Thiosulfite, Acetic Acid, Potassium, Alum, Boric Acid
600	Undiluted Penetrant Emulsifier – 92% Alkyl Aryl Sulfonate, 8% Polyethylene Glycol Ether
60	Undiluted Penetrant – 62% Alkyl Aryl Phosphate, 16% Aliphatic Hydrocarbon Oil, 16% Solvent, 6% Aromatic Hydrocarbons

TABLE G-2
DETAILED BUILDING CONTAMINATED PROCESS DISCHARGE DATA
PAGE SIX

BUILDING 9201-5N

Gallons/ Year	Description
14,400	Plating Shop Rinse – Trace of Plating Materials
2,600	Ultrasonic Cleaner Rinse – ppm Uranium and Titanium
960	Undiluted Photographic Fixer – Water, Sodium Sulfite, Sodium Thiosulfite, Boric Acid, Potassium Alum (Silver removed)
500	Undiluted Photographic Developer – Water, Sodium Sulfide, Sodium Carbonate, Elon, Potassium Bromide, Hydroquinone.

BUILDING 9204-1

1,100	Vapor Blaster Waste – Water, Aluminum Oxide
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BUILDING 9204-2

35,100	Hydrochloric Acid (concentrated)
7,000	Condensate with Trace of D ₂ O
580,000	Condensate with Trace of Lithium Compounds
1,500	Wash – Lithium Compounds, Dirt
1,000	Compressor Blowdown – Water with Oil

BUILDING 9204-2E

1,200	Undiluted Photographic Developer – Water, Sodium Sulfite, Sodium Carbonate, Elon, Potassium Bromide, Hydroquinone
2,400	Undiluted Photographic Fixer – Water, Sodium Sulfite, Sodium Thiosulfite, Acetic Acid, Boric Acid, Potassium Alum.

TABLE G-2
DETAILED BUILDING CONTAMINATED PROCESS DISCHARGE DATA
PAGE SEVEN

BUILDING 9204-3

Gallons/ Year	Description
(19 kg)	Calutron Operations – Small Quantities of Rubidium Nitrate, Strontium Nitrate, Titanium Chloride, Copper Nitrate, Iron Nitrate, Magnesium Nitrate, Calcium Hydroxide, Zinc Nitrate – Discharged in Solution
6	Ammonium Hydroxide
9	Hydrochloric Acid
349	Nitric Acid
2	Acetic Acid
3	Ethanol

BUILDING 9204-4

6	Undiluted Penetrant Waste – Emulsifier – 92% Alkyl Aryl Phosphate, 8% Polyethylene Glycol Ether
6	Undiluted Penetrant Waste – 62% Alkyl Aryl Phosphate, 16% Solvent, 6% Aliphatic Hydrocarbon Oil, 16% Solvent, 6% Aromatic Hydrocarbon
600	Undiluted Photographic Developer – Sodium Sulfite, Sodium Carbonate, Elon, Potassium Bromide, Hydroquinone
1,200	Undiluted Photographic Fixer – Sodium Sulfite, Sodium Thiosulfite, Acetic Acid, Boric Acid, Potassium Alum.
1,200	Washdown – < 1% Oil
300	Water – < 1% Caustic, ppm Uranium
360,000	Coolant Degradation Waste – 5-30% Bacteria Solids, pH-6, 100-700 ppm Nitrates, Uranium < 3 ppm, TOC 100-300 ppm.
83,200	Plating Rinse – Water, Trace Nitric Acid, Sodium Hydroxide, Ferric Chloride, Uranium, Nickel

BUILDING 9401-2

8,870,000	Plating Rinse Water – May Contain ppm of Caustic, Hydrochloric Acid, Chromic Acid, Copper, Nickel, Hydrofluoric Acid, Nitric Acid, Sulfuric Acid, Chromate, Zinc
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TABLE G-2
DETAILED BUILDING CONTAMINATED PROCESS DISCHARGE DATA
PAGE EIGHT

BUILDING 9401-3

Gallons/ Year	Description
3,000,000	Coal Yard Runoff – Acid, Coal Fines
20,000,000	Water Softener Regeneration Waste – Acid and Sodium Softeners, Neutral
20,000	Floor Drains Washdown – Water, Oil, Dirt, Coal Fines
20,500,000	Boiler Blowdown and Drain – pH, High pH, Hot

BUILDING 9404-2

25	Compressor Blowdown – Water, Oil
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BUILDING 9404-5

5,400	Paint Spray Booth – Water, Paint
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BUILDING 9404-18

12,000	Demineralizer Carbon Filter Backwash – Water, Trace Carbon, Iron
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BUILDING 9706-2

12	Undiluted Photographic Developer/Fixer Wastes
2	Miscellaneous – Laboratory Acids, Basis and Solvents Used in Medical Laboratory (undiluted)

BUILDING 9709

340	Undiluted Photographic Developer/Fixer Wastes
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BUILDING 9712

52,000	Garage Wash – Water, Detergent, Oil, Dirt
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TABLE G-2
DETAILED BUILDING CONTAMINATED PROCESS DISCHARGE DATA
PAGE NINE

BUILDING 9720-6

Gallons/ Year	Description
52,000	Spray Booth Blowdown – Water, ~ 340 lbs./Year Paint Residues
150	Demineralizer Regeneration – 6 Gallons Hydrochloric Acid and 6 Gallons of Caustic Per Year

BUILDING 9720-13

12,000	Equipment Cleaning – Water, Detergent, Oil, Dirt
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BUILDING 9728

6,000,000	Laundry Wash and Rinse Water – Water, Soap, Sour, Soda Ash, Salt, Traces of Metals
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BUILDING 9731

30,000	Demineralizer Regeneration Waste – Water, Sulfuric Acid, Caustic Soda – Neutral
600	Undiluted Photographic Developer, Fixer, Bleach, Hardener
1,000	Wash – 1% Propylene Glycol, Trace Borax, Nitrates, Phosphates

BUILDING 9737

1,000	Wash – Water, Detergent, Oil, Dirt
76	Cleaning Solutions – Toluene, Ethanol, Acetone
120,000	Printed Circuit Board Chemicals, Rinse Solutions Containing ppm Quantities of Ferric and Copper Chlorides and Copper Sulfate
1,000	Cleaning Solution – Water, < 1% Hydrochloric, Nitric Acids

BUILDING 9766

100	Undiluted Photographic Developer, Fixer
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TABLE G-2
DETAILED BUILDING CONTAMINATED PROCESS DISCHARGE DATA
PAGE TEN

BUILDING 9767-1

Gallons/Year	Description
1,000	Compressor Blowdown – Water, Oil

BUILDING 9808

6,000,000	Shop Washdown – Detergent, Trace Oil, Mercury, Other Metals
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BUILDING 9818

600,000	Condensate – < 200 ppm Nitrates
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BUILDING 9980, 9981

2,400	Undiluted Photographic Developer – Water, Sodium Sulfite, Sodium Carbonate, Elon, Potassium Bromide, Hydroquinone
4,800	Undiluted Photographic Fixer – Water, Sodium Sulfite, Sodium Thiosulfite, Acetic Acid, Boric Acid, Potassium Alum.

BUILDING 9995
UNDILUTED LABORATORY CHEMICALS

13	Acid Waste – 50% Acetone, 50% Mixture of Nitric, Sulfuric and Hydrochloric Acids
3,210	Acid Waste – 10% Acid (Nitric, Hydrochloric, Hydrofluoric)
650	Alkaline Waste – 1% Caustic, Trace Aluminum, Iron
26	Nitrate Solution – 0.0005N Silver Nitrate
65	Acid Waste – 1% Nitric Acid, Trace Carbonates
750	Acid Cleaning Solution – Water, Chromic Acid
130	Plating Solution – Water, Nitric Acid, Sulfuric Acid, Boric Acid, Nickel, Iron, Copper, Cadmium, Chromate, Cyanide, Zinc, Aluminum-traces
10	Acid Waste – Sulfuric Acid (30%)

TABLE G-2
DETAILED BUILDING CONTAMINATED PROCESS DISCHARGE DATA
PAGE ELEVEN

BUILDING 9995
UNDILUTED LABORATORY CHEMICALS - Continued

Gallons/ Year	Description
15	Wash - Acids, Detergent
69	Photographic Developer, Acid Waste
17	Photographic Developer, Fixer

BUILDING 9998

500	Mop Water - Water, Detergent, Trace Uranium
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Note: Discharge rate of small flows is generally intermittent.

END

DATE FILMED

11 / 20 / 90