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U.S. Department of Energy
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Environment, Safety and Health
Office of Environmental Audit

Environmental Survey Preliminary Report

Oak Ridge Gaseous Diffusion Plant
Oak Ridge, Tennessee

February 1989

PREFACE

TO

THE DEPARTMENT OF ENERGY

OAK RIDGE GASEOUS DIFFUSION PLANT

ENVIRONMENTAL SURVEY PRELIMINARY REPORT

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

The ORGDP Survey is a portion of a 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 1989.

The preliminary findings are subject to modification based on the results of the Sampling and Analysis (S&A) phase of the Survey. Preliminary findings are also subject to modification based on comments from the Oak Ridge Operations Office (ORO) concerning their technical accuracy. The modified findings will be incorporated into the Environmental Survey Summary Report.

February 1989
Washington, D.C.

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EXECUTIVE SUMMARY

Introduction

This report presents the preliminary findings from the first phase of the Environmental Survey of the U.S. Department of Energy's (DOE's) Oak Ridge Gaseous Diffusion Plant (ORGDP) conducted March 14 through 25, 1988.

The Survey is being conducted by an interdisciplinary team of environmental specialists, led and managed by the Office of Environment, Safety and Health's Office of Environmental Audit. Individual team components are being supplied by a private contractor. The objective of the Survey is to identify environmental problems and areas of environmental risk associated with ORGDP. 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 carried on at ORGDP, and interviews with site personnel.

The Survey team developed a Sampling and Analysis Plan to assist in further assessing certain of the environmental problems identified during its on-site activities. The Sampling and Analysis Plan will be executed by Idaho National Engineering Laboratory (INEL). When completed, the results will be incorporated into the ORGDP Survey findings for inclusion into the Environmental Survey Summary Report.

Site Description

ORGDP is one of three DOE facilities which make up the Oak Ridge Reservation (ORR) on federally-owned land in Roane and Anderson Counties, eastern Tennessee. The ORR occupies nearly 36,000 acres, while ORGDP's portion covers 690 hectares (ha) (1,700 acres) in the westernmost part of the reservation. About 285 ha (707 acres) (within a security fence) are considered "developed," with about 120 major buildings and structures. The remaining 405 ha (1,000 acres) are woodlands, rolling hills, and open space.

ORGDP was involved in the production of enriched uranium using the gaseous diffusion process until September 1985, when it was placed on "ready standby" status. In December 1987, the production facilities were officially placed in a shutdown mode. The site remains active in several scientific missions, including:

- Research and development of advanced enrichment methods
- Engineering and computer support studies
- Analytical laboratory programs
- State-of-the-art waste treatment facilities
- Toxic Substances Control Act (TSCA) incineration studies

Employee population was 4,428 prior to the shutdown of the enrichment production facilities, and still remains at about 4,000 at current levels of activity. Most of the present staff work in technical service and program support divisions, with increasing attention being given to research, development, and waste management efforts. Martin Marietta Energy Systems, Inc. (MMES), is the contractor selected by DOE to operate all ORR facilities, including Y-12 and the Oak Ridge National Laboratory (ORNL).

The Survey team met with representatives of state and Federal agencies on February 11, 1988, to describe the Survey and discuss any concerns that they might have about the site. No major issues or concerns were raised.

Summary of Findings

The major preliminary findings of the Environmental Survey of ORGDP are as follows:

- There are more than 70 areas on-site that are actual or potential sources of soil, surface water, and groundwater contamination. The sites, most of which ORGDP is aware of, range in size from small spills to multi-acre landfills. The degree to which the areas have been characterized is highly variable.

- There appear to be at least 12 areas on-site where groundwater is contaminated with organics, radionuclides, metals, and other contaminants. Concentrations of some contaminants have exceeded drinking water standards.

- The groundwater monitoring program has a number of deficiencies which reduce the utility of the program to define the nature and extent of groundwater contamination.

- Lack of sufficient treatment and disposal capacity for mixed (hazardous/radioactive), mixed polychlorinated biphenyl (PCB), and radioactive wastes may result in improper storage and handling of these wastes on-site and in an increased potential for release of hazardous constituents to the environment.

Overall Conclusions

The Survey found no environmental problems at ORGDP that represent an immediate threat to human life. The preliminary findings identified at ORGDP by the Survey do indicate that the site has some potentially significant environmental problems, which are predominantly a result of past practices. The most pressing problem facing the site at present is the presence of numerous actual and potential sources of groundwater contamination on-site, and inadequacies in the groundwater monitoring program, which make it difficult to characterize the nature and extent of contamination.

The environmental problems described in this report vary in terms of their magnitude and risk, and 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 the groundwater investigation and site remediation activities, will contribute toward meeting this requirement.

Transmittal and Follow-up of Findings

The preliminary findings of the Environmental Survey of the ORGDP were shared with the DOE Oak Ridge Operations Office (ORO) and the site contractor at the Survey closeout briefing held March 25, 1988. The ORO presented the preliminary Survey findings to the Region IV office of the U.S. Environmental Protection Agency (EPA) and the TDHE on April 25, 1988, and June 8, 1988, respectively. By July 8, 1988, ORO had developed a draft action plan to address the preliminary Survey findings. A final action plan addressing all the Survey findings cited herein will be prepared by ORO within 45 days after receiving this Preliminary Report. Those problems that involve extended studies and multiyear budget commitments will be the subject of the Environmental Survey Summary Report and the DOE-wide prioritization.

Within the Office of the Assistant Secretary for Environment, Safety and Health, the Office of Environmental Guidance and Compliance (OEG) has immediate responsibility for monitoring environmental compliance and the status of the ORGDP Survey findings. The Office of Environmental Audit will continue to assess the environmental problems through a program of systematic environmental audits that will be initiated toward the conclusion of the DOE Environmental Survey in 1989.

1.0 INTRODUCTION

The purpose of this report is to present the preliminary findings made during the Environmental Survey conducted March 14 through March 25, 1988, at the U.S. Department of Energy's (DOE's) Oak Ridge Gaseous Diffusion Plant (ORGDP) near Oak Ridge, Tennessee. ORGDP is operated for DOE by Martin Marietta Energy Systems, Inc. Since this is a Preliminary Report, the contents are subject to revision. Revisions based on Oak Ridge Operations Office (ORO) review and comments concerning the technical accuracy, the results of the Sampling and Analysis (S&A) phase of the Survey, and other pertinent information that may be obtained by the Survey team will be incorporated into the Environmental Survey Summary Report.

The ORGDP Survey is part of the larger, comprehensive DOE Environmental Survey effort announced by Secretary John S. Herrington on September 18, 1985. The purpose of the Environmental Survey is to identify, via a "no fault" baseline Survey of all the Department's major operating facilities, existing environmental problems and areas of environmental risk. The identified problem areas will be prioritized in 1989 on a Department-wide basis in order of importance. The prioritization will enable DOE to more effectively address environmental problems and 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 are, however, used in the Survey as a means of identifying existing and potential environmental problems and risk.

The ORGDP Environmental Survey is being conducted by an interdisciplinary team of environmental specialists headed and managed by the Office of Environment, Safety and Health's Office of Environmental Audit. A complete list of Survey participants and their affiliations is included 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 DOE Environmental Survey Manual. 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. A summary of the site-specific Survey activities is presented in Appendix B, and the Survey Plan is presented in Appendix C.

The preliminary Survey findings are presented in Chapters 3 and 4 in the form of existing and potential environmental problems. Chapter 3 includes those findings that pertain to a specific environmental medium, e.g., air or soil, while Chapter 4 includes those that are non-media-specific, e.g., waste management, radiation, and quality assurance. Because the findings vary greatly in terms of magnitude, risk, and characterization, and consequently require different levels of management attention and response, they are further divided into four categories within each of the sections in Chapters 3 and 4.

The criteria for placing a finding into one or more 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 timeframe of the DOE-wide Survey.

- Evidence that the likelihood is high for an unplanned release due to, for example, the condition or design of pollution abatement or monitoring equipment or other 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 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, more 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 category, the range of alternatives available for response, and the corresponding timeframes for response, are the greatest. Environmental problems included within this category will typically require lengthy investigation and remediation phases, as well as multi-year 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, even though below those established by regulatory authorities, that 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 an environmental problem.

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 Offices and appropriate Program Office for appropriate 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 ORGDP Survey is S&A. The Idaho National Engineering Laboratory (INEL), the S&A team for ORGDP, began taking samples in October 1988. Prior to sampling, an S&A Plan was prepared by DOE and the INEL in accordance with the protocols in the DOE Environmental Survey Manual. The S&A Plan is designed to fill existing data gaps or weaknesses. The results generated by the S&A effort are used to assist the Survey team in further defining the existence and extent of environmental problems and risks identified during the Survey.

It is clear that the findings and observations in this report are highly varied in terms of magnitude, risk, and characterization. Consequently, the priority, magnitude, and timeliness of near-term responses require careful planning to ensure appropriate and effective application. The information in this Preliminary Report will assist the ORO in planning these near-term responses.

The ORO submitted a draft action plan dated July 8, 1988, in response to the preliminary findings presented at the conclusion of the on-site Survey activities and summarized in the ORGDP Survey Status Report dated April 27, 1988. The draft action plan for the ORGDP Survey has been reviewed by the Office of Environmental Guidance and Compliance (OEG), which has immediate responsibility for monitoring the status and overseeing the adequacy of corrective action taken by the Operations Office in response to the Survey findings.

As required in the December 2, 1987, memorandum from the Assistant Secretary for Environment, Safety and Health to the Operations Office Manager entitled, Follow-up of Environmental Survey Findings, the ORO will prepare and submit a final action plan to the Deputy Assistant Secretary (DAS) for Environment within 45 days after receiving this Preliminary Report. The final action plan for the ORGDP Survey will address all the preliminary findings cited herein, and will incorporate OEG's comments on the draft action plan.

2.0 GENERAL SITE INFORMATION

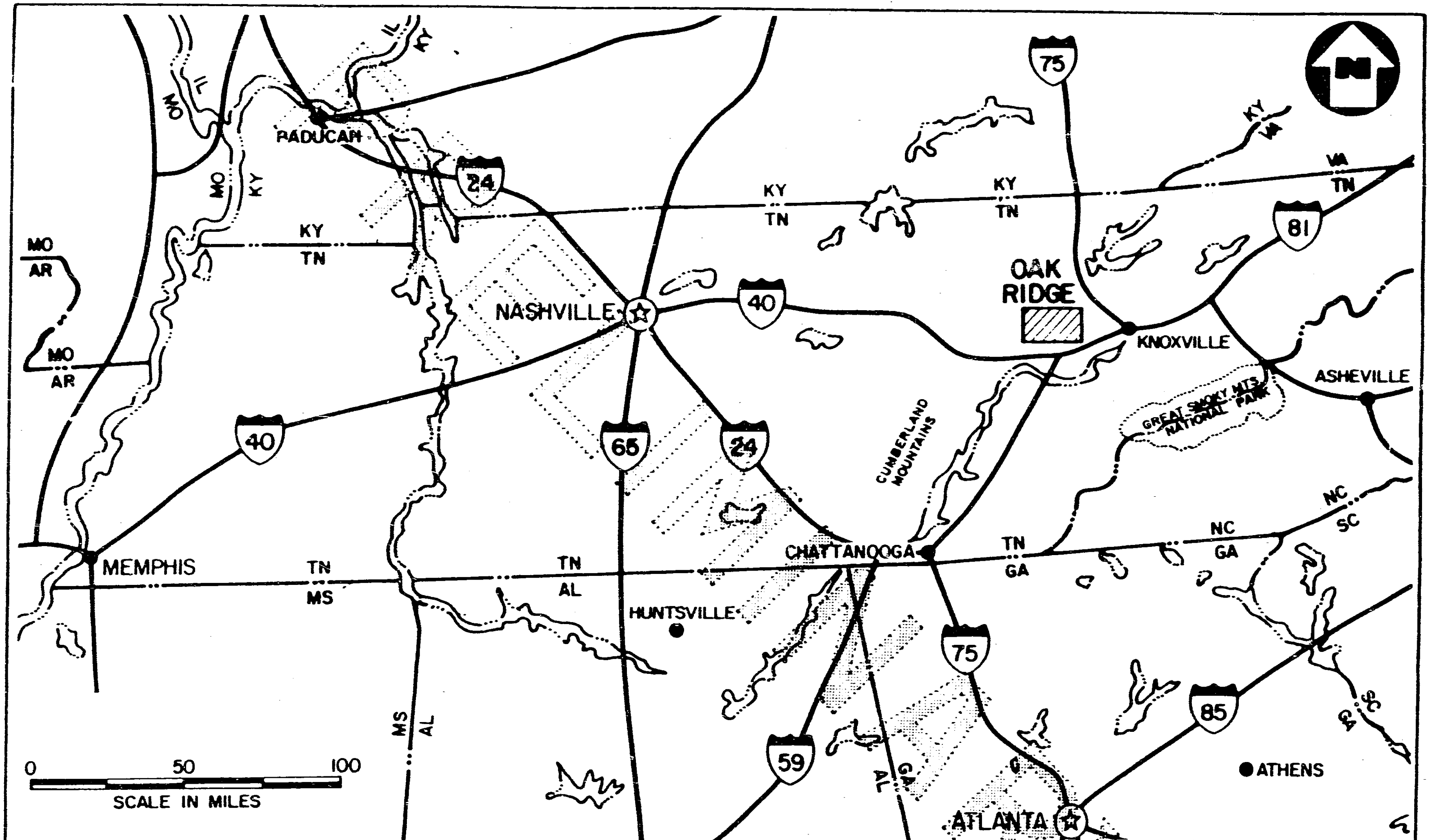
2.1 Site Setting

The Oak Ridge Gaseous Diffusion Plant (ORGDP) is part of the U.S. Department of Energy's (DOE) Oak Ridge Reservation (ORR) in eastern Tennessee. The ORGDP site occupies 690 hectares (ha) (1,700 acres) in the westernmost part of the 14,260-ha (35,240-acre) ORR. Of the total ORGDP area, about 285 ha (707 acres) within security fencing are considered developed. The other two DOE installations on the reservation are the Oak Ridge National Laboratory (ORNL) in the central region and the Y-12 Plant in the easternmost part of ORR. Refer to Figure 2-1 for locating Oak Ridge in relation to its geographic region, and to Figure 2-2 for the location of the three major installations on ORR (Oakes et al., 1987a).

Except for the City of Oak Ridge, land within 8 kilometers (km) (5 miles) of ORR is mainly rural, used largely for small-scale farming and pasturage of cattle. Recreational activities, including fishing, boating, swimming, and water skiing, are widely practiced in the rivers and lakes of the area. The 80-km (50-mile) population distribution includes a number of cities and towns in addition to rural areas, totaling over 1.1 million people. Population centers and locations may be summarized as follows:

Name	Distance From ORGDP (km)	Distance From ORGDP (mi)	Direction From ORGDP	Population (1980)
Oak Ridge (city)	11	7	Northeast	28,000
Oliver Springs	13	8	North	3,600
Clinton	30	19	Northeast	5,300
Lenoir City	19	12	Southeast	5,400
Kingston	11	7	Southwest	4,400
Harriman	14	9	West	8,300
Knoxville	42	26	East	183,000

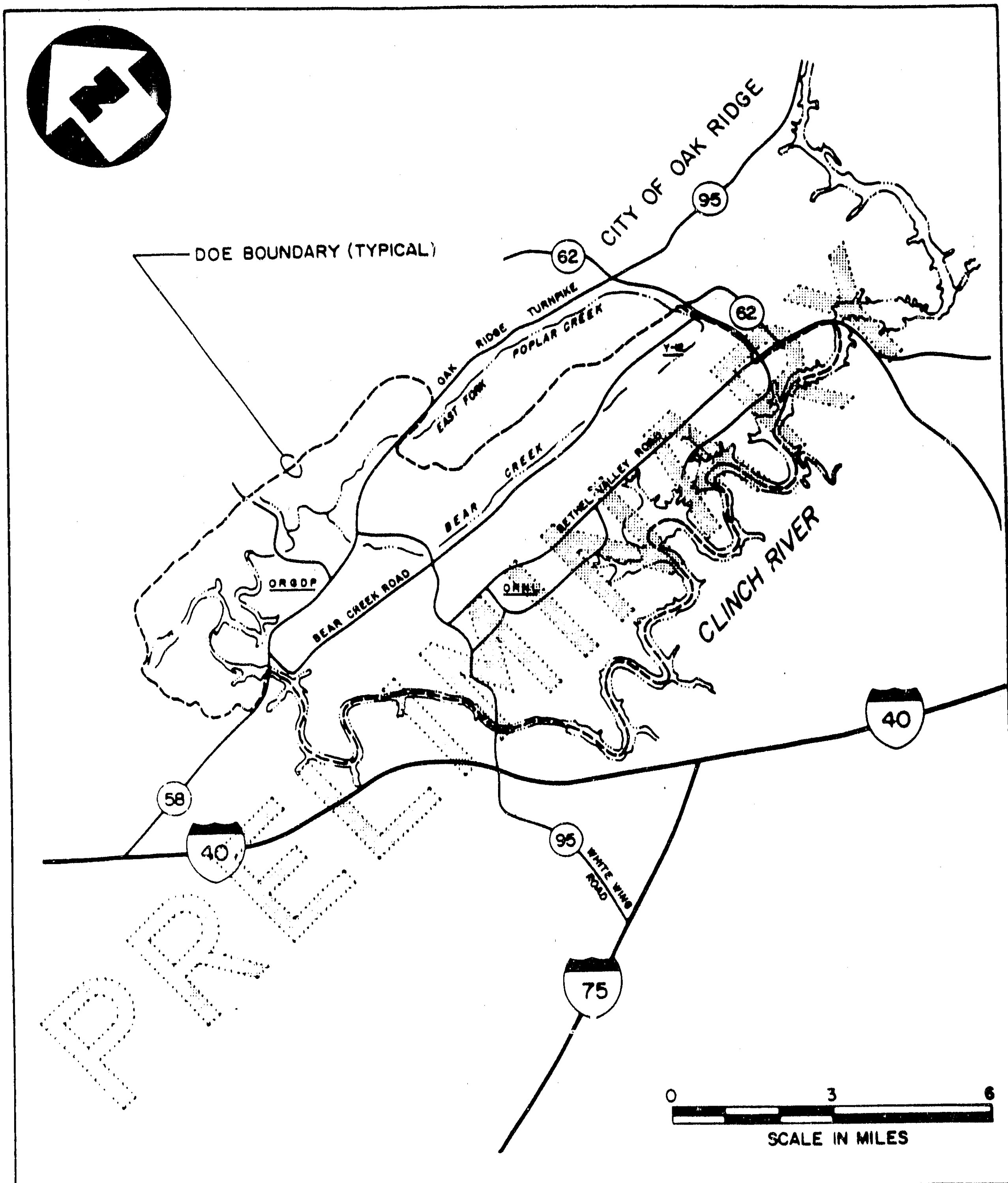
The sector that includes the east-northeast (ENE), east (E), and east-southeast (ESE) directions from ORGDP contains two-thirds of the population living within 80 km (50 miles) of the site. The east sector alone has over 540,000 people of the 1.1 million total. Moreover, during the Manhattan Project in the 1940s, the population of the City of Oak Ridge was nearly three times its present size of 28,000. ORGDP employees tend to live within 40 km (25 miles) of the facility, commuting to the site



Source: Oakes et al., 1987a

FIGURE 2–1

RELATIONSHIP OF ORR TO SURROUNDING AREA
ORGDP – OAK RIDGE, TN



Source: Oakes et al., 1987a

FIGURE 2-2

LOCATION OF THREE MAJOR INSTALLATIONS ON THE ORR
ORGDP - OAK RIDGE, TN

from all directions. About one-fourth of the staff lives in the City of Oak Ridge, and about one-third lives in Knox County (MMES, 1984).

The whole of ORR lies in a region characterized by elongated ridges and valleys trending in a northeast-southwest direction. The reservation is bounded on the west by the Cumberland Plateau, on the north by the Cumberland Mountains, on the distant east by the Great Smoky Mountains, and on the immediate east and south by the Clinch River. The ridges provided safety, isolation, and separation for the Manhattan Project to achieve its production goals in secrecy during World War II.

ORGDP enjoys a relatively pleasant climate, dry and sunny with mild temperatures. Summers may be quite humid, while winters are cool, but comparatively short. Severe storms are rare, probably because the surrounding mountains (especially the Great Smokies) act as a barrier, diverting hot, southeasterly winds from high-pressure cells along the South Atlantic Coast away from the area. Precipitation varies from year to year, averaging 136 cm (53.5 in.) annually, of which about 25 cm (10 in.) is snowfall. Based on historic occurrence, it is probable that a maximum 1-hour rainfall of 3.3 cm (1.3 in.) will occur once a year, and a 1-hour rainfall of 7.6 cm (3.0 in.) will occur once every 100 years. For a 24-hour period, the yearly probability is a 7.6-cm (3.0-in.) rainfall, and the 100-year probability is a 17.3-cm (6.8-in.) rainfall (MMES, 1984). Year-round temperatures average 14.4°C (57.9°F), with highest readings of 30.7°C (87.3°F) in July and lowest readings of -1.8°C (28.8°F) in January.

About 80 percent of ORR is forestland, characteristic of central and southern Appalachia. The dominant deciduous trees are oak and hickory, while coniferous forest is largely cedar, hemlock, white pine, and short-leaf pine. Extensive stands of yellow pine and mixed hardwoods (maple, sourwood, dogwood, redbud, hackberry, elder, sycamore, elm, tulip tree, sweet gum, and yellow poplar) are typical throughout the reservation. Prior to World War II, the ORGDP site was rolling woodland, with some cleared pasture and cropland. Site preparation activities flattened hills and filled valleys to such an extent that the site within the security fence appears nearly flat. Vegetation within the site was cleared, except for the banks of Poplar Creek and the Clinch River. Today, even after 40 years, relatively little revegetation has occurred within the fence boundaries.

The woodland sites provide varied habitat for many wildlife species. Mammals include white-tailed deer, cottontail rabbits, gray squirrels, opossums, woodchucks, beavers, muskrats, raccoons, striped skunks, red and gray foxes, longtailed weasels, and, on rare occasions, mink and bobcats. Birds include bobwhite, ruffed grouse, mourning doves, and waterfowl. Canada geese are the most common nesting waterfowl at ORGDP, while wood ducks and hooded mergansers also breed on the site. Wintering flocks include mallard; black, pintail, gadwall, ring-neck, golden-eye, and bufflehead ducks; and common mergansers. Other breeds, including widgeons, teal, redheads, canvasbacks, lesser scaup, ruddy ducks, and American coots are observed during the migratory seasons (Boyle et al., 1979).

Reptiles and amphibians include bullfrogs, snapping turtles, eastern spiny softshell turtles, salamanders, and fence lizards. Fish species include gizzard shad, threadfin shad, white bass, striped bass, yellow bass, largemouth bass, bluegill, white crappie, smallmouth buffalo, and silver redhorse (Boyle et al., 1979).

A number of flora and fauna observed at or near ORR are on lists of rare, endangered, or threatened species. These may be summarized as follows (Boyle et al., 1979):

<u>Plant species</u>

- Endangered - Medicus
- Rare - Large fothergilla; Goldenseal; Ginseng
- Threatened - False foxglove; Black snakeroot; Ginseng; Carey's saxifrage; Carolina saxifrage

<u>Animals</u>

- Endangered - Eastern mountain lion; Bald eagle
- Threatened (Audubon Blue List) - Canvasback; Cooper's hawk; Sharp-shinned hawk; Marsh hawk; Red-shouldered hawk; Osprey; Sparrow hawk; Barn owl; Purple martin; Bewick's wren; Eastern bluebird; Loggerhead shrike; Yellow warbler; Grasshopper sparrow; Henslow's sparrow; and Bachman's sparrow

<u>Aquatic species (fish)</u>

- Threatened - Slender chub; Spotfin chub; and Yellowfin madtom

2.2 Overview of Major Site Operations

Until late summer of 1985, the primary responsibility of ORGDP was enrichment of uranium hexafluoride (UF_6) in the uranium-235 isotope. The gaseous diffusion process used at ORGDP was based on the fact that lighter molecules diffuse preferentially than heavier molecules through the walls of a porous barrier. Thus, the gas passing through the barrier wall is slightly richer in uranium-235 than the gas remaining on the original side of the barrier. Repeating this process through hundreds, or even thousands, of stages yields a gas enriched to several times the original concentration of 0.711 percent uranium-235 in natural feedstock. Three gaseous diffusion plants (Oak Ridge, Tennessee; Paducah, Kentucky; and Portsmouth, Ohio) worked together to provide commercial and Government users with 2-4 percent uranium-235 enriched uranium, and Portsmouth has been configured to produce the higher concentrations of enriched uranium required for military applications.

ORGDP has not enriched any uranium since mid-1985, when it was placed on "ready standby" status. In December of 1987, the production facilities were officially placed in a shutdown mode. The site remains active in a number of scientific missions, including the following:

- Research and development of advanced enrichment techniques
- Engineering and computer support programs
- Analytical laboratory programs
- New waste treatment facilities
- Full-scale Toxic Substances Control Act (TSCA) incineration studies.

Employee population was 4,428 in October 1983, but there have been some losses due to shutdown of production at the gaseous diffusion facilities. Some of the losses are being offset by the continued growth of other oncoming processes, for example, atomic vapor laser isotope separation (AVLIS). The employee population distribution in 1983, while diffusion processes were still operating, was as follows:

Function	Employees	Percent of Total Employees
Technical Services	1,550	35
Plant Support	1,328	30
Research and Development	620	14
Administration	443	10
Production	354	8
Construction Contractor	89	2
Waste Management	44	1
TOTAL	4,428	100

ORGDP programs and research activities involve a variety of different processes and facilities, both production-oriented and support or auxiliary in function. Although the uranium enrichment production units were placed in a shutdown mode in December 1987, active research, development, and supporting activities are continuing. A summary of the extent of ORGDP facilities may be found in Table 2-1.

In addition to the extensive gaseous diffusion facilities, now idle, the ORGDP site also includes the following research, auxiliary, and support facilities:

- Chemical Cleaning and Decontamination - Building K-1420
- Steam Plant - Building K-1501
- AVLIS - Building K-1037 (former Barrier Plant - only part of Building K-1037 is used by AVLIS)
- Gas Centrifuge Enrichment Research - Buildings K-1200, K-1210, K-1210-A, K-1220, K-1052, K-1023, K-1600, and K-101
- Computer and Data Processing Center - Building K-1007
- Analytical and Research Laboratories - Buildings K-1004-A, B, C, D, L, and K-1006
- Air and Nitrogen Plants - Buildings K-1101 and K-1201
- Chemical Recovery Facility - K-1232
- Wastewater Treatment Plant (Sewage) - Building K-1203
- Maintenance and Machine Shops - Building K-1401
- Garage - Building K-1414
- Water Treatment Plant - Building K-1515
- TSCA Incinerator Complex - Building K-1435
- Laundry - Building K-1015
- Paint Shop - Building K-1095
- Central Neutralization Facility - Tentatively identified as CNF or Building K-1407-H
- Sludge Fixation Facility.

Table 2-2 provides additional details on the size of the major facilities on-site at ORGDP along with the appropriate responsible division's identity. Figure 2-3 gives locations for most of these buildings and facilities.

Numerous other important ancillary facilities have not been included in the above discussion because they are not buildings or structures. These include burial grounds for contaminated and

TABLE 2-1

EXTENT OF ORGDP FACILITIES (AS OF 09/01/82)
ORGDP - OAK RIDGE, TN

	Main Area	Powerhouse Area	Total ORGDP
Acres Inside Secure Fence	706	82.4	788.4
Acres Under Roof	172.5	4.7	177.2
Major Buildings, Number	117	12	129
Miles of Perimeter Fence	10.2	2.3	12.5
Miles of Paved Road	23.8	2.25	26.05
Acres of Pavement	215	5.0	220
Miles of Railroad	5.0	4.4	9.4

Source: Adapted from Union Carbide Corporation, Nuclear Division, 1982

TABLE 2-2

MAJOR ORGDP FACILITIES (AS OF 09/01/82)
ORGDP - OAK RIDGE, TN

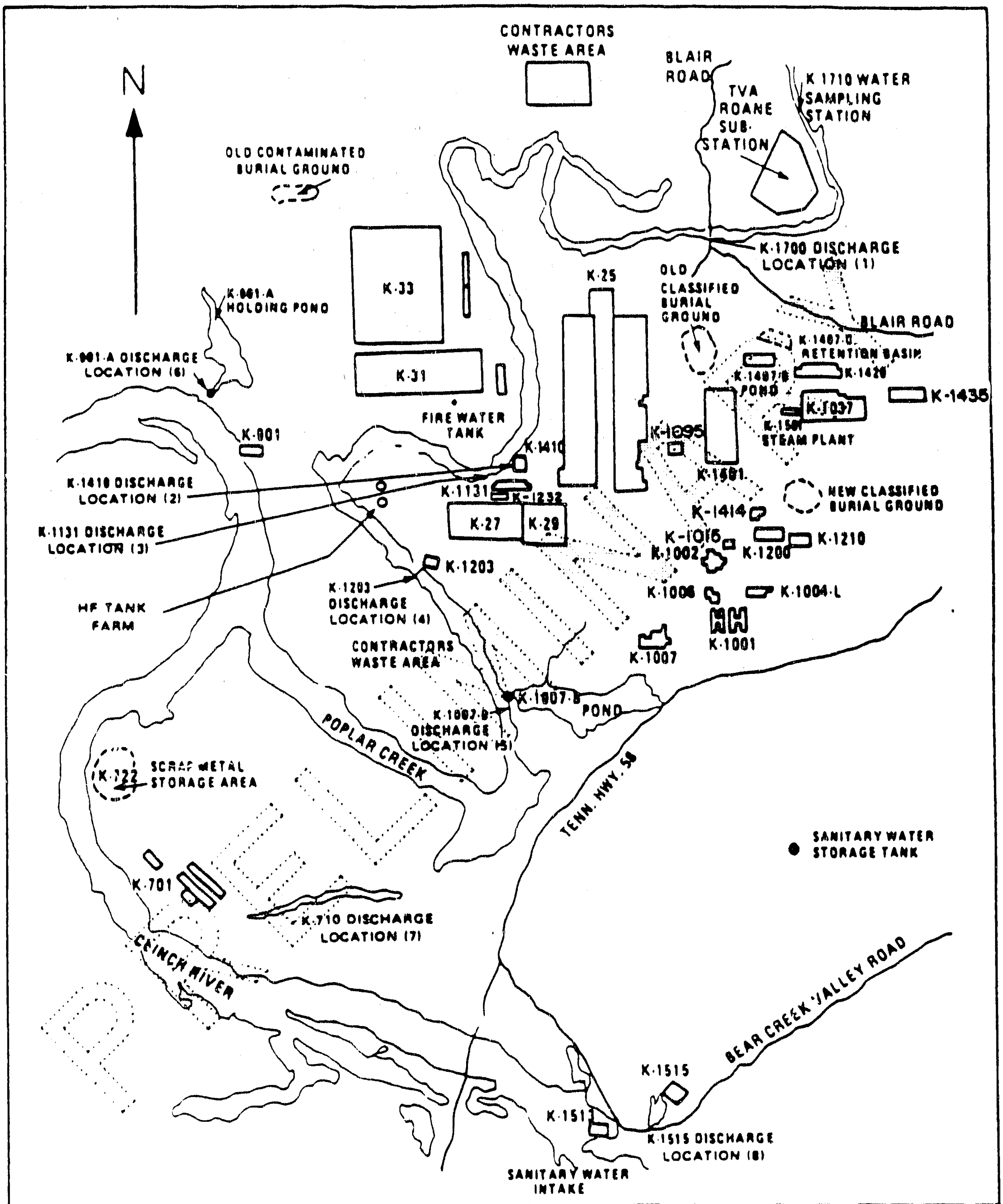
Building Number	Description	Floor Area (sq. ft.)	Responsible Division
K-301, 302, 304, 305, 306, 309, 310, 311, 312	K-25 Process Buildings	4,755,724	Operations
K-402-1 thru 9	K-27 Process Buildings	1,114,386	Operations
K-502-1 thru 3	K-29 Process Buildings	582,400	Operations
K-602-1 thru 6	K-31 Process Buildings	1,659,628	Operations
K-902-1 thru 8	K-33 Process Buildings	2,780,104	Operations
K-1001	Administration Buildings	93,703	Maintenance
K-1004-A	Laboratory	18,659	Process Support
K-1004-B	Laboratory	17,942	Process Support
K-1004-C	Laboratory	17,785	Process Support
K-1004-D	Laboratory	24,870	Process Support
K-1004-L	Laboratory Pilot Plant	42,266	Process Support
K-1006	Development Laboratory	19,619	Process Support
K-1007	Computers & Data Processing Center	132,168	Computer Sciences
K-1015	Laundry	8,039	Maintenance
K-1037	Industrial Research Building	163,161	Operations and AVLIS
K-1095	Paint Shop	12,067	Maintenance
K-1101	Nitrogen Building & Air Plant	29,837	Operations
K-1200	Centrifuge Preparation Laboratory	70,971	Separation Systems
K-1201	Compressor/N_2 Filling Station	6,906	Operations
K-1203	Wastewater Treatment Plant	Not listed	Operations
K-1210	Centrifuge Test Facility	34,120	Separation Systems
K-1210-A	Advanced Engineering Test Facility	9,852	Separation Systems
K-1220	Centrifuge Demonstration Facility	61,800	Separation Systems
K-1232	Chemical Recovery Facility	9,300	Operations
K-1401	Maintenance Building	473,181	Maintenance and Process Support

TABLE 2-2
MAJOR ORGDP FACILITIES (AS OF 09/01/82)
ORGDP - OAK RIDGE, TN
PAGE TWO

Building Number	Description	Floor Area (sq. ft.)	Responsible Division
K-1407-A thru H	Central Neutralization Facility*	Not listed	Operations
K-1414	Garage & Gas Station	15,001	Maintenance
K-1420	Decontamination & Uranium Recovery	94,549	Operations
K-1435	Toxic Substance Control Facility*	Not listed	Operations
K-1501	Steam Plant	24,172	Operations
K-1515	Water Filtration Plant	6,500	Operations
K-1650	Central Control Facility	21,120	Operations
K-1652	Plant Protection HQ	23,232	Security and Plant Protection

Source: Adapted from Union Carbide Corporation, Nuclear Division, 1982

* New Facility (built since 09/01/82 inventory).



Source: Boyle et al., 1979

FIGURE 2–3

PRINCIPAL SITE FEATURES
ORGDP – OAK RIDGE, TN

non-contaminated materials, settling basins, ponds or lagoons, electrical substations and switchyards, monitoring stations and wells, storage yards, parking areas and others. Large cooling tower installations serving the heat-generating processes also exist on-site, although most of these have been idled by the shutdown of gaseous diffusion activities. Cooling water for still active operations is pumped directly out of Poplar Creek and the Clinch River.

2.3 State and Federal Concerns

The Survey team met with representatives from the Tennessee Department of Health and Environment and the U.S. Environmental Protection Agency - Region IV on February 11, 1988, as part of the pre-Survey visit to ORGDP. The purpose of this meeting was to explain the Survey process to the regulatory agencies and to identify any environmental concerns they might have about ORGDP so that these concerns could be reviewed during the Survey. Attendees are shown in Appendix B.

The Survey Team Leader described all aspects of the DOE Survey. The questions from the attendees were general in nature and no major issues, environmental or otherwise, were raised. The meeting lasted approximately 1 hour.

3.0 MEDIA-SPECIFIC SURVEY FINDINGS AND OBSERVATIONS

The discussions in this section pertain to existing or potential environmental problems in the air, soil, 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 Oak Ridge Gaseous Diffusion Plant (ORGDP) is located in Roane County, which is part of the eastern Tennessee-southwestern Virginia interstate air quality control region (AQCR).

Roane County is designated by the U.S. Environmental Protection Agency (EPA) as "better than national standards" (attainment) for total suspended particulates. With respect to the new PM_{10} standard, Roane County is in Group III, most likely to be in compliance. Roane County is designated in attainment for nitrogen oxides, carbon monoxide, ozone, and lead. Only recently the EPA has proposed to reclassify the last non-attainment area for sulfur dioxide in the county (near the Kingston steam plant of the Tennessee Valley Authority) to attainment since "after reviewing the monitoring data, no violations were found since 1980" (EPA, 1988a).

Tessessee ambient air quality standards for the criteria pollutants are virtually identical to U.S. standards. These are shown in Table 3-1. In addition, Tennessee has developed ambient air standards for fluorides. These are shown in Table 3-2. Roane County is in full compliance with the fluoride standards. Section 3.1.3 discusses ambient air monitoring for fluorides near ORGDP.

Air quality with respect to radionuclides (uranium) near ORGDP is comparable to the nationwide average. Oak Ridge Reservation (ORR) monitors several radionuclides at 13 stations on-site and at 6 remote stations located 19 to 121 kilometers (12 to 75 miles) from the reservation. Locations are shown in Figure 3 1. Radionuclide monitoring data for 1986 from seven stations on the reservation (including three adjacent to ORGDP) and six remote stations are shown in Tables 3-3 and 3-4 (Oakes et al., 1987b) along with the ranges obtained in nationwide monitoring conducted by EPA (EPA, 1987a).

TABLE 3-1

**TENNESSEE AMBIENT AIR QUALITY STANDARDS
ORGDP - OAK RIDGE, TN**

Contaminants	Primary Standards			Secondary Standards		
	Concentration		Averaging Interval	Concentration		Averaging Interval
	µg/m³	ppm by volume		µg/m³	ppm by volume	
Suspended Particulates	75 260	-- --	AGM 24 hours	60 150	-- --	AGM 24 hours
Sulfur Dioxide	80 365	0.03 0.14	AAM 24 hours	1,300	0.5	3 hours
Carbon Monoxide	10,000 40,000	9.0 35.0	8 hours 1 hour	10,000 40,000	9.0 35.0	8 hours 1 hour
Ozone	235	0.12	1 hour	235	0.12	1 hour
Hydrocarbons* (non-methane)	160	0.24	3 hours 6-9 a.m.	160	0.24	3 hours 6-9 a.m.
Nitrogen Dioxide	100	0.05	AAM	100	0.05	AAM
Lead	1.5		Calendar quarter	1.5	--	Calendar quarter

Source: TDHE, 1985

* No longer in use as a Federal standard

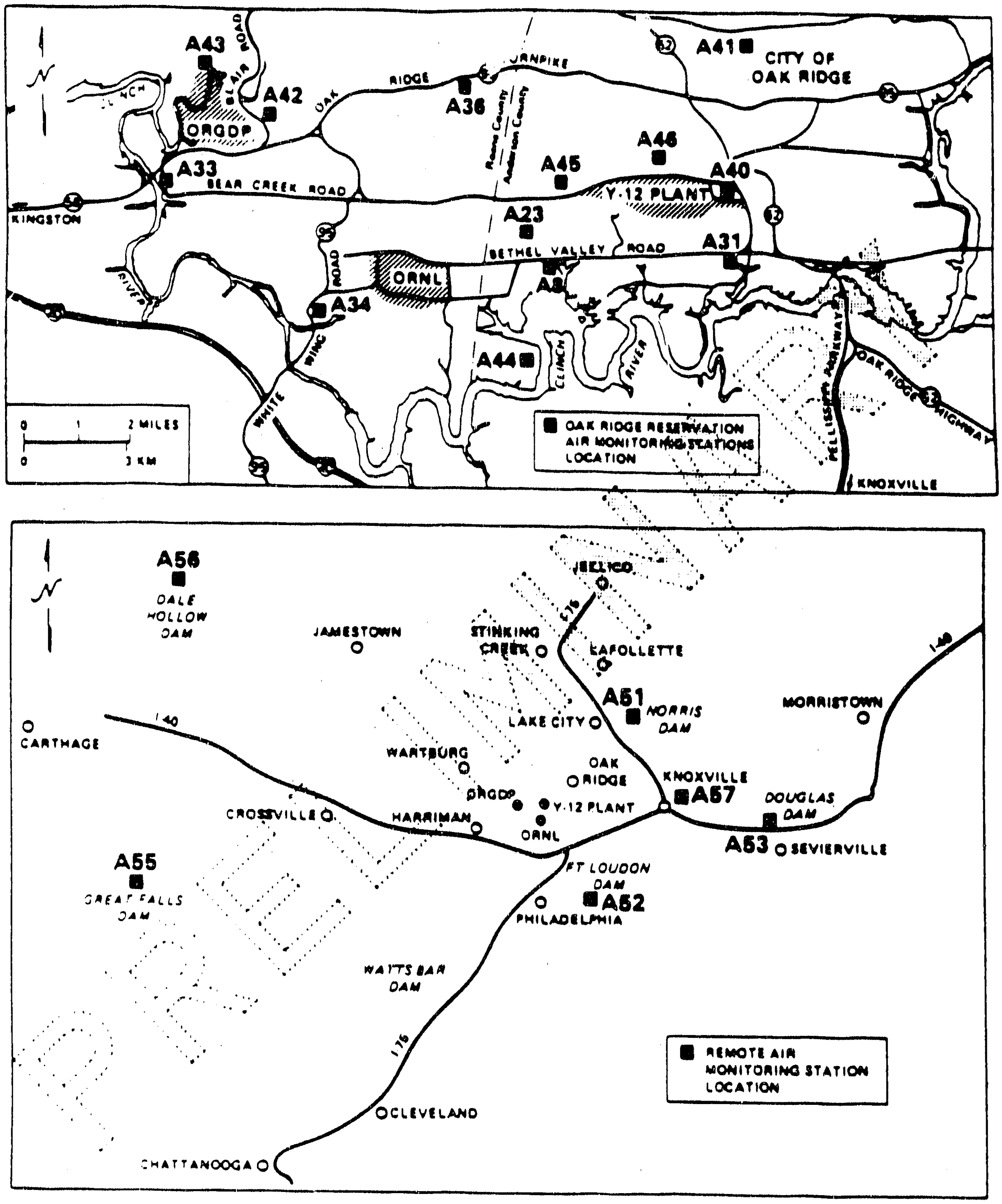
µg/m³ = Micrograms per cubic meter
AGM = Annual geometric mean
AAM = Annual arithmetic mean

TABLE 3-2

TENNESSEE AMBIENT AIR QUALITY STANDARDS FOR GASEOUS FLUORIDES EXPRESSED AS HYDROGEN FLUORIDE ORGDP - OAK RIDGE, TN

Primary Standards			Secondary Standards		
Concentration		Averaging Interval	Concentration		Averaging Interval
µg/m³	ppb by volume		µg/m³	ppb by volume	
1.2	1.5	30 days	1.2	1.5	30 days
1.6	2.0	7 days	1.6	2.0	7 days
2.9	3.5	24 hours	2.9	3.5	24 hours
3.7	4.5	12 hours	3.7	4.5	12 hours

Source: TDHE, 1985



Source: Oakes et al., 1987a

FIGURE 3–1

AIR MONITORING STATIONS – OAK RIDGE RESERVATION
ORGDP – OAK RIDGE, TN

TABLE 3-3

URANIUM-IN-AIR AT REMOTE STATIONS NEAR OAK RIDGE RESERVATION, 1986
($x\ 10^{-15}\ \mu Ci/m^3$)[a]
ORGDP - OAK RIDGE, TN

Radionuclide	Maximum	Minimum	Average	Nationwide Range
Uranium - 234	0.059	.0026	.033	.005-.124
Uranium-235	0.0026	.00027	.0014	.0002-.005
Uranium-238	0.045	.0020	.025	.005-.069
Gross Beta	47	<5	<11	

Source: Oakes et al., 1987b

(a) Beta units are $10^{-15}\ \mu Ci/cm^3$

TABLE 3-4

ORGDP URANIUM-IN-AIR CONCENTRATIONS, 1986[a]
OAK RIDGE STATIONS ON RESERVATION
($\times 10^{-15}$ μCi/m^3)[b]
ORGDP - OAK RIDGE, TN

Radionuclide	Maximum	Minimum	Average
Uranium-234	0.85	0.035	0.51
Uranium-235	0.063	0.0032	0.039
Uranium-238	0.17	0.0074	0.1
Gross Beta (Stations A33, A42, A43)	110	< 10	< 20
Gross Beta (Stations A8, A23, A31, A44)	120	< 10	< 30

Source: Oakes et al., 1987b

(a) Stations A8, A23, A31, A33, A42, A43, A44. (See Figure 3-1.)
(b) Beta units are 10^{-15} μCi/cm^3.
(c) Derived concentrations guidelines are 0.047 μg/m^3 for U-235, 0.3 μg/m^3 for U-238, and 10^{-12} μCi/cm^3 for beta radiation.

Prevailing winds near ORGDP are from the southwest (SW) and west-southwest (WSW) during the 8:00 AM to 4:30 PM hours and from the northeast (NE) and east-northeast (ENE) during the hours of 4:30 PM to 8:00 AM. About 24 percent of the winds come from the NE and ENE directions and 21 percent come from the SW and WSW directions. A recent wind rose from the ORGDP meteorologic tower is shown in Figure 3-2. This pattern is similar to those obtained at the other towers near the other Oak Ridge DOE operations. During 1988 three meteorological towers were in operation at the Oak Ridge National Laboratory (ORNL) and two at the Y-12 location (see Figure 3-3). An additional two towers were operated, one between ORNL and Y-12 and one near the west end of the ORR, south of ORGDP.

Climatic conditions in the area result in Oak Ridge being one of the country's calmest wind areas. The atmosphere can be considered to be in an inversion status about 36 percent of the time.

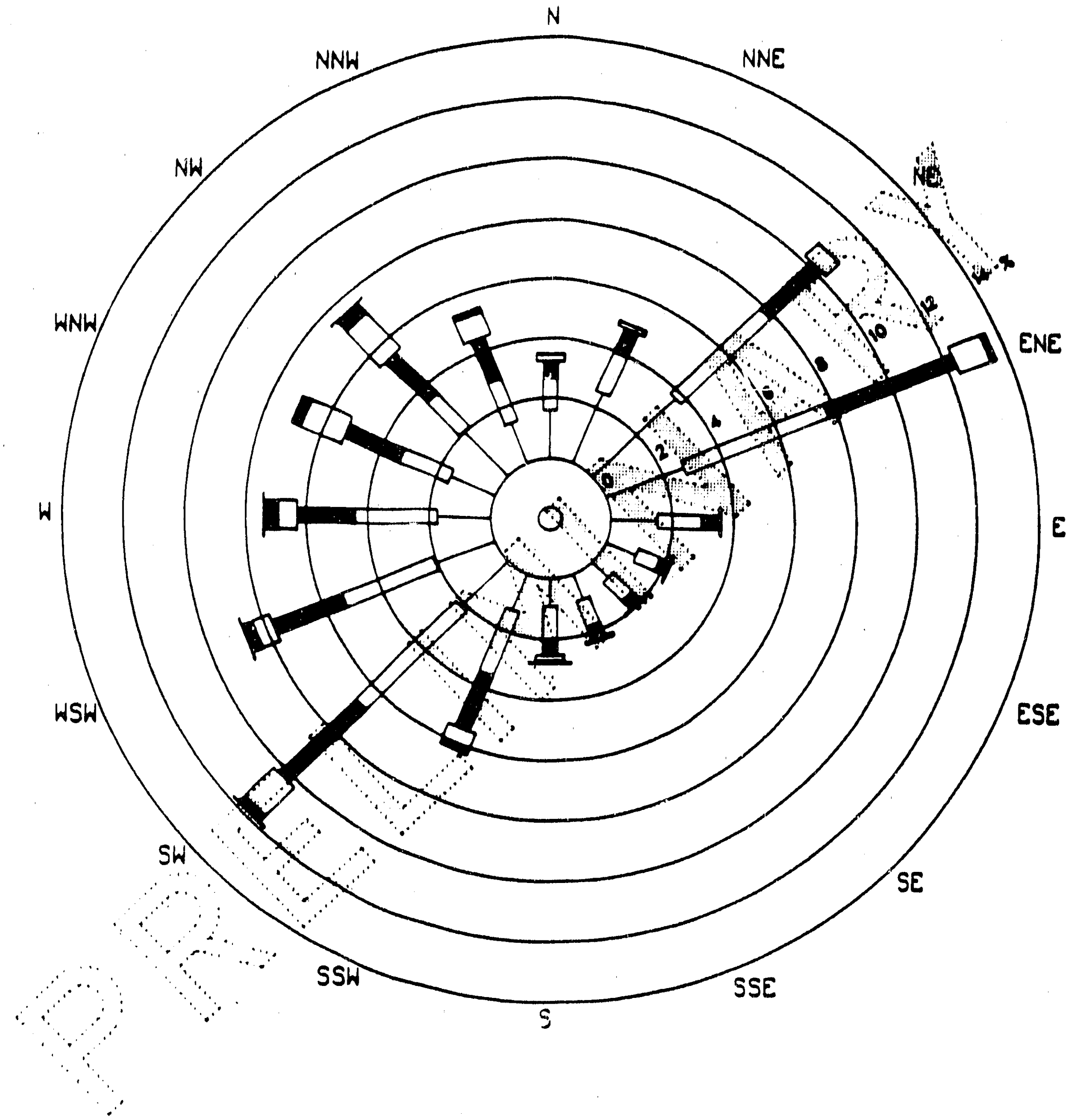
3.1.2 General Description of Pollution Sources and Controls

Permitted Sources

ORGDP has approximately 269 air emission sources, which are listed in Table 3-5. Approximately 120 air permits from the Tennessee Department of Health and Environment (TDHE) cover those sources requiring permits. Many of the emission points shown in Table 3-5 (e.g., the laboratory vents) do not require permits, and many of the sources are no longer operational.

Air Emissions

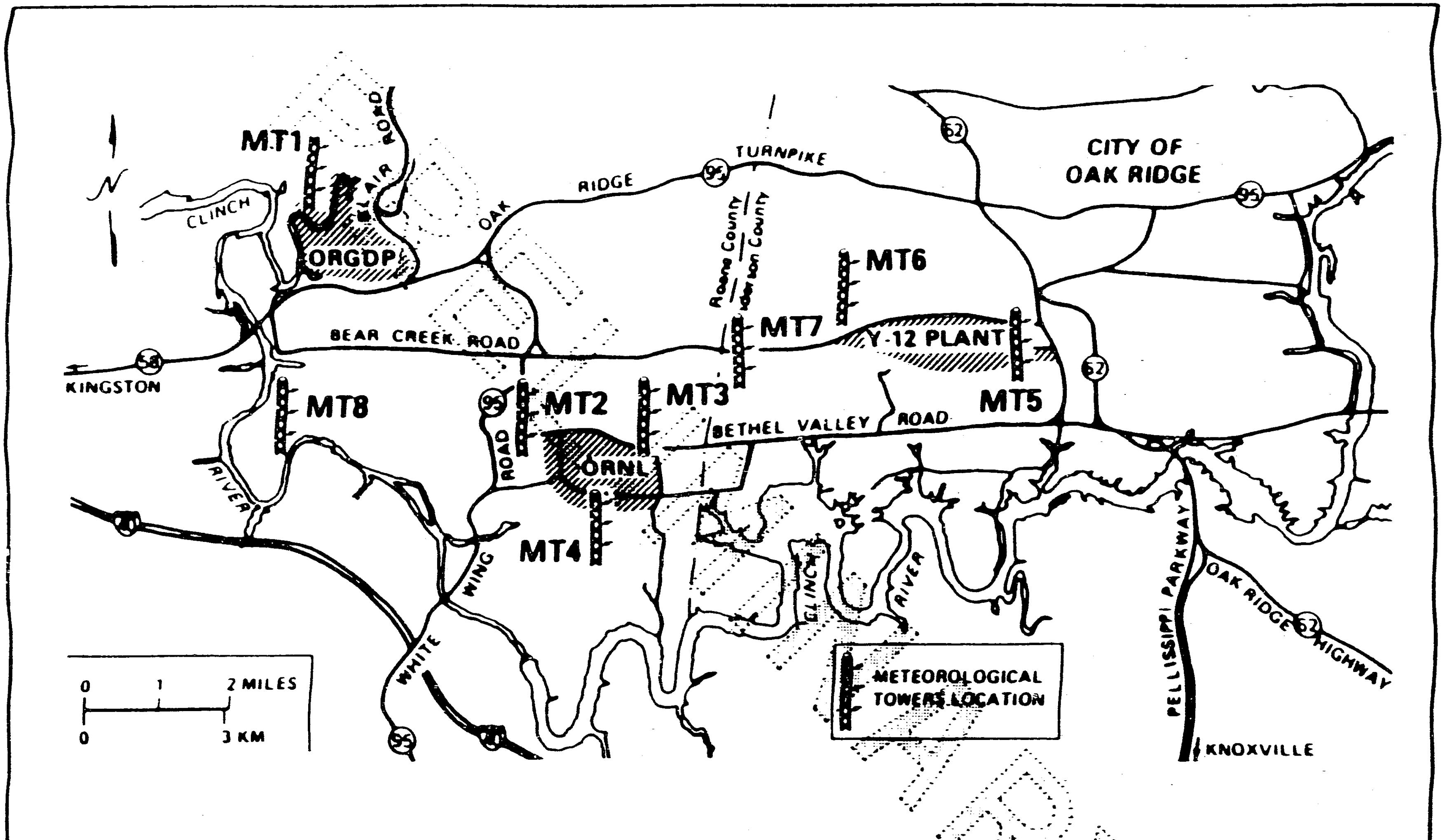
Emissions estimates performed by the Survey team for some solvents used in large quantities are shown in Table 3-6. While ORGDP was a major user of Freon-114 (dichlorotetrafluoroethane) prior to the shutdown of the gaseous diffusion process, air emissions of Freon-114 at present are minor. Current emissions result from storage and handling losses as the Freon is prepared for transportation to Portsmouth and Paducah. The remaining organic compounds are primarily used in vapor degreasers, cold cleaners, and air conditioning units. Other sources of air emissions to be discussed include: the steam plant, the Toxic Substances Control Act (TSCA) incinerator, particulate (radionuclide) sources, cooling towers, and the asbestos removal program.



Source: Oakes et al., 1987a

FIGURE 3–2

WIND ROSE FOR ORGDP (60m) – 1987
ORGDP – OAK RIDGE, TN



Source: Oakes et al., 1987a

FIGURE 3–3

LOCATIONS OF METEOROLOGICAL TOWERS ON THE OAK RIDGE RESERVATION
ORGDP – OAK RIDGE, TN

TABLE 3-5

AIR EMISSION SOURCES
ORGDP - OAK RIDGE, TN

Description of Function	No. of Emission Points	Pollutant[a]	Description of Function	No. of Emission Points	Pollutant[a]
Bake-off oven	1	Organics	Disassembly stand	1	Part
Bake-off oven	1	Part	Disassembly stand	1	Uranium oxide
Cleaners	17	Part	Drying tracks	5	Hydrocarbons
Cleaning and drying	1	Part	Emission stack	1	Fluorides
Coal sizing and conveying system	1	NE	Emission stack	1	Part
Coal/gas/oil steam plant	1	CO	Emission stack	1	Uranium
Coal/gas/oil steam plant	1	Fluorides	Exhaust hood	1	VOC
Coal/gas/oil steam plant	1	NO_x	Fabrication	1	Part
Coal/gas/oil steam plant	1	Organics	Filter test facility	2	Part
Coal/gas/oil steam plant	1	SO_2	Fire Dept. training facility	1	Part
Coal/gas/oil steam plant	1	part	Fluorine vents	4	Fluorides
Concrete fixation	1	Part	Fuel oil storage	2	Organics
Curing oven	1	Organics	Furnace	1	VOC
Degreaser	1	NE	Furnaces	13	Hydrocarbons
Degreaser	1	Perchloroethylene	Gas storage tank	2	NE
Degreaser	3	Organics	Grit blaster	1	Part
Disassembly stand	1	Fluorides	Heat exchange	1	114Freon

TABLE 3-5
AIR EMISSION SOURCES
ORGDP - OAK RIDGE, TN
PAGE TWO

Description of Function	No. of Emission Points	Pollutant[a]	Description of Function	No. of Emission Points	Pollutant[a]
Heat exchange	1	FHC	Oil storage tanks	7	Mineral oil
Hood	3	Hydrocarbons	Oil storage tanks	32	Code BG oil
Incinerator	1	CO	Ovens	3	Part
Incinerator	1	Fluorides	Ovens	1	NE
Incinerator	1	HCL	Ovens	1	Other
Incinerator	1	Organics	Paint drying oven	1	VOC
Incinerator	2	NO_x	Parts cleaning	1	NO_x
Incinerator	2	Part	Parts cleaning	1	Trioxide
Incinerator	2	SO_2	Pellet conversion oven	1	Technetium
KOH scrubber	1	Technetium	Pellet conversion oven	1	Uranium
KOH scrubber	1	Uranium	Pellet conversion oven	2	Fluorides
Laboratory vents	12	Many	Plastic shop	1	Organics
Machine repair	1	Fluorides	Plastic shop oven	1	NE
Machine repair	1	Part	Plating system	1	HCl vapor
Main vent	1	Fluorides	Product withdraw vent	1	Fluorides
Mechanical laboratory	1	Part	Relief compressor	1	Fluorides
Nickel Plating	1	HCl vapor	Sand blaster	2	Part
Nickel Plating	1	NO_x	Scrubber	1	Fluorides

TABLE 3-5
AIR EMISSION SOURCES
ORGDP - OAK RIDGE, TN
PAGE THREE

Description of Function	No. of Emission Points	Pollutant[a]	Description of Function	No. of Emission Points	Pollutant[a]
Spray booth	1	Part	Storage tank	4	Trichloroethene
Spray booth	3	VOC	Storage tank	4	Varsol
Steam plant	1	SO_2	Vacuum system	1	NE
Steam plant	2	Part	Vacuum system	3	HF
Storage tank	1	Acetone	Vacuum system	5	Fluorides
Storage tank	1	Ethyl alcohol	Vacuum system	16	CO
Storage tank	1	Gasoline	Vacuum system	16	Organics
Storage tank	1	Hexane	Vacuum system	16	Uranium
Storage tank	1	Isopropyl alcohol	Vent	2	Fluorides
Storage tank	1	Methylene chloride	Vent	1	NE
Storage tank	1	Paints	Vent	1	VOC
Storage tank	1	Water	Waste oil decontamination	1	Organics
Storage tank	1	Xylene	Wet air vents	2	Fluorides
Storage tank	4	Freon	Wreck disassembly	1	Fluorides
Storage tank	4	Other	Wreck disassembly	1	Part
Storage tank	4	Perchloroethane oil			
TOTAL	**269**				

Source: Oakes et al , 1987b

(a) NE = no emission; VOC = volatile organic compounds; Part = particulate; SO_2 = sulfur dioxide; FHC = Fluorohydrocarbons; HF = Hydrogen fluoride; CO = Carbon monoxide.

TABLE 3-6

ORGANIC AIR EMISSIONS, 1986
ORGDP - OAK RIDGE, TN

Solvent	Annual Use (lb)	Air Emissions[1]
Freon-113	6,900	6,417
Freon-114	1,600	1,488
Freon-11	2,000	1,860
Freon-12	9,100	8,463
Freon-22	3,000	2,790
1,1,1-Trichloroethane	600	558
Methylene chloride	3,200	2,976
TOTAL		**24,552**

Source: Hibbetts, 1987

(1) Estimated by Survey team at 93 percent of use.

Steam Plant

The steam plant (K-1501) at ORGDP consists of seven boilers with a total rated capacity of 350,000 pounds per hour (lb/hr) of steam. Units 1 through 6 were installed in the 1940s and are coal-fired. Unit 4 is equipped to be fired with either coal or natural gas. Compliance with sulfur dioxide limitations is obtained by limiting the sulfur content of coal to 2.44 percent by contract. In 1972 a large natural gas boiler (Unit 7) rated at 100,000 lb/hr was installed.

During the early 1970s, compliance with opacity standards was mandated by the state air agency and in 1978 two electrostatic precipitators were installed. Problems with the precipitators were experienced resulting in a "less-than-consistent compliance record" (Oakes et al., 1987a). Problems resulted because of the method used for the dumping of ash and scheduling problems with the operation of boilers and precipitators. Numerous problems occurred during the early 1980s. Compliance has improved during 1986 and 1987 because of the shutdown of the gaseous diffusion process. This reduced steam demand to a point where base loading with natural gas can be effectively used to minimize operation with coal firing and reduce particulate emissions.

Operation with coal firing is necessary only during periods of natural gas curtailment or when the number 7 (or number 4) boiler requires servicing.

Table 3-7 shows 1987 compliance experience. In summary, violations of the Tennessee opacity standards occurred on 48 percent of the days that a coal-fired boiler was in operation. The days of noncompliance (33) represent a substantial improvement over 1986 (84 days of noncompliance). This result was achieved by maximizing use of natural gas.

Although no Notices of Violation have been issued, the state air agency is aware of the problem. Operating permits are scheduled to be renewed in October 1988. Without a plan that ensures continued compliance with the opacity standard, it is expected that operating permits will not be issued (see Finding 3.1.3.1).

The problem is exacerbated by the fact that boiler number 7 is nearing the end of its useful life. A quality assurance (QA) team was appointed in December 1985 to make recommendations to bring the plant into 100 percent compliance with Tennessee air emissions standards. A review of many alternatives was made and the QA team recommended the installation of two 40,000 lb/hr wood-fired boilers as the most economical option. It appears however that more conventional natural-gas-

TABLE 3-7

STEAM PLANT (K-1501) OPACITY IN 1987
ORGDP - OAK RIDGE, TN

Quarter	Days on Coal	Days out of Compliance	Total Minutes of Noncompliance
1	33	24	3,045
2	34	8	1,703
3	2	1	50
4	0	0	50
TOTAL	**69**	**33**	

Source: Adapted from Oak Ridge Gaseous Diffusion Plant Records by DOE Survey team fired boilers are in general the most favored option, although this choice could lead to violations during periods of natural gas curtailment.

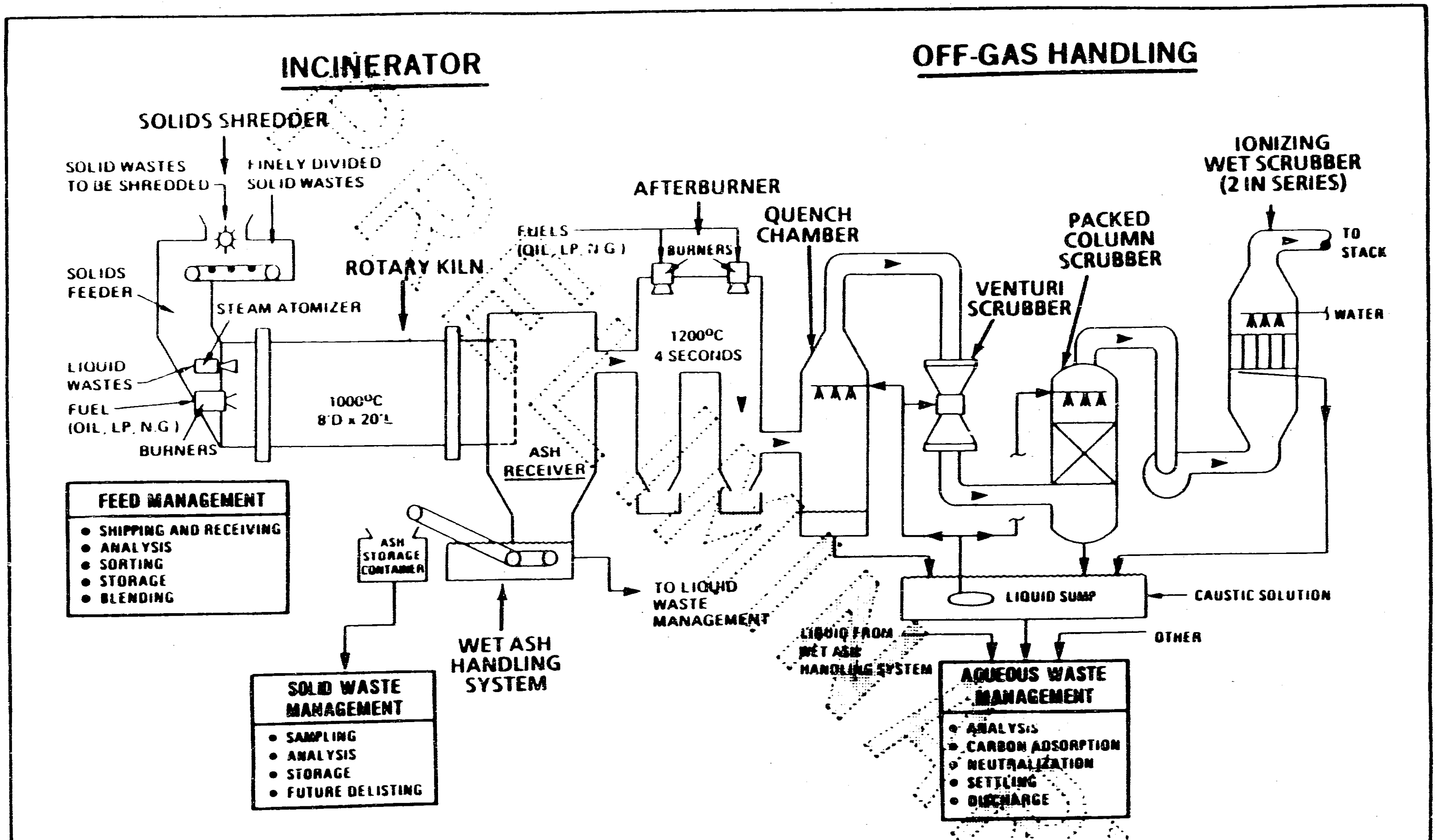
K-1435 Incinerator

Construction work was completed on the K-1435 incinerator [commonly called the Toxic Substances Control Act (TSCA) incinerator because its feed will include polychlorinated biphenyls (PCBs)] and off-gas treatment facility in June 1986. Because of the complexity of permitting (permits are required under TSCA, the Resource Conservation and Recovery Act, the National Pollutant Discharge Elimination System, and the Clean Air Act), numerous delays have been experienced. At the time of the Survey, a "TSCA Trial Burn" originally scheduled for late 1986 had not taken place.

A schematic illustrating the incinerator and its off-gas treatment is shown in Figure 3-4. The principal control (which ensures complete combustion) is the afterburner or secondary combustion chamber (SCC). Particulate matter and acid gases are removed in a series of devices consisting of (1) a quench chamber where the temperature is reduced from about 1,200°C (2,160°F) to about 95°C (200°F) by direct water quenching, (2) a venturi scrubber which removes the larger particulates, (3) a packed column scrubber that removes most of the remaining particulates and most of the acidic gases, and (4) ionizing wet scrubbers (two ionization chambers and two scrubbers in series), which would remove most of the particulates and acidic gases remaining after the first scrubbers. An induced draft fan and stack complete the off-gas handling system.

Removal efficiency has been estimated to be 99.2 percent for acid gases and 97.3 percent for particulates. Permit conditions (at a maximum waste feed rate of 3,000 lb/hr) limit emissions to the following:

Particulates	3.0 lb/hr
Sulfur Dioxide	8.8 lb/hr
Hydrogen Fluoride	3.2 lb/hr
Hydrogen Chloride	3.68 lb/hr
Volatile Organic Compounds	1.15 lb/hr



Source: Adapted from Ambrose, 1986

FIGURE 3-4

TSCA INCINERATOR EQUIPMENT SCHEMATIC
ORGDP – OAK RIDGE, TN

The incinerator is designed to utilize either natural gas or No. 2 fuel oil to supplement the heat content of the waste feed and to control temperature in both the primary combustion chamber and the SCC. The fuel oil system is a backup to the natural gas system and will be used only when natural gas is not available.

Controls are in place that allow a thermal relief valve to open to vent combustion gases to the atmosphere through a stack in the event of shutdown of the induced fan or interruption of the water supply to the quench chamber. This prevents damage to the gas cleaning system during an interruption of quenching and avoids a backward flow during shutdown of the induced draft fan. When the thermal relief stack opens, all kiln and secondary burners are interlocked to shut down.

In addition to continuous process monitoring and control, the incinerator is equipped with an interlock and shutdown system that automatically shuts off the waste feed and shuts down the combustion systems and gas cleaning systems. This ensures safe and efficient shutdown in response to any major process upset condition or equipment malfunction.

Stack and ambient air sampling related to the incinerator are discussed in Section 3.1.3.

Cooling Towers

Major ORGDP cooling towers are listed in Table 3-8. Towers 892-H, 892-G, 861-E, 892-J, and 832-J have been removed from service because of shutdown of the gaseous diffusion process. At the time of the Survey, only tower 801-H was in operation. Because of the possibility of a fire in any of the out-of-service towers, a schedule of demolition has been prepared. Current condition is the principal factor determining the order of demolition.

The proposed demolition schedule calls for K-892-H to be demolished in fiscal year (FY) 1989, K-892-G in FY 1990, K-861-F in FY 1991, and K-892-J in FY 1992. It is anticipated that by 1993 tower K-801-H will either be replaced or require extensive repairs. The newest tower, K-832-H, and the new cell at tower K-861-E are in good condition and might be moved and used at other locations. The new cell would, however, require replacement of the Munter's fill which contains asbestos.

A fire in any of these towers would release substantial quantities of chromium to the atmosphere. Investigations at ORGDP (Haymore, 1986) showed concentrations of total chromium in cooling tower wood as high as 3,000 to 4,000 parts per million (ppm) (towers K-862-E and K-892-H). The chromium

TABLE 3-8

MAJOR COOLING TOWERS
ORGDP - OAK RIDGE, TN

Tower Number	Date Placed in Service	Function	Remarks
K-801-H	1944 (Rebuilt-1978)	Cooling for K-25	In operation
K-832-H	1945 (Rebuilt-1985)	Cooling for K-27 Cooling for K-29	Out of service
K-861-E	1951 (Cell 17* added-1979)	Cooling for K-31	Out of service
K-892-H	1954	Cooling for K-33	Out of service
K-892-G	1954	Cooling for K-33	Out of service
K-892-J*	1977-1978	Increased cooling for CIP-CUP	Out of service

Source: Adapted from MMES, 1988a

* Munter's fill (asbestos)

is probably present in the less toxic trivalent state since the more soluble hexavalent form would not accumulate. A fire at tower K-892-J has the additional potential to release asbestos (from the Munter's fill).

ORGDP has taken precautions to protect the idle cooling towers against fires. The automatic sprinklers remain activated and electrical systems have been de-energized (a large percentage of cooling tower fires are theorized to have started through electrical faults). In addition "no smoking" restrictions are rigorously enforced. (Cigarette smoking is suspected to be the cause of a cooling tower fire that occurred at tower K-862-H in 1979.)

Particulate Controls

ORGDP uses high-efficiency particulate air (HEPA) filters at 11 locations (see Table 3-9). Standard Operating Procedures (SOPs) call for annual testing of efficiency and continuous measurements of pressure drop across a HEPA filter when in use. During the Survey, two filters (in Building K-1037) were noted without pressure drop monitors. The two filters were not in use and ORGDP plans to install monitors in the near future before the filters are placed in use.

The SOPs call for tagging out a HEPA filter that has not been inspected for 1 year. Testing is normally delayed until the unit is to be returned to service. At the time of the Survey, several units were so tagged. (These are noted to be in "standby" condition in Table 3-9.)

The control of emissions from the UF_6 cylinder decontamination system in building K-1420 is discussed in Finding 3.1.4.4.2. This unit has not been used recently and the HEPA filter provides good control of the UO_2F_2 particles which result when the UF_6 is removed by reaction with water. However, good practice dictates that such discharges be vented vertically above the roof line. Presently (and in the past) the system discharges horizontally through the building wall. The HEPA filter was installed only recently (mid-1986). The impact of this discharge on soil in the area is discussed in Section 3.2.2 and Finding 3.2.4.3.1.

Asbestos Removal

During the forthcoming demolition program at ORGDP, it will be necessary to remove asbestos from many process buildings. Since asbestos is a hazardous air pollutant under the Clean Air Act (40 CFR 61, Subpart H) removal and disposal must be performed in compliance with these regulations. In addition, regulations promulgated under the Occupational Safety and Health Act

TABLE 3-9

HEPA FILTER SYSTEMS
ORGDP - OAK RIDGE, TN

Number	Description	Location
48-0004		K-1037
48-0011	UF_6 Cy. Decon-System	K-1420
48-0013	LHF Heat Induction Furnace	K-1420
48-0020	Lab. Hood	K-1006
48-0021	Lab. Hood	K-1006
48-0022	Lab. Hood	K-1006
48-0023	Lab. Hood	K-1006
48-0024	Lab. Hood	K-1006
48-0025	Lab. Hood	K-1006
48-0001	Standby	K-1037
48-0010	Standby	K-1420

Source: Adapted from ET&I Files by DOE Survey team

(OSHA) must be observed (29 CFR 1910 and 29 CFR 1926). Although not applicable to this demolition, the recently enacted Asbestos Hazard Emergency Response Act (AHERA) will be studied to determine which parts should be considered. At present AHERA applies only to asbestos removal projects involving school buildings.

ORGDP estimates that about 450,000 square feet of asbestos must be removed or treated. This estimate includes only friable asbestos and therefore does not include transite, shingles, or cooling tower fill. The estimate includes 41,000 square feet which will not be removed since the lines on which it is installed will remain active.

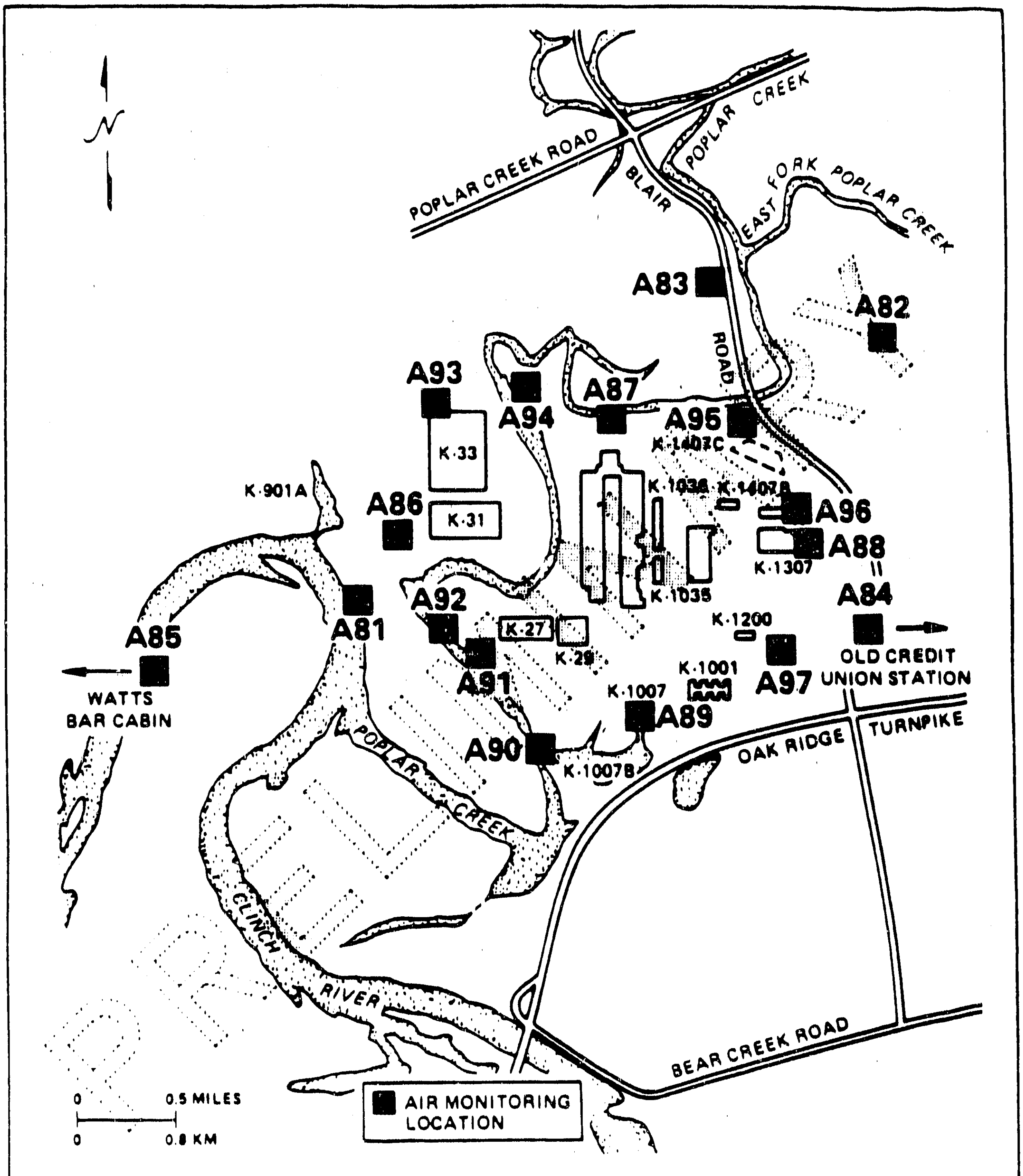
After consideration of many alternatives, a schedule of removal of about 400,000 square feet of asbestos and encasement of the 41,000 square feet remaining active has been prepared. High-priority areas that will be scheduled first include: the K-25/K-27/K-631 tie lines, the K-25 and K-27 Buildings (including pipe galleries), the compressor test building (K-633), the boiler house (K-701) and other tie lines. These areas include 267,000 square feet of asbestos.

One unique recommendation has been made for the abatement project. In most cases, pipe insulation will not be removed from the pipe. Sections of pipe will be removed and buried with the asbestos insulation intact. This methodology has the advantages of (1) satisfying the requirement of reducing the potential for release of carcinogens to a level "as low as reasonably achievable" (ALARA), (2) requiring less handling, and (3) avoiding separate removal of the pipe if only the insulation were removed. The only disadvantage appears to be that a larger volume will be required at the burial site. The Survey team agrees that this method is best in that the release of asbestos fibers to the atmosphere will be minimized. In addition this is probably the most cost-effective alternative.

3.1.3 Environmental Monitoring Program

Ambient Air Monitoring

Prior to 1986, ORGDP operated a network of 11 air monitoring stations (shown in Figure 3-5 as A86 through A96). Total suspended particulates (TSP) and a variety of nuclides were routinely determined. This network was designed to provide monitoring data for tracking releases as opposed to data on ambient environmental conditions. Problems with the location of the monitoring stations (e.g., poor siting, elevation and proximity to roads), resulted in data consistently indicating that TSP levels on-site were above ambient air quality standards. In 1986 these were replaced with a



Source: Oakes et al., 1987a

FIGURE 3–5

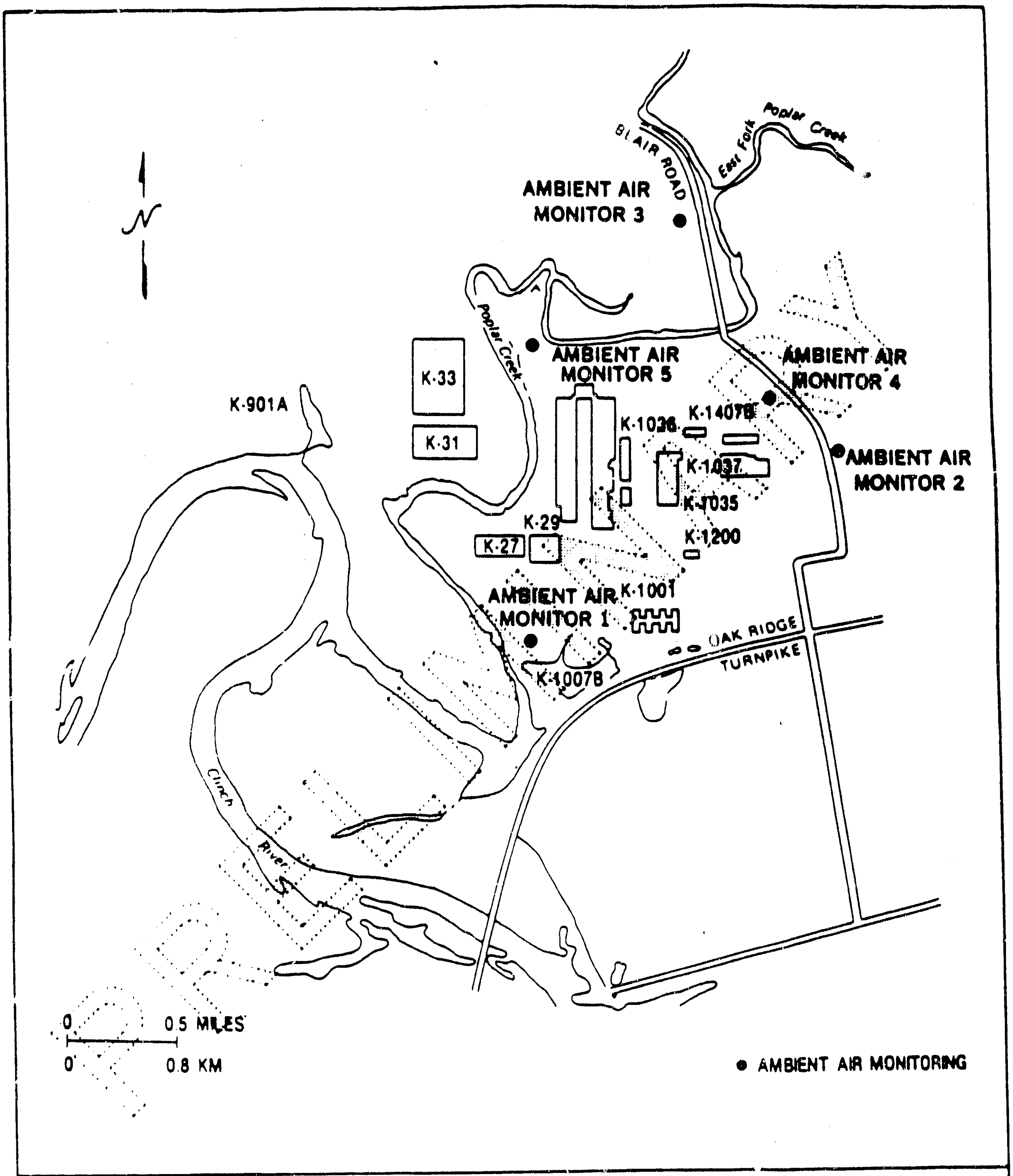
LOCATION MAP OF PERIMETER AIR MONITORING STATIONS AROUND ORGDP (THROUGH 1986)
ORGDP – OAK RIDGE, TN

network of five new stations (shown in Figure 3-6). This network has been in operation since early 1987. The locations for the new stations were selected to be in compliance with all siting criteria listed in 40 CFR 58.12, and the stations are operated according to the schedule outlined in 40 CFR 58.13. The schedule calls for one 24-hour sample to be taken every 6 days. This schedule meets the regulatory intent of obtaining representative data each day of the week. However, since no data are accumulated for five out of every six days, it would not provide good information during most unscheduled releases. ORGDP maintains several portable monitors that could be placed in operation whenever a release is detected. Considering the small potential for substantial releases (see Section 3.1.3.2, Stack Sampling), the Survey team agrees with this system. TSP levels obtained with the new network consistently indicate attainment of ambient air quality standards.

Particulate samples are collected as described in 40 CFR 50 Appendix B. In this procedure, air is passed through a preweighed Whatman 41 filter at about 50 cubic feet per minute (ft^3/min). After determination of TSP by weighing, the samples are dissolved and analyzed for uranium, chromium, and lead. Since the new air monitoring stations commenced operation in early 1986, soil samples have not been collected near the stations (see Finding 3.2.4.4.1). Standard procedures at most U.S. Department of Energy (DOE) sites call for coterminous taking of air and soil samples.

Ambient air samplers are also operated near the perimeters of the Y-12 Plant and ORNL. In addition, ORR operates 12 stations on or near the boundaries of the reservation. These are shown in Figure 3-1. As can be seen, stations A33, A42, and A43 are sufficiently close to ORGDP to provide information and serve to validate information from ORGDP stations. In general, although many ambient air monitoring data are accumulated by four groups at Oak Ridge (ORGDP, ORNL, Y-12, and ORR), there has been little coordination of the systems. Oak Ridge has proposed to have a consultant review the systems to improve the quality of data (e.g., siting), the coordination of data collection, and possibly to determine if any stations are superfluous.

With the shutdown of the gaseous diffusion process, measured discharge of fluorides to the atmosphere decreased from 75 kilograms in 1983 to 7 kilograms in 1986 (1984, 47 kilograms; 1985, 28 kilograms). Presumably future years will record values at or below the 1986 level. Until 1985, ORGDP operated 5 ambient air monitoring stations for gaseous fluorides (A81 through 85 on Figure 3-5). Samples were taken by pumping air through filter paper impregnated with potassium carbonate solution. During 1986, sampling was continued to demonstrate that low levels of fluorides had been attained. A total of 192 (7-day) samples were collected at stations A81 to A84, and 50 samples were collected at station A85. (Since A85 is located 8 kilometers upwind of ORGDP, it serves to estimate background conditions.)



Source: Bowers, 1988b

FIGURE 3-6

NEW AMBIENT AIR MONITORS (1987-PRESENT)
ORGDP - OAK RIDGE, TN

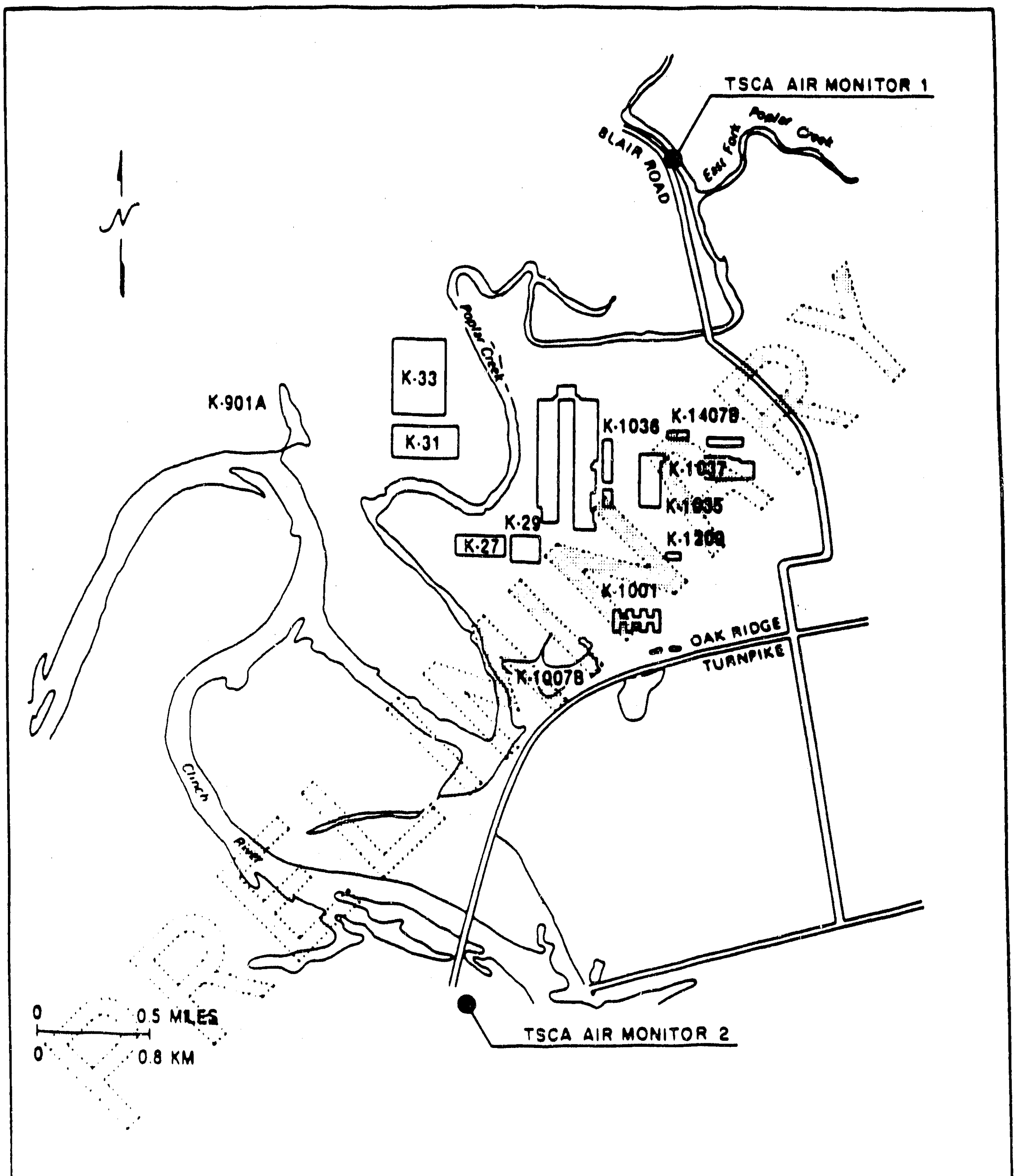
The highest quarterly average concentration at stations A81-84 was 0.08 microgram per cubic meter ($\mu g/m^3$), while the highest quarterly average of 7-day samples was 0.05 at station A85. Thus all samples were well below the ambient air standard of 1.6 $\mu g/m^3$; similar results were obtained for 30-day samples. No exceedances were found. Because of the low levels, ORGDP requested TDHE approval to eliminate fluoride monitoring at the above stations. TDHE concurred with this decision. Fluoride air sampling near the Y-12 perimeter is continuing.

TSCA Ambient Air Monitoring

With the startup of the TSCA incinerator, ORGDP plans to install two ambient air monitors to sample for organics related to incineration of PCB. Modeling of the predicted stack emissions indicates that the points of greatest impact are at the locations shown (TSCA-1 and TSCA-2) on Figure 3-7. Two monitors were purchased and installed during 1988. Plans call for analysis for uranium, PCBs, furans, dioxins, and possibly benzene hexachloride. Because of the high analytical costs, samples may be collected and stored for future analysis. For example, it may be more cost effective to analyze samples only during periods of malfunction at the incinerator. ORGDP personnel suspect that most analyses will show levels below detectable limits. The Survey team shares this opinion.

Stack Sampling

Prior to the shutdown of the gaseous diffusion process, only two stacks at ORGDP required continuous monitoring: the purge cascade scrubber vent and the steam plant. During 1986, certain post-shutdown activities at the purge cascade were occurring and emissions monitoring continued. Emissions of uranium, technetium, and fluoride for recent years are shown in Table 3-10. Sampling at the purge cascade stack was discontinued in early 1987. Therefore, the steam plant at present is the only major emissions source. The steam plant has a continuous opacity monitor. Compliance problems were discussed in Section 3.1.2 and are the subject of Finding 3.1.4.3.1. Sulfur dioxide emissions are estimated from the sulfur content of coal as received. Contract limits on the sulfur contents (2.44 percent maximum) have been a successful tool in ensuring compliance with the sulfur dioxide emission standard.



Source: Bowers, 1988b

FIGURE 3–7

AMBIENT AIR MONITORS – TSCA INCINERATOR
ORGDP – OAK RIDGE, TN

TABLE 3-10

AIR EMISSIONS – 1982–1986
ORGDP - OAK RIDGE, TN

	Uranium (grams)	Technetium (grams)	Fluorides (kilograms)
1982	2,000	2.0	71
1983	2,000	1.0	75
1984	1,000	1.0	47
1985	1,220	0.17	28
1986	198	0.23	7

Source: Oakes et al., 1987b

Plans call for stack sampling at the TSCA incinerator for radionuclide particulates to be performed using EPA Method 5 (modified). Gas flow rates and temperature will be measured using EPA Methods 1 and 2. Isokinetic sample probes are located at a point eight stack diameters downstream of the last obstruction in the 100-foot stack.

The sampling train will contain a filter for trapping uranium-containing particulates followed by at least four impingers in series. The filter will be heated to the 223° to 273°F range to avoid condensation. The impingers will be immersed in an ice-saltwater bath to improve condensation. The last impinger will contain silica gel to ensure complete collection of moisture. The next-to-last impinger will be empty. Any moisture collected will be added to the contents of the previous scrubber. If this combination contains more than 10 percent of the total uranium, the test will be rejected and modifications will be made to the sample train (such as using more impingers).

Radionuclides responsible for dose are shown in Table 3-11. Since uranium, technetium, iodine-131, and iodine-125 will be responsible for more than 95 percent of the dose, sampling and analysis will concentrate on these species. When collecting samples for iodine analyses, potassium hydroxide will be added to the scrubbers to enhance absorption. In addition, some impingers will contain impregnated charcoal. Uranium analyses will utilize the fluorometric method (EC-285), while iodine-131 will be analyzed by Method 902 or EC-138.

During the period following the trial burn, the only radioactive wastes to be incinerated will be those containing uranium. Thus, analyses for the iodine radionuclides will not be necessary.

Dose Calculations

With the shutdown of the gaseous diffusion plant, the principal source of radionuclide air emissions at ORGDP are the stacks from 1420 and the old incinerator at 1421. Emissions from these sources are extremely low partly because of intermittent operations but also because of controls. In 1986 the whole-body dose from all ORGDP emissions was 0.000000023 millirem (mrem). [The National Emission Standard for Hazardous Air Pollutants - NESHAP - standard is 25 millirem per year (mrem/yr) and the total exposure (50-year equivalent) to the total population living within 80 kilometers was 0.003 person-rem.] As required by the NESHAP regulations (40 CFR 61.H), these estimates were prepared utilizing AIRDOS-EPA. Technically, ORGDP would be exempt from reporting these doses since 40 CFR 61.98 exempts sources responsible for a dose equivalent below 5 mrem/yr whole body or 15 mrem/yr critical organ. Because of the proximity of other DOE operations, DOE Oak Ridge procedure is to report dose estimates simultaneously. The 1986 dose estimates for the three

TABLE 3-11

RADIONUCLIDES RESPONSIBLE FOR DOSE, TSCA INCINERATOR ORGDP - OAK RIDGE, TN

	Total Body		Lung		Thyroid	
Nearest Boundary	62.1%	^{125}I	53.9%	U*	94.6%	^{125}I
	23.7%	^{36}Cl	41.9%	^{36}Cl	3.6%	^{131}I
	6.3%	U*	2.0%	^{32}P	1.5%	^{36}Cl
	3.6%	^{32}P				
Nearest Resident	83.8%	U*	98.5%	U*	95.0%	^{125}I
	10.0%	^{125}I	0.8%	^{36}Cl	4.5%	^{131}I
	3.6%	^{36}Cl				
	1.4%	^{14}C				

Source: Ambrose, 1986

* Assumed to be enriched to 1 percent ^{235}U.

Oak Ridge facilities are shown in Table 3-12. As can be seen from the data, all three facilities are well below the NESHAP standards of 25 and 75 millirem for dose to the whole body and critical organ, respectively. However the critical organ dose for Y-12 is marginally above the reporting limit of 15 millirem. The doses are not additive since each facility has an impact on different populations.

The dose from the TSCA incinerator under a worst-case scenario has been estimated by ORGDP. It was assumed that all incoming radionuclides would volatilize and be released to the atmosphere (zero removal efficiency in the scrubbers). The dispersion of the particulate was modeled by AIRDOS-EPA to determine the dose to the nearest resident and also to a theoretical person living at the nearest boundary. These doses were then added. It was also assumed that the residents were at their residences 24 hours a day 365 days a year. In spite of the conservative assumptions, the dose to the whole body was 0.11 mrem/yr and the dose to the critical organ (thyroid) was 1.4 mrem/yr, well below the reporting limits of 5 mrem/yr and 15 mrem/yr, respectively.

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

None

3.1.4.4 Category IV

1. Steam plant boiler - violations of opacity standards. Coal-burning boilers at the steam plant are frequently in violation of opacity standards. Exceedances in 1987 occurred on 33 of the 69 days that the coal-fired boilers were operated. Although this is not a significant environmental problem and TDHE has not issued any Notices of Violation, the operating permits for the boilers may not be renewed. The permit renewal date is October 1988. Five of

TABLE 3-12

DOSE FROM AIR EMISSIONS - 1986
DOE OAK RIDGE FACILITIES
(mrem/year)
ORGDP - OAK RIDGE, TN

DOE Facility	Whole-Body Dose Equivalency	Critical Organ Dose Equivalency		
		Lung	Bone	Thyroid
Y-12 Plant	0.00026	15.9	1.03	
ORNL	0.5	0.5	0.42	0.51
ORGDP	0.00000067	0.000024	0.00057	0.00024
EPA Standard	25	75	75	75

Source: Adapted from Oakes et al., 1987b seven boilers are coal-fired only; the other two are equipped to burn natural gas; however, one of these boilers is nearing the end of its useful life.

A QA team appointed in December 1985 recommended the installation of two 40,000-lb/hr wood-fired boilers as the low-cost alternative. Installation of similar-sized natural gas boilers is now the preferred alternative.

2. The UF_6 cylinder cleaning vent (Building K-1420) discharges horizontally out of the building, resulting in poor air dispersion. In addition, the exhaust may have contacted the ground, resulting in contamination of the ground/soils in the area with uranium and fluoride. Although the vent now has a HEPA filter, accepted practice dictates that vents discharge vertically above the roof line. The impact of this discharge on soil contamination is discussed in Finding 3.2.4.3.1.

3.2 Soil

3.2.1 Background Environmental Information

The site occupied by ORGDP is, in general, underlain by residual soils formed by the in-place decomposition of rock. Alluvium also occurs in floodplains along the creeks. Fill materials placed during construction of the plant were derived from on-site sources, usually excavations for other buildings or facilities nearby.

The typical residuum in the site area is generally cohesive silty clay of medium to high plasticity. Decomposition of the bedrock 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. The residuum overlies a zone of weathered bedrock that is partially decomposed, usually with variable hardness, fracturing, and porosity. Below the weathered zone lies unweathered bedrock.

Valley soils, such as those developed on the Chickamauga Limestone beneath the site, are generally much thinner than those developed on the carbonate ridges. Valley soils are a mixture of clays, silts, and weathered shale fragments. The Rome Formation, which is predominantly sandstone and shale, weathers to form a shallow soil containing fragments of weathered rock. Soils reportedly mapped in the site area by the Soil Conservation Service range from a shaly silt loam to silt loam for areas underlain by limestone, and silt loam to loam for areas underlain by sandstone and shale (Kuhlmeier, 1987). Table 3-13 presents some selected physical characteristics of the unconsolidated residuum at ORGDP.

Background radioactivity and soil chemistry in the site area are not well documented prior to plant startup. 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 picocuries per gram (pCi/g) of thorium-232 and 0.72 to 1.3 pCi/g of uranium-238 (Myrick et al., 1983). Throughout the United States, the uranium-in-soil concentrations range from 0.12 to 3.8 pCi/g (uranium-238), and the thorium-in-soil concentrations range from 0.10 to 3.4 pCi/g (thorium-232). Soils in the vicinity of the ORGDP would be expected to have background concentrations of thorium and uranium within the ranges observed throughout Tennessee. Thus, uranium or thorium concentrations greater than background levels may be indicative of a local contamination source.

TABLE 3-13

PHYSICAL CHARACTERISTICS OF UNCONSOLIDATED RESIDUUM
ORGDP - OAK RIDGE, TN

Parent Material	Soil Name Texture	USCS Classification	Fragments (% >1")	Grain Size Analysis				Liquid Limit	Plasticity Index	pH	Permeability (cm x 10^{-4})	Drainable Porosity
				No. 4	No. 10	No. 40	No. 200					
Limestone and Shale	Armuchee Shaly Silt Loam	CL-ML	0 - 2	65-85	60-80	55-80	50-70	45-70	17-35	4.5-5.5	1 - 4	.1 - .14
Limestone	Dewey Silt Loam	CL-ML	0 - 5	90-100	80-100	75-95	65-80	27-40	12-20	4.5-5.5	4 - 14	.12 - .18
Cherty Dolomitic Limestone	Fullerton Cherty Silt	CL-ML	2 - 15	60 - 90	50 - 88	40 - 80	30 - 70	29 - 42	11-17	4.5-5.5	4 - 14	.1 - .15
Sandstone	Lahew Loam	CL-ML,SM	0 - 5	80-100	80-100	60-95	30-75	15-30	NP-7	4.5-5.5	4 - 14	.06 - .10
Sandstone and Shale	Muskingum Silt Loam	CL-SC	0 - 10	75-100	70-95	50-90	30-80	20-35	2-10	4.5-5.5	4 - 21	.08 - .14
Clayey Limestone	Talbott Silt Loam	CL-ML	0 - 3	90-100	85-100	75-95	70-80	28-36	16-25	4.5-6.0	4 - 16	.14 - .19
Sandstone	Waynesboro Loam	ML-SM	0 - 5	85-100	80-100	70-95	43-70	15-29	2-9	4.5-5.5	4 - 16	.12 - .16
Limestone	Wolflever			N/A	N/A			N/A	N/A	N/A	N/A	N/A
Nolichucky				N/A	N/A			N/A	N/A	N/A	N/A	N/A

Source: Kuhlmeier, 1987

There are no Federal or state regulations that limit the concentration of uranium in soils. However, there is guidance available from both the U.S. Nuclear Regulatory Commission (NRC) and the DOE. The NRC, in a memorandum pertaining to a Branch Technical Position on the disposal or on-site storage of residual thorium or uranium, established derived concentration limits for various disposal options (NRC, 1981). One of these options applies to wastes with concentrations of uranium or thorium sufficiently low 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 EPA for protection against transuranium elements present in the environment (EPA, 1977). The derived concentration limits are natural uranium, 10 pCi/g; depleted uranium, 35 pCi/g; and enriched uranium, 30 pCi/g. These concentration limits are based on the assumption that all the daughter products of these elements are present in secular equilibrium.

The DOE has established guidelines for residual radioactivity at Formerly Utilized Sites Remedial Action Program (FUSRAP) and remote Surplus Facilities Management Program (SFMP) sites (DOE, 1985; Gilbert et al., 1985). The guidelines specify concentrations for thorium-232 and 230, and radium-228 and 226 only. For other radionuclides or mixtures, the soil concentration guidelines must be derived, on a site-specific basis, from a basic dose limit of 100 millirem per year (mrem/yr) to an individual, from all pathways.

There are no regulatory standards for nonradiological contaminant concentrations in soil as there are for drinking water supplies or air. A determination of "safe" or "acceptable" levels in soil depends on contaminant migration pathways (e.g., wind or water erosion or leaching to the groundwater) and potential human exposure routes (e.g., ingestion of soil by children or farm animals, ingestion of contaminated groundwater, or inhalation of fugitive dust containing contaminants). Therefore, acceptable levels must be determined on a site-specific and chemical-specific basis.

3.2.2 General Description of Pollution Sources and Controls

Soils can become contaminated by air emissions, runoff, storage and disposal activities, spills, and resuspension of contaminated materials from other areas. On-site soil sampling at the ORGDP typically has been limited to areas of known air emissions or spills. Because the general location and nature of materials spilled were known, the focus of soil sampling has been area-specific, as opposed to routine site-wide monitoring, and limited to the specific materials thought to have been present. Because soil monitoring is limited in terms of areas sampled and constituents analyzed, the Survey team in some cases utilized process information and physical evidence of contamination to identify a number of potential soil contamination sources and areas of known soil contamination.

Actual and potential sources of soil contamination from operations and airborne emissions, both past and present, are described below. These areas primarily consist of diffuse and/or large areas where soils have been contaminated. Discrete areas of soil contamination resulting, for example, from isolated small spills are addressed in Section 4.5.1. Soil contamination associated with storage areas, and with active or inactive waste disposal sites (e.g., the K-900 Bottle Smasher and K-770 Contaminated Scrap Yard) is addressed as part of Sections 4.1.1 and 4.5.2.3, respectively, and in the findings dealing with the particular disposal sites.

Areas of known or suspected soil contamination are as follows:

- K-1420 Cylinder Cleaning Facility Stack Area - The soil and paved areas adjacent to the K-1420 Cylinder Cleaning Facility Stack are apparently contaminated with uranium, and probably contaminated with other radionuclides including technetium-99 released from cylinder cleaning operations. The facility, operated since the middle 1950s, is used for cleaning uranium hexafluoride cylinders. No exhaust system was in place to vent contamination released from the cleaning process. It is suspected by the Survey team that airborne contamination and contaminated particulate matter were released directly from the facility. A ventilation stack was installed in December 1971 (or January 1972) to exhaust airborne contamination; however, it operated until approximately mid-1986 without a high-efficiency particulate air (HEPA) filter. The installation of a HEPA filter, estimated by ORGDP personnel to be in mid-1986, provides for control of emissions from this stack. This stack was reported by ORGDP to formerly be one of the higher sources of uranium releases at the plant (Lay, 1988).

  Soil sample data for the period 1975 through 1981, when semiannual monitoring was performed at two locations in the area, revealed uranium concentrations as high as 44.3 micrograms per gram (µg/g) in the soil (Union Carbide Corporation, Nuclear Division, undated). Similarly, vegetation analyses indicate uranium concentrations up to 45.0 µg/g in grass at the same locations. For comparison, sampling data for 1986 indicate typical average values for uranium to be less than 3 µg/g and 1 µg/g in soil and grass respectively (Oakes et al., 1987b) at most on-site and all off-site locations. Monitoring has not been performed in these areas since 1981 (see Section 4.3.1).

- Purge Cascade Vent Areas (Old and New) - The soil and vegetation (grass) in the vicinity of the Purge Cascade Vents, both old and new, are contaminated with low levels of uranium, technetium-99, and fluoride. Operation of these vents released contaminants to the atmosphere as part of their function to clean undesirable chemicals and other matter from the process lines. The old vent, located on the K-25 building roof, and the new vent, located above the roof of the K-29 building adjacent to the open gap between the K-27 and K-29 buildings, have functioned during the life of the plant. The old vent operated from 1945 to 1978. The new vent operated from 1978 to 1985 (Faulkner, 1988). Because the enrichment process is no longer in operation, the purge cascade vents are no longer considered an active source of contamination.

  Soil samples collected in an area near the old vent from 1975 through 1981 indicate uranium and fluoride concentrations ranging from 0.03 to 132.1 µg/g and 110 to 1,660 µg/g, respectively (Union Carbide Corporation, Nuclear Division, undated). Soil samples collected in 1986 at off-site locations had average values typically less than 3 µg/g uranium and less than 700 µg/g fluoride (Oakes et al., 1987b). Grass samples analyzed over the same period had concentrations ranging from 0.092 to 97.0 µg/g for uranium, and 8 to 134 µg/g for fluoride (Union Carbide Corporation, Nuclear Division, undated). These areas have not been sampled as part of the monitoring program since that time. However, grass samples in the area south of the K-27 and K-29 buildings were collected in April 1986 for the purpose of assessing the radioactivity of the grass in order to make a decision regarding disposition of the cut grass. Analyses indicated that uranium and technetium-99 were present at maximum concentrations of 17 µg/g and 1.3 pCi/g, respectively (ACD, 1986). Grass samples collected in 1986 at off-site locations had typical average values less than 6 µg/g for fluoride, 0.1 µg/g for uranium, and 1.0 pCi/g for technetium-99 (Oakes et al., 1987b).

- Cooling Tower Areas - The ground surface areas near the cooling towers received zinc chromate as a result of deposition of drift and windage from the towers. The chromate, composed partially of hexavalent chromium, and the zinc have been observed in soil and vegetation samples obtained from 1975 through 1981 at the sample locations nearest the towers. Soil analyses reported for those years range from 20 to 2260 µg/g for total chrome, and 9 to 2,885 µg/g for zinc. Hexavalent chromium is thought to compose approximately 5 percent of the total chrome that is leachable from the soil (Taylor, 1980). Sampling at one of the locations (perimeter fence east of the K-33-H cooling tower) is still performed semiannually; however, analyses for metals other than uranium have not been performed since 1981.

The enrichment process is no longer in operation, and consequently the cooling towers are no longer in use. Thus they are no longer a contributing source of surface soil and vegetation contamination.

3.2.3 Environmental Monitoring Program

3.2.3.1 <u>Soil Monitoring</u>

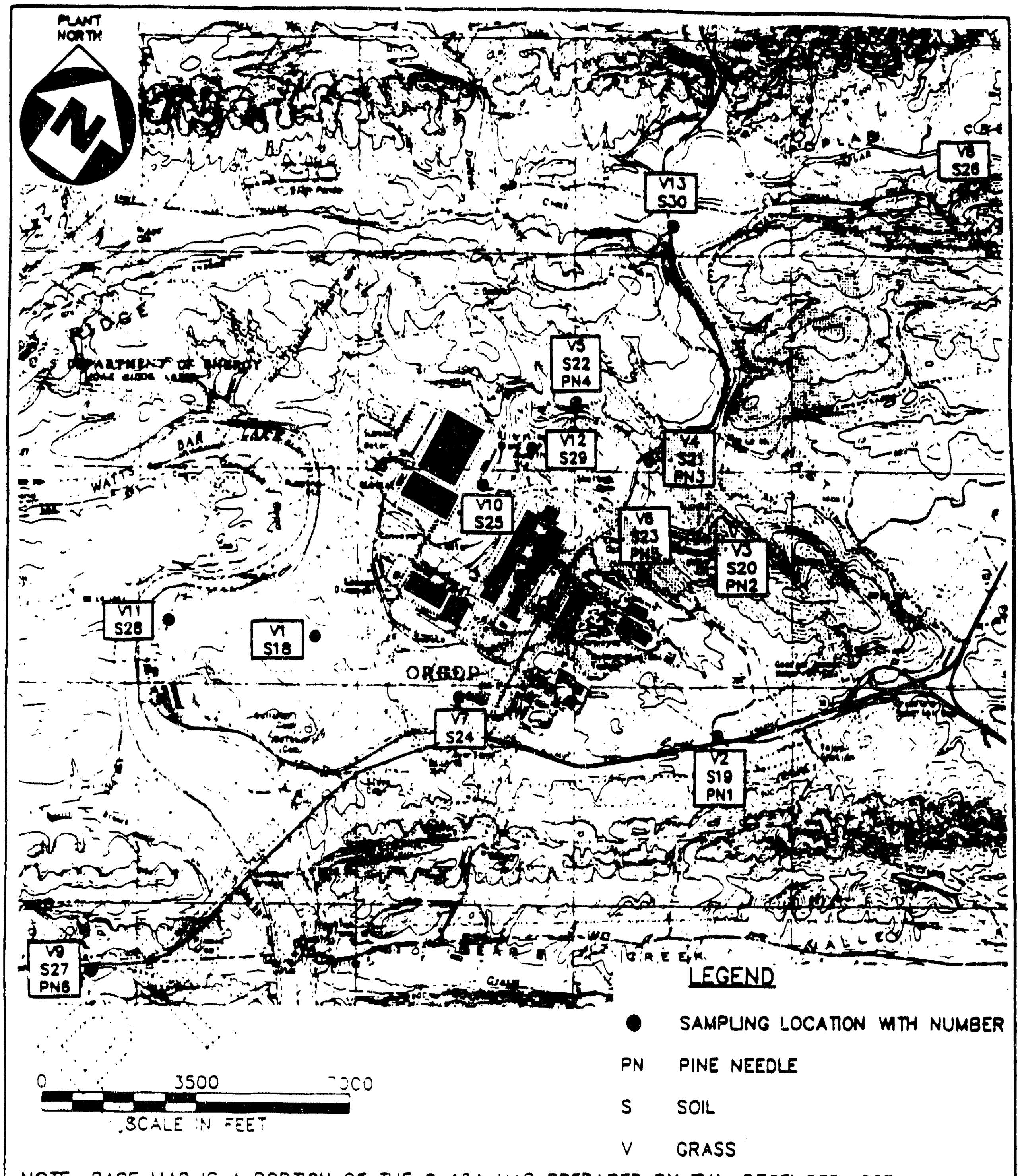
Soil sampling is performed at 13 locations on-site and off-site (within approximately 1 mile of the site) on a semiannual basis. Soil sampling was not scheduled during the on-site Survey, thus not observed, but written procedures and sample locations were thoroughly reviewed during the Survey. Locations of soil sampling are presented in Figure 3-8.

Soil samples are analyzed in an on-site laboratory for uranium and fluoride. Results of analyses for 1986 are presented in Table 3-14. Of the areas sampled, three revealed concentrations of uranium above the other values, possibly indicative of contamination due to site operations. These sample sites--S25K, perimeter fence east of K-33-H cooling tower; S28K, K-722 Scrap Yard; and S29K, Peninsula at K-1064--are located at or near areas of known soil contamination or close to past or present sources of airborne releases of contaminants.

3.2.3.2 <u>Vegetation Monitoring</u>

Vegetation sampling consists of collecting grass from the same 13 locations as the soil samples, and pine needles from 5 of the locations on a semiannual basis. Figure 3-8 shows the locations of the vegetation samples. Vegetation sampling was not scheduled during the on-site Survey, thus not observed, but written procedures and sample locations were thoroughly reviewed during the Survey.

Vegetation is analyzed for uranium, technetium-99, and fluoride at the on-site laboratory. Results from analyses of grass and pine needles collected in 1986 are presented in Tables 3-15 and 3-16, respectively. As with the soil samples, vegetation analytical results indicate areas where contamination, possibly from past or present operations, is apparent. The areas with apparent contamination elevated above other values--V6K, intersection of Blair Road and K-1407-C access



NOTE: BASE MAP IS A PORTION OF THE S-16A MAP PREPARED BY TVA, DECEMBER 1987.

Source: Oakes et al., 1987a

FIGURE 3-8

SOIL AND VEGETATION MONITORING LOCATIONS
ORGDP – OAK RIDGE, TN

TABLE 3-14

1986 FLUORIDE AND URANIUM IN SOIL DATA
ORGDP - OAK RIDGE, TN

Sample Location	Number of Samples	Concentration (µg/g dry wt)						U (pCi/g dry wt)		
		F⁻			U (total)					
		Feb.	July	Av	Feb.	July	Av	Feb.	July	Av
S18K	2	380	200	290	1.8	2.4	2.1	1.37	1.8	1.585
S19K	2	881	750	816	2.8	2.0	2.4	2.13	1.5	1.815
S20K	2	306	50	178	2.9	3.4	3.2	2.2	2.6	2.4
S21K	2	446	150	298	1.8	2.3	2.1	1.4	1.7	1.55
S22K	2	445	550	498	2.6	3.0	2.8	2.0	2.3	2.15
S23K	2	196	<50	<123	2.1	2.1	2.1	1.6	1.6	1.6
S24K	2	514	50	282	2.2	2.4	2.3	1.7	1.8	1.75
S25K	2	449	700	575	3.8	3.4	3.6	2.9	2.6	2.75
S26K	2	333	150	242	1.9	2.4	2.2	1.4	1.8	1.6
S27K	2	600	650	625	1.8	2.2	2.0	1.4	1.7	1.55
S28K	2	380	550	465	14.2	24.6	19.4	10.8	18.7	14.75
S29K	2	590	500	545	5.7	2.2	4.0	4.3	1.7	3.0
S30K	2	370	200	285	1.6	1.2	1.4	1.2	0.9	1.05

Source: Oakes et al., 1987b

TABLE 3-15

1986 GRASS SAMPLING DATA*
ORGDP - OAK RIDGE, TN

Sample Location	F^- concentration (µ/g dry wt)			U (total) concentration (µg/g dry wt)			U (total) concentration (pCi/g dry wt)			99Tc concentration (pCi/g dry wt)		
	Feb.	July	Av	Feb.	July	Av	Feb.	July	Av	Feb.	July	Av
V1K	1.5	23.0	12.3	0.1	0.12	0.113	0.08	0.095	0.0875	0.4	0.9	0.65
V2K	0.13	5.4	2.77	0.7	0.19	0.447	0.05	0.147	0.0985	<0.4	<0.4	<0.4
V3K	2.0	3.8	2.9	0.1	0.24	0.171	0.08	0.183	0.1315	<0.6	2.6	<1.6
V4K	1.7	2.4	2.1	0.1	0.05	0.077	0.08	0.041	0.0605	0.7	<0.4	<0.37
V5K	2.7	8.7	5.7	<0.1	0.03	0.064	<0.08	0.021	<0.0505	0.5	<0.4	<0.45
V6K	2.2	7.1	4.7	0.2	0.07	0.14	0.15	0.055	0.1025	0.9	1.4	1.15
V7K	5.9	3.8	4.9	0.1	0.05	0.076	0.08	0.039	0.0595	0.9	0.7	0.8
V8K	4.0	3.0	3.5	0.1	0.097	0.0985	0.08	0.074	0.077	0.6	<0.4	0.5
V9K	2.3	9.2	5.8	0.1	0.07	0.084	0.08	0.152	0.066	<0.4	<0.4	<0.4
V10K	8.3	5.8	7.1	0.1	0.17	0.137	0.08	0.132	0.106	<0.4	6.1	3.3
V11K	11.3	7.8	9.6	10.4	3.2	6.83	7.9	2.470	5.185	36.0	136.2	86.1
V12K	3.1	5.1	4.1	0.2	0.17	0.18	0.02	0.126	0.073	0.7	7.4	4.1
V13K	4.0	3.0	3.5	0.1	0.03	.066	0.08	0.024	0.052	<0.4	<0.4	<0.4

Source: Oakes et al., 1987b

* Ingestion by cattle of 30 µg of fluoride per gram (dry weight) of grass for average grazing intake is considered to produce no adverse effect on the cattle.

TABLE 3-16

1986 PINE NEEDLE SAMPLING DATA
ORGDP - OAK RIDGE, TN

Sample Location	F^- concentration (µ/g dry wt)			U (total) concentration (µg/g dry wt)			U (total) concentration (pCi/g dry wt)			^{99}Tc concentration (pCi/g dry wt)		
	Feb.	July	Av	Feb.	July	Av	Feb.	July	Av	Feb.	July	Av
PN1	6.9	6.3	6.6	1.2	0.126	0.66	0.11	0.096	0.103	<0.4	<0.4	<0.4
PN2	3.0	5.8	4.4	<0.1	0.045	<0.07	<0.08	0.034	<0.057	<1.2	<1.2	<1.2
PN3	3.9	7.1	5.5	0.1	0.095	0.10	0.08	0.072	0.076	<0.4	<0.4	<0.4
PN4	2.6	3.0	2.8	0.1	0.085	0.09	0.08	0.065	0.072	<0.4	<1.0	<0.7
PN5	<0.1	4.5	<2.3	0.2	0.077	0.14	0.15	0.059	0.104	1.4	0.6	1.0

Source: Oakes et al., 1987b

road; V7K, perimeter fence at the southwest corner of K-1007; V10K, perimeter fence east of the K-33-H cooling tower; V11K, K-722 Scrap Yard; and V12K, peninsula area at K-1064--are near or downwind of known or suspected sources of contamination and are discussed in Section 3.2.2 and Finding 4.5.2.3.

The soil and vegetation sample collection locations are not all based on current sources or potential future sources of soil and vegetation contamination. Although air monitoring locations have recently been established in consideration of current or known future sources, any collocation with soil and vegetation monitoring locations was unintentional. ORGDP plans to procure consulting services to review the current monitoring programs, and recommend a program approach that would integrate soil, vegetation, and air monitoring relative to operations. See Finding 3.2.4.4.1.

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. Soil contamination has not been fully characterized. The Survey identified three areas that are or may be contaminated with hazardous or radioactive constituents. The contaminated areas include, but may not be limited to, the following:

   a. K-1420 Cylinder Cleaning Facility Stack Exhaust Area - This stack was reportedly one of the higher quantity sources of uranium releases during enrichment operations. The stack was installed in December 1971 (or January 1972) and operated until approximately mid-1986 without a HEPA filter. It has operated since mid-1986 with a HEPA filter. Soil sampling sites previously sampled in the area revealed uranium concentrations as high as 44.3 ug/g in 1977. Sampling has not been performed at that location since 1981. The extent of contamination is presently uncharacterized near this potential source.

b. Purge Cascade Vent Areas (Old and New) - The operation of the process equipment to enrich uranium required purging of undesirable trace quantities of other radionuclides, in particular technetium-99. The purge cascade vents exhausted the process lines of this and other impurities. Airborne distribution and subsequent deposition resulted in soil and vegetation contamination in areas close to the purge vents. Previous special sampling of the grass south of the K-27 and K-29 buildings performed in April 1986 revealed low-level contamination by technetium-99 (1.3 pCi/g), uranium (17 µg/g), and fluoride (61 µg/g). Historically, the nearby sample locations in the downwind (both northeast and southeast) directions have consistently shown higher concentrations of uranium, technetium-99, and fluoride than have more distant or cross-wind locations. Soil contamination from these sources has not been completely characterized.

c. Cooling Tower Areas - The areas near the cooling towers received airborne deposition of chromate-treated cooling water during operation of the enrichment process. Cooling water contained 18 to 21 parts per million (ppm) chromium, 1 to 2 ppm zinc, and 0.8 to 1.6 ppm phosphorus (Motley, 1987). The amount of hexavalent chromium is roughly one-half the total chromium concentration at 9 ppm (Taylor and Park, 1981). Sampling performed at three locations near cooling towers K-33-H, K-33-G, and K-31 from 1975 through 1981 showed soil contamination by chromium and zinc ranging from 20 to 2,260 µg/g and 9 to 2,885 µg/g, respectively. Typically, concentrations of these elements in soil are less than 100 µg/g for samples collected at locations just outside of the plant area. Sampling for these metals was discontinued in 1982. The extent of hexavalent chromium contamination in the soil relative to the former operation of the towers is uncharacterized.

3.2.4.4 Category IV

1. Soil and vegetation sampling locations are not collocated with ambient air monitoring stations. Current ambient air monitoring stations located relative to known (K-1420 Cylinder Cleaning Facility) or future (K-1035 TSCA incinerator) airborne contaminant release points are not collocated with soil and vegetation sampling locations in a manner that would allow correlation of AIRDOS predicted soil deposition with actually monitored soil contamination. The use of predicted values only for evaluating environmental impacts for airborne releases without proving or calibrating the computer model in use at the facility reduces the level of confidence in the predicted values. Collocation of air monitoring locations with soil and

vegetation monitoring locations would provide a means to collect more meaningful data to calibrate the AIRDOS model used for the sources. A program of evaluation is planned, but has not been implemented. See Section 3.1.3 for information regarding ambient air monitoring.

3.3 Surface Water

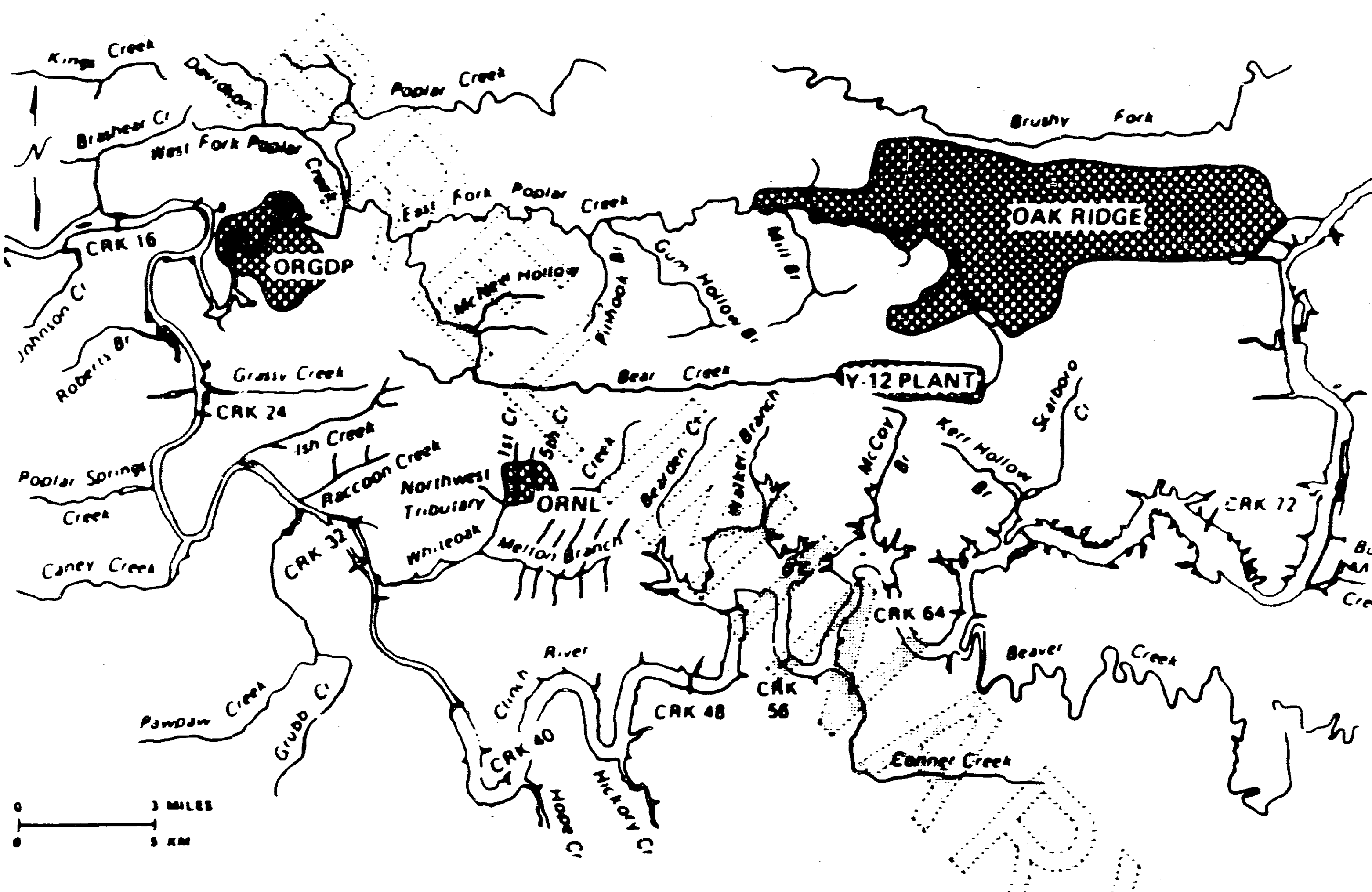
3.3.1 Background Environmental Information

Regional Setting

Surface-water features at ORGDP and in fact for virtually all of the ORR, follow the northeast- to southwest-trending valleys. Each of the three DOE facilities affects different sub-basins of the Clinch River, the major surface-water body in the ORGDP area. Drainage from the Y-12 Plant enters Bear Creek and the East Fork of Poplar Creek; ORNL drains into White Oak Creek and several tributaries; and ORGDP drains into Poplar Creek, the Clinch River, and an unnamed tributary of Poplar Creek known locally as Mitchell Branch. Refer to Figure 3-9 for details (Rogers et al., 1988a).

The hydrology of the Clinch River-Poplar Creek system is highly complex due to flow alterations induced by the Melton Hill Dam upstream on the Clinch River and the Watts Bar Dam downstream on the Tennessee River. The flows in the vicinity of the ORGDP can thus be downstream, upstream, or zero. Historically, zero flow over Melton Hill dam occurs about 50 days a year, usually during weekends, when industrial electrical power requirements are diminished. To sustain peak power demands, intermittent releases of 510 m^3/sec (18,000 ft^3/sec) frequently result on weekdays. At full pool elevation, the Clinch River in the area of ORGDP ranges in depth from less than 1 meter (3 feet) to about 7.3 meters (24 feet) and in width from 90 to 180 meters (295 to 590 feet). The Poplar Creek flow rate averages about 6 m^3/sec (215 ft^3/sec), with recorded maximum and minimum rates being 254 and 0.5 m^3/sec (8,960 ft^3/sec and 18 ft^3/sec), respectively. The average depth of the creek in the vicinity of ORGDP is about 3.5 meters (11.5 feet) and the average width is about 70 meters (230 feet).

The 560-kilometer (350-mile)-long Clinch River has its headwaters near Tazewell, Virginia, and empties into the Tennessee River at Kingston, Tennessee. It drains an 11,420-square-kilometer (4,410-square-mile) watershed and comprises about 11 percent of the Tennessee River watershed. Melton Hill Dam was built in 1963 and controls the flow of the Clinch River in the ORR area. It has a head of 15 meters (50 feet) and creates a reservoir that extends 70 kilometers (4.4 miles) upstream. Watts Bar Dam, although on the Tennessee River, affects the flow of water in the lower reaches of the Clinch River up to the Melton Hill Dam, thus becoming a major influence on surface waters in the immediate ORGDP area. Watts Bar Dam has a head of 34 meters (112 feet) and creates a reservoir that extends up the Clinch River from its mouth to the 37-kilometer (23-mile) mark upstream. Poplar Creek enters the Clinch River at the 19.2-kilometer (11.9-mile) mark.



Source: Rogers et al., 1988a

FIGURE 3–9

LOCATION MAP OF OAK RIDGE RESERVATION TRIBUTARIES
ORGDP – OAK RIDGE, TN

Flooding

Flood risk on the Clinch River and on Poplar Creek has been evaluated by the Tennessee Valley Authority (TVA), the agency which regulates water levels in the ORGDP area. Regional floods occur typically in the December to April period, the season of maximum precipitation and greatest surface runoff, since most vegetation is dormant. The severity of flooding on the Clinch River was diminished considerably by construction of TVA dams at Morris, Melton Hill, and Watts Bar. From 1883 until 1936 (prior to Morris Dam's closure), 47 floods overflowed the Clinch River floodplain. Since 1936 only one flood (1937) surpassed the reservoir's storage capacity. The combined effects of the three dams should prevent almost all future excessive flows on the Clinch (Boyle et al., 1979).

ORGDP staff have used data from TVA's flood hazard analysis branch to predict water levels above the ground floor of major facilities during the 100-year flood) (1 in 100 chances of being equaled or exceeded in any given year) and the 500-year flood (1 in 500 chances of being equaled or exceeded in any given year). Refer to Table 3-17. The same data were used to identify areas of ORGDP which would have blocked access during flood conditions. Refer to Table 3-18 for this information. See also Figure 3-10 for graphic views of the potentially flooded areas.

Extreme floods may result on the tributaries to the Clinch River from two types of storms:

- Intense rainfall of long duration during winter.
- Cloudbursts of short duration but great intensity during summer.

High-intensity summer rains occur frequently whenever warm moist air from the Gulf of Mexico flows northward over the eastern continental range. The most intense storm during the period of record in the City of Oak Ridge occurred on August 10, 1960, when 18.9 centimeters (7.43 inches) of rain fell in 3.3 hours. At the storm center, 1.2 kilometers (0.75 mile) north of the Oak Ridge weather stations, about 22.9 centimeters (9 inches) fell during the same period. To demonstrate the restricted areal extent of such cloudbursts, during the same 3.3-hour period the rain gauge at ORGDP's station 19 kilometers (12 miles) west of Oak Ridge recorded only 0.08 centimeter (0.03 inch) of precipitation. Rainfall of this type is a source of concern, since it cannot be controlled by the operation of TVA's dams (Boyle et al., 1979).

TABLE 3-17

FACILITIES WITHIN THE FLOODPLAIN ORGDP - OAK RIDGE, TN

Building	Description	Water Level Above Ground Floor (ft)	
		100-Year Flood	500-Year Flood
K-700-A-27	Substation for 1513 Pad	0.0	1.3
K-701	Boiler House	1.48	3.89
K-702	Turbine Room	1.48	3.89
K-703	Office Area	1.48	3.89
K-705-B	Intake Tunnel	0.0	0.01
K-706	Pump House	0.0	0.01
K-71	Sewage Treatment Facility	0.0	1.01
K-723	Warehouse	0.0	0.01
K-726	Warehouse	0.0	1.51
K-738	Warehouse	0.0	0.76
K-801	Intake Pump House	0.0	1.8
K-801-H	Cooling Tower Top Wall	0.0	0.3
K-802	Pump House	0.0	1.3
K-802-H	Cooling Tower	0.0	1.3
K-891	Pump House: Floor Base of Pumps	2.7 1.7	6.3 5.3
K-901-A	Holding Pond (normal pool elev. 740.0)	7.3	9.7
K-1025-A	Warehouse	2.5	5.9
K-1025-B	Warehouse	2.5	5.9
K-1025-C	Warehouse	2.5	5.9
K-1025-D	Warehouse	2.5	5.9
K-1025-E	Warehouse	2.5	5.9
K-1064-D	Truck Loading Facility	0.0	1.3

TABLE 3-17
FACILITIES WITHIN THE FLOODPLAIN
ORGDP - OAK RIDGE, TN
PAGE TWO

Building	Description	Water Level Above Ground Floor (ft)	
		100-Year Flood	500-Year Flood
K-1064-E	Yard Shop	0.0	0.3
K-1066-E	Cylinder Storage Yard	0.0	1.8
K-1066-F	Cylinder Storage Yard grade elev. varies (755.0 elev.) grade elev. varies (752.0 elev.)	 2.5 5.5	 5.9 8.9
K-1066-J	Cylinder Storage Yard grade elev. varies (750.3 elev.) grade elev. varies (748.2 elev.)	 7.2 9.3	 10.6 12.7
K-1066-L	Cylinder Storage Yard	1.5	4.9
K-1132	HF Storage Tanks	0.0	2.1
K-1133	HF Storage Tanks	0.0	2.1
K-1134-B	HF Storage Tanks	0.0	2.1
K-1135	HF Storage Control Building	0.0	2.2
K-1203-2	Holding Basin (bed elev. 747.52)	1.88	4.58
K-1203-4	Chlorination Control	0.0	2.1
K-1203-5	Drying Bed	1.4	4.1
K-1203-6	Drying Bed	1.4	4.1
K-1203-8	Chlorine Tank	0.0	2.1
K-1203-10	Lift Station: Base of Pumps Base of Motors	4.9 3.6	7.6 6.3
K-1203-11	Air Blower Station	0.0	2.1
K-1203-12	Lift Station	7.14	9.84
K-1203-13	Monitoring Station	0.0	2.1
K-1203-14	Comminutor	1.86	4.56
K-1204-9	Ejector Station	2.1	5.4

TABLE 3-17
FACILITIES WITHIN THE FLOODPLAIN
ORGDP - OAK RIDGE, TN
PAGE THREE

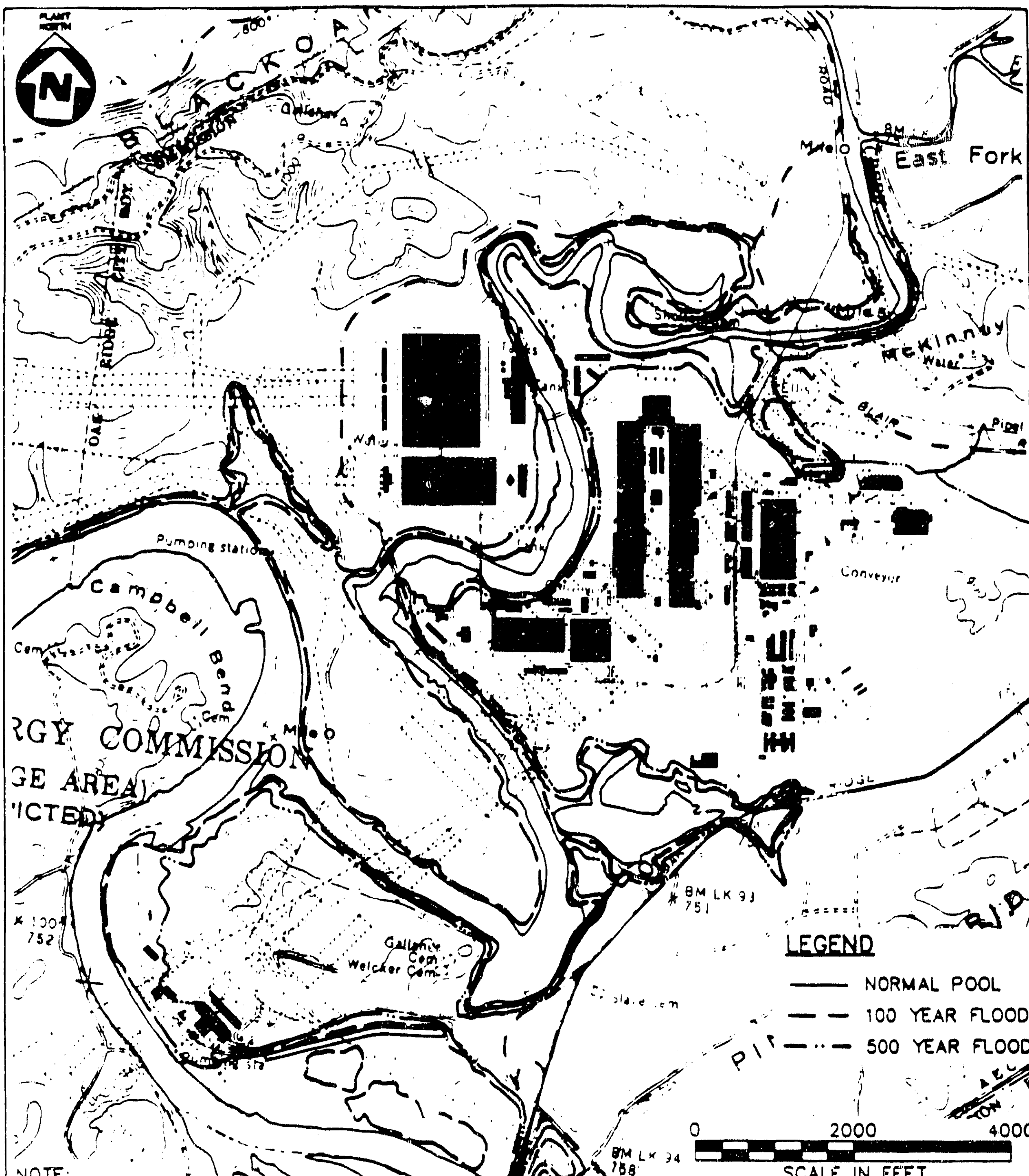
Building	Description	Water Level Above Ground Floor (ft)	
		100-Year Flood	500-Year Flood
K-1204-10	Ejector Station	7.5	10.8
K-1240-9A	Parking Area	0.3	3.3
K-1250-5	Blair Road Bridge	2.9	6.3
K-1250-6	Blair Road Railroad Bridge	1.0	4.4
K-1251	Barge Loading Facility	1.8	4.3
K-1407-B	Holding Pond (normal pool elev.)	2.0	5.4
K-1513	Pump House: Floor Inside Building Base of Pumps	1.8 0.0	5.3 2.3
K-1515-C	Lagoon (normal pool elev.)	7.8	10.3

Source: MMES, 1984

TABLE 3-18
AREAS WITH BLOCKED ACCESS DURING FLOOD CONDITIONS
ORGDP - OAK RIDGE, TN

Facility or Area	Flood	
	100-Year	500-Year
Outside the Perimeter Fence (Roads Flooded)		
Access to K-1513	X	X
Powerhouse area west of K-724 and K-707	X	X
Facilities on West and North Perimeter roads from Highway 58 and facilities north of Portal 9 from Oak Ridge Turnpike	X	X
Portal 5	X	X
Any part of the plant off of Blair Road from Highway 61	X	X
Rail service to the plant	X	X
East Duct Road to refuse waste burial	X	X
Rail service from K-25 to the powerhouse area		X
All powerhouse facilities west of K-704		X
Inside the Perimeter Fence (Roads Flooded)		
West Poplar Creek Road		X
Access to K-891		X
Northwest Patrol Road at K-1064	X	X
Northeast Patrol Road at K-1066 and K-1070-B	X	X
Access to K-1135		X
North Patrol Road at K-1025		X
Northeast Patrol Road at K-1025		X
Ninth Street at K-1066		X

Source: MMES, 1984



NOTE:
BASE MAP IS A PORTION OF THE USGS EVERTON, TN QUADRANGLE (7.5 MINUTE SERIES. 1968).

Source: MMES, 1984

FIGURE 3-10

FLOODPLAIN MAP
ORGDP - OAK RIDGE, TN

Evapotranspiration and Runoff

Loss of water to the atmosphere by evapotranspiration is approximately 76 centimeters (30 inches) annually, or approximately 55 percent of the total annual precipitation. Evapotranspiration is at a maximum from July to September. Seasonal relationships between evapotranspiration and precipitation are reflected in seasonal patterns of runoff to streams. Runoff is greatest in the winter when evapotranspiration is low and precipitation is high. Precipitation not lost as evapotranspiration or quick runoff to streams percolates through the soil and eventually recharges the groundwater system.

As noted above, rainfall and evapotranspiration (and therefore runoff) vary throughout the year so that stream flow is seasonally dependent. Two "seasons" can be identified, a dormant season (November through April) and a growing season (May through October). Seventy-three percent of the 48-hour storms (long storms of moderate intensity) occur in the dormant season while 75 percent of the three-hour storms (short, intense) occur in the growing season. Peaks in rainfall occur in July when short but heavy rainstorms occur. Conversely, October brings many slow-moving high-pressure cells that suppress rain and provide mild, clear dry weather (Rogers et al., 1988a).

Stream Classifications

The Tennessee Department of Public Health has classified the Clinch River and its tributaries for multiple uses. A summary of this classification as it affects ORGDP's receiving streams is given in Table 3-19. Note that several gaps occur for selected uses at Poplar Creek, East Fork of Poplar Creek, and even for the Clinch River. However, all points in all streams are intended for use to support fish and aquatic life, livestock watering and wildlife, and irrigation of crops. Only the two larger streams (Clinch River and Poplar Creek) find use as industrial water supply. The only industrial user of Poplar Creek is ORGDP itself.

Although there are nine public water supply systems serving 91,500 people that withdraw surface water within a 32-kilometer (20-mile) radius of the ORR, only one (City of Kingston, Tennessee) is downstream from ORGDP. Kingston's intake is actually on the Tennessee River 0.6 kilometer (0.4 mile) upstream from the mouth of the Clinch River. Water use in the area is carefully monitored (even though ORR effluents are downstream of the intake) because it is in the area of backflow of Clinch River water in the Tennessee River. Kingston pumps approximately 9 percent of its average daily supply from this source (Rogers et al., 1988a).

TABLE 3-19

USE CLASSIFICATION OF RECEIVING STREAMS
ORGDP - OAK RIDGE, TN

Use	Clinch River	Poplar Creek	East Fork of Poplar Creek	Mitchell Branch[1]
Domestic Water Supply[2]	km 7.0-74.7 (mi 4.3-46.4)	--	--	--
Industrial Water Supply	km 7.0-74.7 (mi 4.3-46.4)	km 0.0-0.8 (mi 0.0-0.5)	--	--
Fish & Aquatic Life	km 7.0-74.7 (mi 4.3-46.4)	km 0.0-origin (mi 0.0-origin)	km 0.0-dam at Y-12 (mi 0.0-dam at Y-12)	km 0.0-origin (mi 0.0-origin)
Recreation	km 7.0-74.7 (mi 4.3-46.4)	km 0.0-0.8 km 2.1-19.8 km 23.0-0rigin (mi 0.0-0.5 mi 1.3-12.3 mi 14.3-origin)	km 0.0-7.7 km 13.3-dam at Y-12 (mi 0.0-4.8 mi 8.3-dam at Y-12)	km 0.0-origin (mi 0.0-origin)
Irrigation	km 7.0-74.7 (mi 4.3-46.4)	km 0.0-origin (mi 0.0-origin)	km 0.0-dam at Y-12 (mi 0.0-dam at Y-12)	km 0.0-origin (mi 0.0-origin)
Livestock Watering and Wildlife	km 7.0-74.7 (mi 4.3-46.4)	km 0.0-origin (mi 0.0-origin)	km 0.0-dam at Y-12 (mi 0.0-dam at Y-12)	km 0.0-origin (mi 0.0-origin)
Navigation	km 7.0-19.2 km 32.0-74.7 (mi 4.3-11.9 mi 19.9-46.4)	--	--	--

Source: Adapted from Rogers et al., 1988b

(1) Standard classification of all other tributaries, named and unnamed.

(2) Kingston is the only downstream public water supply system using surface water. Its intake is on the Tennessee River 0.6 kilometer (0.4 mile) upstream from the confluence of the Clinch River and the Tennessee River.

ORGDP maintains pumphouses on Poplar Creek and the Clinch River to provide surface water for virtually all plant uses. The pumphouse at K-1513 on the Clinch River at km 23.3 (mi 14.5) is upstream of all plant discharge points (except for the pond serving the filtration and treatment plant itself). This station provides ORGDP with all of its sanitary water and most of its cooling and fire protection water. It services the main site, the Power House area, and the City of Oak Ridge Industrial Park located south of Bear Creek Road near the water treatment plant.

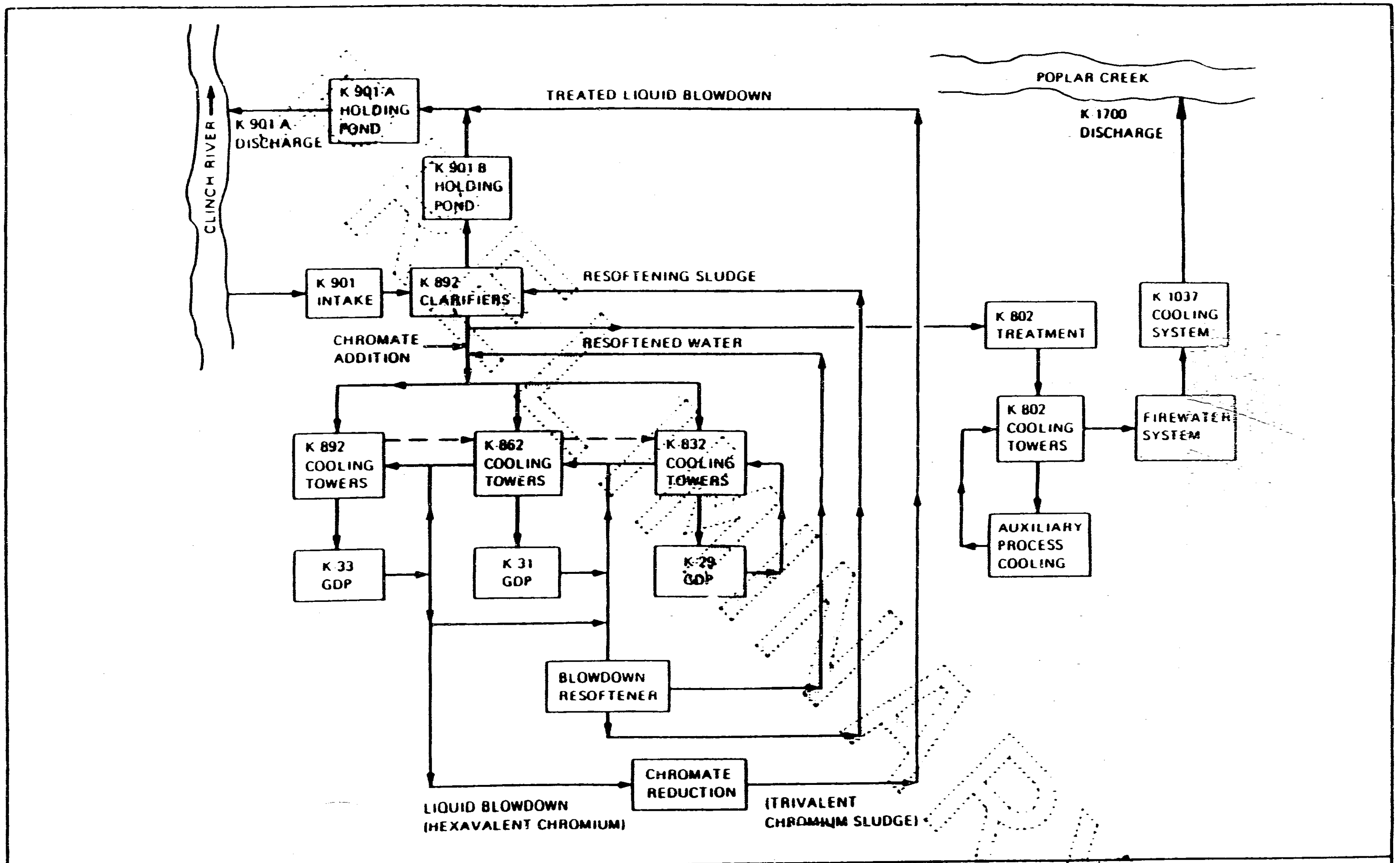
Two raw water intake pumping stations, K-901 on the Clinch River at km 18.5 (mi 11.5) and K-891 on Poplar Creek at km 5.6 (mi 3.5) were used heavily until August 1985 to provide makeup water for the gaseous diffusion processes recirculating cooling water systems. These systems consist of more than 5.6 kilometers (3.5 miles) of pipelines with 30- to 150-centimeter (12- to 60-inch) diameters. Makeup flows ranged from 22 to 90 million liters per day [(6 to 24 million gallons per day (mgd)] and the maximum recirculating water capacity was over 2 billion liters per day (530 mgd). Currently these two intake stations are operating at very low pumping rates compared to past operations. Their use is limited to providing cooling water for air plants, nitrogen plants, the maintenance building, and various other buildings. The Poplar Creek pumphouse (K-891) also is an important source of fire protection water for the ORGDP site.

3.3.2 General Description of Pollution Sources and Controls

3.3.2.1 Principal Wastewater Sources

Wastewaters are generated by a number of different operations, past and present, on-site at ORGDP Discharges may be continuous or intermittent, dilute rinses or more concentrated solutions, process-related, or natural surface runoff. Control and treatment measures are in place to minimize the amount of pollutants released. Where appropriate, wastewaters are combined prior to treatment and discharge.

The major generator of wastewaters over most of ORGDP's history was the recirculating cooling water (RCW) system which had to control the buildup of scale-forming compounds by blowing down (discharging) a portion of its total volume to an electrolytic chromium reduction facility, then to settling ponds prior to release. Refer to Figure 3-11 for a flow diagram of the RCW system. Typical continuous discharge flows ranged from 280 to 700 liters per minute [74 to 185 gallons per minute (gpm)]. This source was terminated by cessation of enrichment operations in August 1985. The discharge from the K-901-A pond continues to flow, but is currently limited to a few small once-



Source: Boyle et al., 1979

FIGURE 3–11

FLOW DIAGRAM OF THE RCW SYSTEM
ORGDP – OAK RIDGE, TN

through cooling water releases, firewater clarifier blowdown, surface runoff and flow from a few small natural springs.

The primary generator of radioactive liquid wastes is Building K-1420, the cleaning, decontamination, and uranium recovery facility. Activities at this facility are expected to increase as major units of enrichment equipment are decommissioned and brought to Building K-1420 to be decontaminated and cleaned prior to recycle or disposal. This operation typically entails some form of mechanical removal, followed by liquid cleaning with water, steam, or weak solutions of nitric acid, and/or sodium carbonate. Waste solutions contain nitrate and fluorides (from UF_6), in addition to uranium and other heavy metals, so treatment and recovery systems within the same building have been designed to recover uranium and remove other metals, nitrates, and more recently fluorides. The main objects cleaned in K-1420 are convertors and compressors from enrichment cells, and UF_6 cylinders ranging in size from less than 25 kilograms (55 pounds) to 12.7 metric tons (14 tons) capacity. Besides the cleaning/decontamination operation, Building K-1420 also houses degreasing and plating lines for depositing nickel onto base metals using electroplating or electroless nickel plating techniques. Rinses and spent solutions from these batch operations are also processed within the building prior to release. Recovery and pretreatment units contained within K-1420 include an extensive uranium recovery system using solvent extraction and ion exchange techniques and a new treatment system for removing fluorides from cylinder cleaning, floor pan, and fluoride scrubber wastewaters via pH adjustment, solids separation, and ion exchange. All pretreated wastewaters and rinses are piped to the K-1407-H Central Neutralization Facility (CNF) for further treatment. See Section 3.3.2.3 for details.

The K-1501 Steam Plant and its ancillaries produce liquid wastes from water conditioning and softening operations, boiler blowdowns, and coal pile runoff, in addition to significant volumes of once-through non-contact cooling water. The plant contains seven boilers, with a total rated capacity of 168,000 kilograms (370,000 pounds) per hour. Present production levels require only 25 percent of rated capacity, so the steam requirements are being met with only two operating boilers. All boilers except No. 7 may be fired with coal, and three of these six can also burn natural gas. Emissions are controlled by electrostatic precipitators in the two stacks serving these six boilers. Boiler No. 7 has its own stack, and can burn either oil or natural gas as fuel. There have been two coal piles adjacent to K-1501, one on the north side, the other on the south. A runoff collection system has been installed to collect the weakly acidic runoff which occurs during heavy rains and channel it to treatment by neutralization. There was some evidence that some of this runoff, especially from the south coal pile, bypasses the dike-and-ditch collection system and enters the storm drain in the area. See Finding 3.3.4.4.2. However, the south coal pile is scheduled to be eliminated in October 1988. The remainder of the steam plant wastewaters (except for the once-through cooling water flows, which are clean enough to be released untreated) are piped to the CNF for treatment. See Section 3.3.2.3 for details.

Another wastewater source may be found in Building K-1015, the laundry. This facility launders 3,600 to 4,500 kilograms (8,000 to 10,000 pounds) of clothing and uniforms daily, not only from ORGDP, but also from the Y-12 Plant and Rust Engineering (site contractor). Seven washers handle loads ranging from 54 to 270 kilograms (120 to 600 pounds) each. No chlorine-based bleaches are used, and all detergents are biodegradable. Washwaters and rinses are drained to a common sump for all machines, then to the sanitary sewage collection system via a large sludge trap outside the building. This sludge is sampled and analyzed quarterly for Extraction Procedure (EP) toxicity, radioactivity, and 29 different metals. Calcium, iron, magnesium, aluminum, and uranium, in that order, are the dominant metals, and all are typically present at concentrations greater than 10 miligrams per gram (mg/g) of sludge. Once a year the sludge trap is cleaned out, yielding seven to ten 208-liter (55-gallon) drums for disposal at the direction of the environmental coordinator for the area. Health Physics personnel monitor the individual laundry washing machines and the worker environment once each month.

The K-1515 Water Treatment Plant produces potable water for all uses at ORGDP, and has a rated capacity of approximately 30 million liters per day (8 mgd). The sanitary water system consists of a raw water pumping station (K-1513) located upstream on the Clinch River at kilometer 23.3 (mile 14.5), a treatment and filtration plant (K-1515), finished water storage tanks (K-1529 and K-1530), and a distribution system with 30.5 kilometers (19 miles) of piping. Although the system dates back to the early 1940s, it has been continuously improved and carefully maintained, providing reliable service to ORGDP's main site, to the Powerhouse Area, and to the City of Oak Ridge Industrial Park just south of Bear Creek Road in the vicinity of the treatment plant. K-1515 does generate a liquid chemical waste during normal operation, consisting of wet slurries from filter backwash operations and chemical sludges from coagulation and settling basins. These wastewaters are conveyed to the K-1515-C holding pond for long-term settling prior to release of the supernatant waters to the Clinch River through National Pollutant Discharge Elimination System (NPDES) Outfall 009. Sludges from the bottom of the holding pond were removed during the early 1970s and disposed of in the K1515 Land Treatment Unit adjacent to Bear Creek Road. Refer to Section 4.5.2.3.t for additional information relating to sludge disposal from this facility.

3.3.2.2 Secondary Wastewater Sources

Maintenance Shop operations at Building K-1401 generate small quantities of wastewater from metals cleaning operations, machine shop coolants and degreasers from the metal fabrication operations, and miscellaneous waste oil and lubricants from routine maintenance activities. Most of the wastes are handled as concentrates requiring recovery or disposal. However, a small quantity of contaminated rinses and other wastewaters from metal cleaning is released to a maintenance shop sump where it is combined with similar releases from the high temperature laboratory (K-1405) and the engineering laboratory (K-1413) and pumped over to the contaminated holding tank at the CNF for treatment.

Another secondary source of wastewaters is the ORGDP Garage housed in Building K-1414. The facility is responsible for maintaining 410 DOE vehicles, ranging in size from 4-cylinder subcompact cars to tractor-trailer rigs. There is also an outdoor automatic vehicle wash facility (K-1414-B) adjacent to the main garage building. The wash facility can handle three vehicles at a time, and operates for 4 hours per day. Washwaters are collected and conveyed to the Sewage Treatment Plant (STP) for treatment. Waste oils and other fluids (e.g., ethylene glycol) are collected in drums and disposed of as hazardous wastes. A large heavy-equipment cleaning bay inside the garage uses high-pressure steam to clean trucks and road maintenance vehicles. Wastewaters are collected in a large sump and conveyed to the STP.

Building K-1095, the Paint Shop, has two large wet spray booths utilizing water curtains to help control fumes and fine droplets from spray painting operations. Both booths use water-based paints in recirculating spray systems. When the paint in the recycle systems becomes unusable, the mixtures are allowed to settle into two phases. The liquid phase is analyzed, and if acceptable is pumped to the sanitary STP. If it is too high in toxic metals, it is disposed of as hazardous waste. Relatively small volumes are involved, typically 1900 liters (500 gallons) per batch, with 3 to 4 batches per year. Over the past 3 years, all batches have been suitable for transfer to the STP.

The ORGDP main site and the Powerhouse Area have a large number of diversion ditches, collection sumps, and storm drains for collecting and conveying surface water and stormwater runoff to the adjacent receiving streams. An ongoing survey has located and identified 135 storm drains, and has begun the task of tracing contaminants found in many drains back upstream to their sources. See Finding 3.3.4.3.1. Thus far, 120 storm drains have been grouped into three categories, as follows (Scheib, 1987):

- 9 drains which may potentially convey process effluents.
- 51 drains which convey once-through cooling water and/or building roof drain water only.
- 60 drains which convey surface-water runoff only.

All nine of the storm drains which may be carrying excess wastewaters flow into surface-water bodies which are covered by NPDES monitoring requirements, so any releases to these drains will be accounted for.

ORGDP maintains a concrete washdown pad in the northern part of the site at area K-1064-C for cleaning fly-ash hauling trucks, trash haulers, and other heavy equipment. Since wastewater from this operation may become contaminated with oil and grease, the pad is equipped with a collection sump and an oil trap to prevent oily matter (and to a lesser extent, solids) from entering the storm drain. Any silt or debris which collects in the sump is periodically removed. During the Survey, problems were noted with this operation. Refer to Finding 3.3.4.4.1 for details.

The buildings in the south-central area of ORGDP primarily identified as K-1004-A through U contain a cluster of laboratories, pilot plants, test facilities, and offices which generate small quantities of liquid rinses and wastewaters. Also, once-through cooling waters and cooling tower blowdowns from these facilities are released to storm sewers and conveyed to the K-1007-B pond for equalization and settling. Overflows from this pond are monitored as part of the NPDES permit requirements.

In the Powerhouse Area, there are a number of scrap storage yards, PCB storage facilities, and ash piles from the on-site burning of coal. Runoff from this area occasionally may contain measurable amounts of metals and/or radioactivity. Further assessment of this problem is being conducted as part of the storm drain survey.

3.3.2.3 <u>Treatment and Control of Wastewater</u>

ORGDP provides a number of facilities designed to minimize the impact of its pollutants on the environment. Three major treatment and control installations are the K-1435 TSCA solid/liquid incinerator, the K-1407-H CNF, and the K-1203 STP. The TSCA Incinerator is a new facility designed to destroy PCBs and other hazardous organic waste in compliance with the TSCA and Resource Conservation and Recovery Act (RCRA) regulations. It will serve to destroy wastes from all three ORR sites (ORGDP, ORNL, and the Y-12 Plant), Paducah Gaseous Diffusion Plant, Portsmouth Gaseous

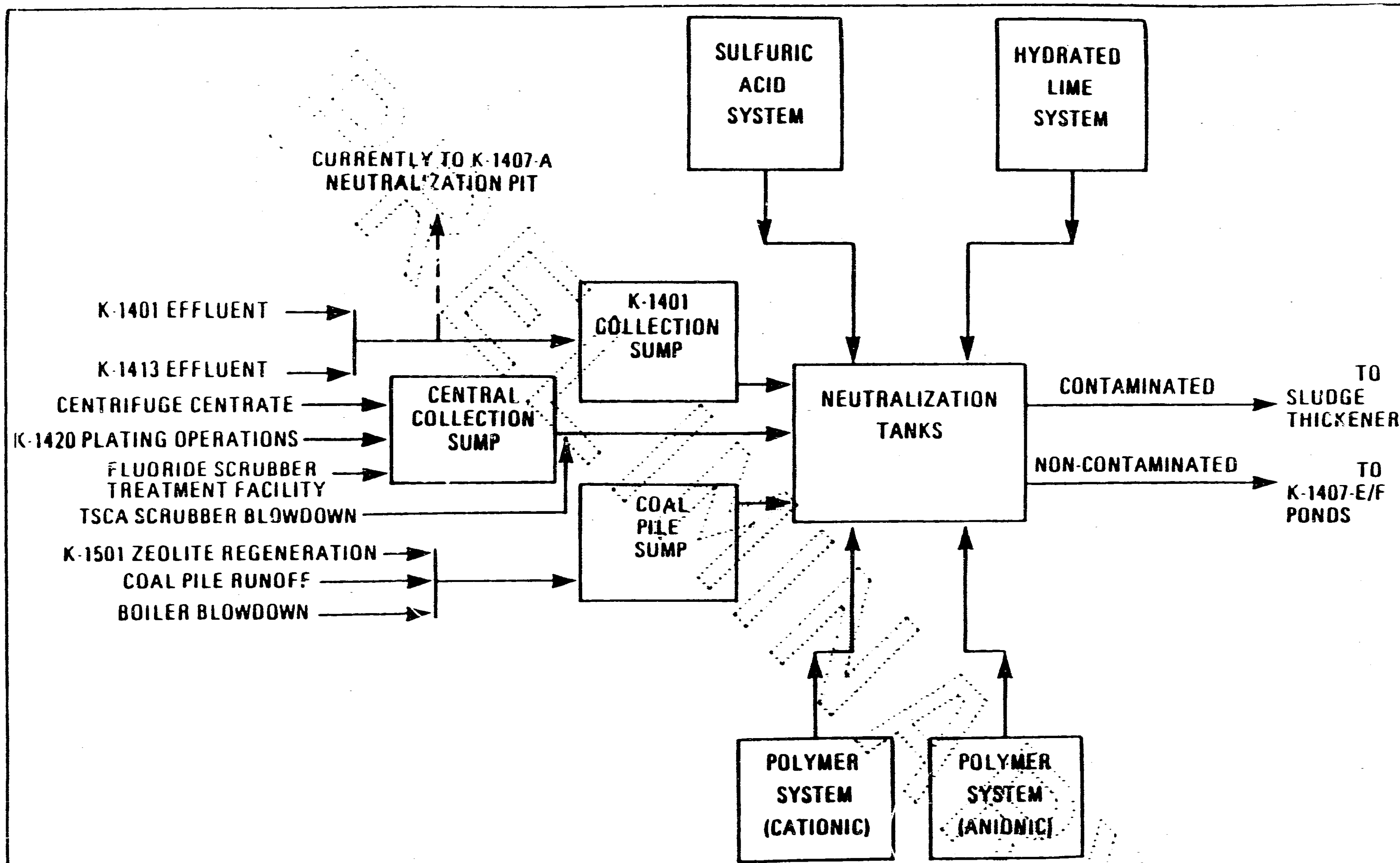
Diffusion Plant, the Feed Materials Production Center, and the RMI Extrusion Plant. The TSCA Incinerator does produce wastewater from the need to scrub and cool gases exiting the rotary kiln. Cooling is accomplished in a four-stage quench chamber, and cleaning of the off-gases involves the following three types of wet air pollution control devices:

- Venturi scrubber
- Packed bed scrubber
- Ionizing wet scrubber.

Water is collected in concrete basins and allowed to settle out solids picked up during the scrubber operation. Most of the water is recycled to the quenching/scrubbing units after pH adjustment, but a small part of the total flow is blown down to the K-1407-H CNF for further treatment prior to release to Mitchell Branch.

The CNF (K-1407-H) provides pH adjustment and metals precipitation either directly or through a lime neutralization pit at K-1407-A. (Refer to Figure 3-12.) Neutralization tanks are rubber-lined for acid/alkali resistance. Settling time is provided and sludges are removed and dewatered using a sludge thickener and centrifuge. In this way, the total volume of hazardous sludge may be minimized. The dual system provides for segregation of hazardous streams from nonhazardous streams. Discharged effluents are released to Mitchell Branch directly, or via either of two settling basins (K-1407-E and K-1407-F), which will serve as NPDES monitoring stations. Although the CNF is presently in use, the active NPDES monitoring points remain at K-1407-B and K-1700 (the mouth of Mitchell Branch). The latter monitoring point (K-1700) will be eliminated in the near future and replaced with active monitoring requirements at points K-1407-F and K1407-J. New permits due to take effect in February 1989 are currently being negotiated, so will be in effect by the time the TSCA Incinerator and CNF go to full-flow conditions.

The third major wastewater treatment system is the K-1203 STP, an extended aeration plant with a capacity of 2.3 million liters (600,000 gallons) per day. The sewage collection system serves the entire main ORGDP site with very few exceptions (septic tanks at remote locations). There are nine sewage lift stations, approximately 1,340 meters (4,400 feet) of force mains, and approximately 15,500 meters (51,000 feet) of gravity mains. There is some evidence that the sewage collection system is subject to infiltration/exfiltration, depending on saturation conditions in the ground. Infiltration may contribute to capacity overloads, while exfiltration releases untreated wastewater to the ground. Refer to Finding 3.3.4.3.2. The plant was built in 1975 to replace a 30-year-old primary



Source: MMES, undatedb

FIGURE 3–12

FLOW DIAGRAM OF THE CENTRAL NEUTRALIZATION FACILITY
ORGDP – OAK RIDGE, TN

treatment plant. The original Imhoff tank is still used to hold up to one million liters (265,000 gallons) of incoming sewage whenever heavy rainfall events occur. At such times, partially treated sewage is routed around part of the system (the retention basin). This practice may be interpreted as a possible NPDES violation. Refer to Finding 3.3.4.4.4. After peak flows subside, the contents of the Imhoff tank are pumped through the STP. The new facilities include a comminutor to continuously shred incoming solids, an aeration tank, clarifiers, sludge holding tank, a chlorinator, and a dechlorinator. A monitoring station for determining compliance with the NPDES permit tracks the quality of the effluent, which enters Poplar Creek at km 3.2 (m 2.0) very near the STP.

3.3.2.4 Spill Prevention Control and Countermeasures Plans

ORGDP staff have prepared Spill Prevention Control and Countermeasures (SPCC) Plans covering oils, hazardous materials, and hazardous waste. Plans are properly certified by a professional engineer and by a certified hazardous materials manager, both recognized by the State of Tennessee. Plans have been continuously upgraded as necessary (the fourth revision is dated February 1988) and contain sufficient detail to satisfy requirements of 40 CFR 112 and to guide plant personnel actions in the event of a spill. Ongoing efforts are aimed at keeping all parts of the plan current, with up-to-date contacts and emergency phone numbers. There are sufficient illustrations and tables to guide the user to the proper locations for action.

3.3.2.5 Potable Water Supplies and Distribution Systems

Finished water produced by the K-1515 water treatment plant is potable grade and is piped to water users given in Section 3.3.2.1. Besides the extensive monitoring of finished water at the treatment plant, selected sources are sampled throughout the distribution system on a bi-weekly basis. Water of high quality produced by the K-1515 plant continually shows no total coliform and very low levels of heavy metals. The only problems noted occur at remote points in the distribution system where an occasional sample contains less than the required minimum of 1.0 milligram per liter (mg/l) total residual chlorine (TRC). This usually means that the water in the lines has not been run often enough or long enough to ensure that fresh water is coming from the tap. All active locations contain more than 1.0 mg/l TRC.

ORGDP has about 170 backflow prevention devices in use, ranging in size from 1.8 centimeters (0.75 inch) up to 15 centimeters (6 inches). The Equipment Testing and Inspection Unit has responsibility for inspecting all units. If repairs are needed, they are usually made on the spot, or the device is disassembled and taken to K-1401 where a large inventory of replacement devices and parts is maintained in ready-to-go condition.

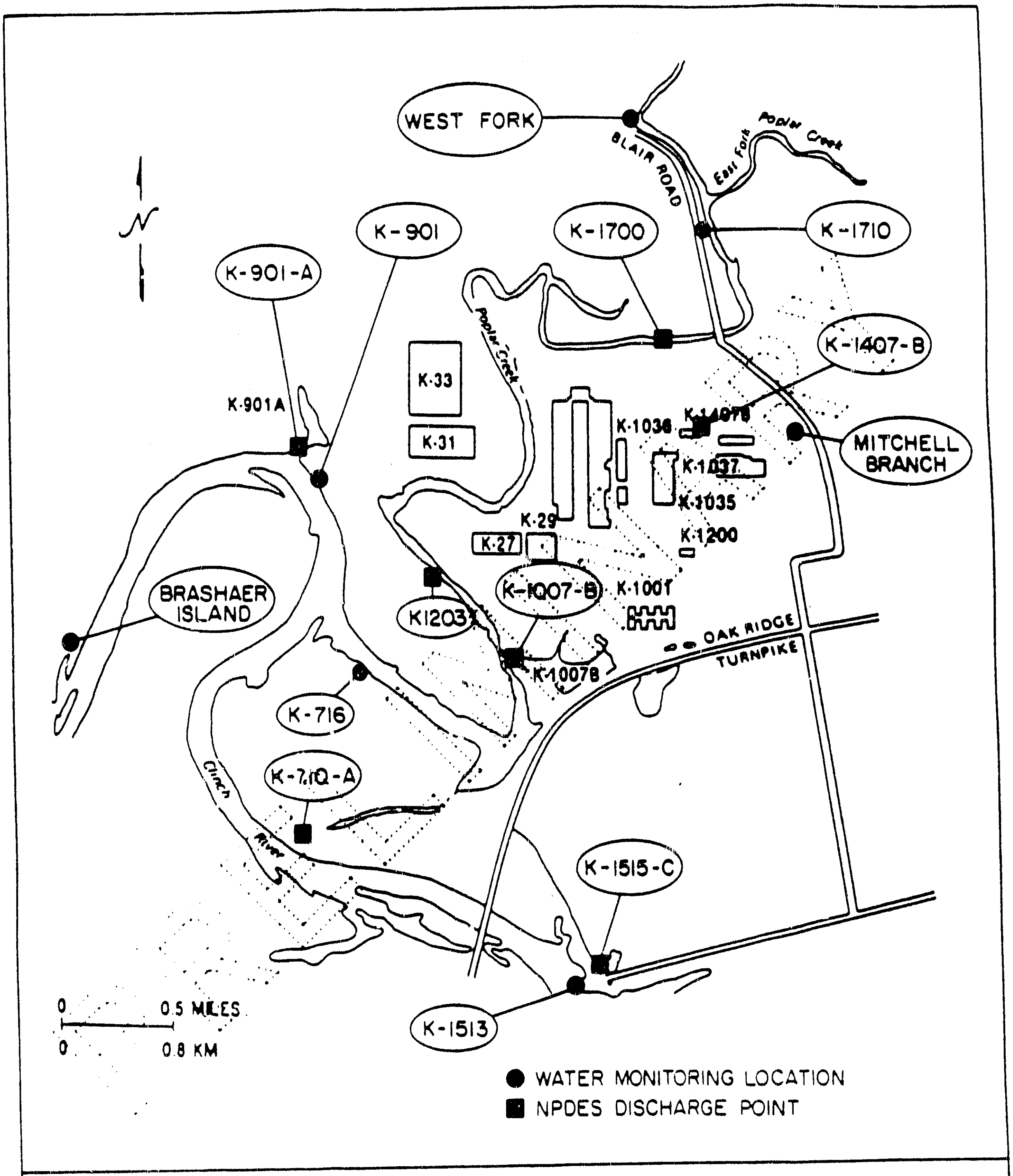
3.3.3 Environmental Monitoring Data

3.3.3.1 Annual Surveillance Reports

Since 1971, surveillance reports covering the three ORR facilities' year-round programs for monitoring the environment have been published annually. Reports cover the immediate areas and surrounding region's groundwater and surface waters, soil, air quality, vegetation and wildlife, and through these multiple and varied pathways, the resident human populations. Recent reports have been issued as two-volume sets, wherein Volume 1 is a "stand-alone" report about the ORR, and Volume 2 presents detailed data and results of analyses upon which conclusions in Volume 1 are based (Rogers et al., 1988a and b).

With respect to surface-water monitoring, ORGDP does measure off-site concentrations upstream and downstream on the Clinch River and on Poplar Creek. Refer to Figure 3-13 for locations of these monitoring points, plus the NPDES points required to be monitored for compliance with TDHE regulations. Off-site monitoring includes both water quality parameters and radionuclides. The goal is to document ORGDP's impact on receiving streams, and to differentiate it from other sites. Composite samples are collected monthly at all locations except K901-A, West Fork, and Brashaer Island. A grab sample is collected monthly at these three locations. All samples are analyzed for radiological and nonradiological parameters. Data for radionuclides upstream and downstream on the Clinch River and Poplar Creek are given in Table 3-20. ORGDP operations currently appear to have no impact on either receiving stream from a radiological standpoint. All radionuclides either showed no difference between upstream and downstream points, or were lower downstream, probably due to dilution from noncontaminated water entering between upstream and downstream points.

Both receiving streams did indicate some impact from nonradiological releases in 1987. Clinch River data are found in Table 3-21, and Poplar Creek data in Table 3-22. In some cases, maximum concentrations (cadmium, zinc, fluoride) increased, but long-term yearly average concentrations showed no change, or even showed some reductions. This may indicate short-term releases or spills which had no real effect on the Clinch River over a longer period of time. For chemical oxygen demand (COD) there was an appreciable increase in maximum readings and in the long-term average, indicating that ORGDP was raising the COD levels in the receiving stream. There are no



Source: Bowers, 1988a

FIGURE 3–13

SURFACE WATER SAMPLING STATIONS
ORGDP – OAK RIDGE, TN

TABLE 3-20

RADIONUCLIDES IN SURFACE STREAMS
ORGDP - OAK RIDGE, TN
(Concentrations In pCi/l)

Clinch River (Upstream Point @ K-1513; Downstream Point @ Brashaer Is)

	Upstream		Downstream		% Change	
	Max	Avg	Max	Avg	Max	Avg
Np	<2	<1	<1	<1	(-500)	n.c.
Pu	<3	M<1	<2	<1	(-33.3)	n.c.
Tc	<222	<165	<224	<164	n.c	n.c
Cs	<100	<100	<100	<100	n.c.	n.c.
U	4.0	<2.0	1.3	<0.7	-67.5	(-65.0)
U (mg/l)	0.006	<0.003	0.002	<0.001	-66.7	(-66.7)

Poplar Creek (Upstream Point @ K-1710; Downstream Point @ K-716)

Np	<2	<1	<1	<1	n.c.	n.c.
Pu	<3	<1	<3	<1	n.c.	n.c.
Tc	<222	<164	<222	<165	n.c.	n.c
Cs	<100	<100	<100	<100	n.c.	n.c.
U	10.0	<5.4	8.7	<2.7	-13.0	(-50.0)
U (mg/l)	0.015	<0.008	0.013	<0.004	-13.3	(-50.0)

Source: Rogers et al., 1988a and b
All data based on year-long monthly analyses for 1987
n.c. No change between upstream and downstream points.
() Values in parentheses are based on highest concentration in a "less than" value. Percent would not apply if true values are near zero.

TABLE 3-21
POLLUTANTS IN SURFACE STREAMS, CLINCH RIVER SAMPLES
ORGDP - OAK RIDGE, TN

	Units	Upstream (K-1513)		Downstream (Brashaer Is)		% Change	
		Max	Avg	Max	Avg	Max	Avg
Arsenic	mg/l	0.005	<0.005	<0.005	<0.005	(?)	n.c.
Cadmium	mg/l	<0.002	<0.002	0.003	<0.002	+ 50.0 +	n.c.
Chromium	mg/l	<0.010	<0.010	<0.010	<0.010	n.c.	n.c.
Copper	mg/l	0.085	<0.013	<0.004	<0.004	-95.3 +	(-69.2)
Lead	mg/l	0.005	<0.004	0.025	<0.007	+ 400	(+ 75.0)
Manganese	mg/l	0.084	0.025	0.074	0.020	-11.9	-20.0
Mercury	mg/l	0.0004	<0.0002	<0.0002	<0.0002	-50.0 +	n.c.
Nickel	mg/l	<0.050	<0.050	<0.050	<0.050	n.c.	n.c.
Sodium	mg/l	5.9	4.7	5.6	4.7	-5.1	n.c
Zinc	mg/l	0.064	<0.030	0.24	<0.02	+ 275	(-33.3)
Total Metals	mg/l	~6.17	~4.82	~5.98	~4.77	-3.0	-1.0
Ammonia-N	mg/l	<0.2	<0.2	<0.2	<0.2	n.c.	n.c.
Cyanide	mg/l	0.006	<0.003	0.003	<0.002	-50.0	(-33.3)
Fluoride	mg/l	0.19	<0.11	0.5	<0.1	+ 163	(-9.1)
Nitrate-N	mg/l	8.37	1.10	0.61	0.40	-92.7	-63.6
Sulfate	mg/l	27	22	25	21	-7.4	-4.5
COD	mg/l	7.5	<5.2	28	<9	+ 273	(+ 73.1)
Solids, dissolved	mg/l	230	171	216	165	-6.1	-3.5
Solids, suspended	mg/l	19	<6	13	<8	-31.6	(+ 33.3)

Source: Adapted from Rogers et al., 1988b
All data are based on year-long monthly analyses for 1987.
n.c. No change between upstream and downstream points.
( ) Values in parentheses are based on highest concentration in a "less than" value. Percents would not apply if true values are near zero.
pH Standard units range = 7.8-8.2 upstream and 7.6-8.4 downstream

TABLE 3-22
POLLUTANTS IN SURFACE STREAMS, POPLAR CREEK SAMPLES
ORGDP - OAK RIDGE, TN

	Units	Upstream (K-1710)		Downstream (K-716)		% Change	
		Max	Avg	Max	Avg	Max	Avg
Arsenic	mg/l	0.005	<0.005	<0.005	<0.005	n.c.	n.c.
Cadmium	mg/l	<0.002	<0.002	0.002	<0.002	n.c.	n.c.
Chromium	mg/l	0.041	<0.013	<0.010	<0.010	-75.6 +	(-23.1)
Copper	mg/l	0.050	<0.085	<0.085	<0.013	+ 70.0	(+62.5)
Lead	mg/l	0.007	<0.004	0.005	<0.004	-28.6	n.c.
Manganese	mg/l	0.250	0.114	0.084	0.025	-66.4	-78.1
Mercury	mg/l	0.0004	<0.0002	<0.0004	<0.0002	n.c.	n.c
Nickel	mg/l	<0.050	<0.050	<0.050	<0.050	n.c.	n.c.
Sodium	mg/l	15.0	10.0	5.6	4.7	-60.7	-53.0
Zinc	mg/l	0.13	<0.03	0.064	<0.03	-50.8	n.c.
Total Metals	mg/l	~15.51	~10.17	~6.17	~4.78	-60.2	-53.0
Ammonia-N	mg/l	<0.2	<0.2	<0.2	<0.2	n.c.	n.c.
Cyanide	mg/l	0.017	<0.006	0.14	<0.005	+ 724	(-16.7)
Fluoride	mg/l	0.70	<0.44	0.6	<0.20	-14.3	(-54.5)
Nitrate-N	mg/l	10.0	2.0	33.6	3.38	+ 236	+ 69.0
Sulfate	mg/l	49	40	40	30	-18.4	-25.0
COD	mg/l	11	<7	14.5	<7.1	+ 31.8	(+1.4)
Solids, dissolved	mg/l	310	215	214	177	-31.0	-17.7
Solids, suspended	mg/l	17	11	22	14	+ 29.4	+ 27.3

Source: Adapted from MMES, Rogers et al., 1988b
All data are based on year-long monthly analyses for 1987.
n.c. No change between upstream and downstream points.
( ) Values in parentheses are based on highest concentration in a "less than" value. Percents would not apply if true values are near zero.
pH Standard units range = 7.7-8.0 upstream and 7.6-8.5 downstream.

drinking water standards for COD, and downstream readings average <9 mg/l. Maximum reported concentrations were 7.5 mg/l upstream and 28 mg/l downstream. Possible sources of COD on-site have not been identified.

The only primary or secondary drinking water standards exceeded by Clinch River parameters are those for manganese. The manganese sources are off-site and upstream of ORGDP on the Poplar Creek watershore, for average values exceed drinking water standards at point K-1710. On the Clinch River samples, only maximum concentrations upstream and downstream exceed standards. ORGDP is not contributing to the manganese loads on either stream, with downstream concentrations lower than upstream for both receiving streams.

ORGDP does elevate nitrate-nitrogen concentrations in Poplar Creek, both short-term as maxima, and long-term as annual average concentrations. While averages remain at 20 to 24 percent of the 10 mg/l drinking water standards on upstream and downstream samples respectively, the 1987 maximum upstream concentration was reported as 10.0 mg/l and the downstream maximum at K-716 was 33.6 mg/l, more than three times that drinking water standard. However, this apparent increase in nitrate-nitrogen in Poplar Creek was not having a serious impact on Clinch River concentrations. Both maximum and average concentrations were more than 60 percent lower downstream on the Clinch River, indicating that the increase was limited to Poplar Creek.

3.3.3.2 NPDES Permit Requirements and Monitoring Results

ORGDP is required to conduct extensive monitoring of selected outfalls and on-site effluent release points as a condition of NPDES Permit No. TN 0002950. This permit was issued to the Department of Energy Oak Ridge Operations Office (DOE/ORO) on February 27, 1984, modified on September 11, 1986, and expires on February 27, 1989. Negotiations are currently proceeding to submit renewal applications for the ORGDP. Basic permit requirements and the number of noncompliances are listed in Table 3-23. Overall, the ORGDP was in compliance 99.8 percent of the time, yielding only 40 noncompliances out of a total of more than 18,000 required determinations.

The two most common exceedances, accounting for half of the total number, occur for aluminum at K-1700, and PCB at K-1407-B. The 1.0 mg/l aluminum daily maximum at K-1700 was exceeded five times, as was the 16 kilogram per day (kg/day) load limitation on aluminum. Individual results were as high as 10 to 12 times the limit. At K-1407-B, the PCB limitation of 0.014 mg/l is actually below the limit of detection of the method used to analyze PCBs. Even if all nondetected values are assumed to

TABLE 3-23

1987 NPDES COMPLIANCE AT ORGDP
ORGDP - OAK RIDGE, TN

Discharge Point	Effluent Parameters	Effluent Limits				Number of Non-compliances	Percentage of Measurements in Compliance
		Monthly Avg (mg/l)	Daily Max (mg/l)	Monthly Avg (kg/d)	Daily Max (kg/d)		
001							
(K-1700 discharge)	Aluminum		1.0		16	10	95
	Chromium	0.050	0.080	0.80	1.2		100
	Nitrate-N		20		310		100
	Suspended solids[a]	30	50	470	780		100
	Oil and grease	10	15	160	230		100
	pH, units		6.0-9.0				100
	Perchloroethylene	0.11		1.9			100
	Trichloroethane	0.11		1.7			100
	Methylene chloride	0.035		0.54			100
	Trichloroethylene	0.41	0.61	6.4	9.5		100
	Lead	0.0080	0.93	0.12	14		100
	Zinc	0.12	1.52	1.86	246		100
	Total halomethanes	1.23	2.05	19	32		100
	Beryllium	0.0010	0.0020	0.016	0.032		100

TABLE 3-23
1987 NPDES COMPLIANCE AT ORGDP
ORGDP - OAK RIDGE, TN
PAGE TWO

Discharge Point	Effluent Parameters	Effluent Limits				Number of Non-compliances	Percentage of Measurements in Compliance
		Monthly Avg (mg/l)	Daily Max (mg/l)	Monthly Avg (kg/d)	Daily Max (kg/d)		
	Cadmium	0.0040	0.010	0.060	0.16	1	99
	Mercury	0.0013	0.011	0.021	0.17		100
	Selenium	0.12	0.31	1.9	4.8		100
	Silver	0.014	0.027	0.22	0.42		100
	Visible solids					1	99
003							
(K-1407-B)[b]	Cadmium	0.26	0.69				100
	Chromium	1.71	2.77				100
	Copper	2.07	3.38				100
	Lead	0.43	0.69				100
	Silver	0.24	0.43				100
	Zinc	1.48	2.61				100
	Cyanide	0.65	1.20				100
	TTO		2.13				100
	Oil and grease	26	52				100
	Nickel	2.38	3.98				100
	TSS	31	60			1	99

TABLE 3-23
1987 NPDES COMPLIANCE AT ORGDP
ORGDP - OAK RIDGE, TN
PAGE THREE

Discharge Point	Effluent Parameters	Effluent Limits				Number of Non-compliances	Percentage of Measurements in Compliance
		Monthly Avg (mg/l)	Daily Max (mg/l)	Monthly Avg (kg/d)	Daily Max (kg/d)		
	PCB, μg/l		0.014			10	84
	Visible solids					3	99
	pH, units		6.0-9.0				
005							
(K-1203 Sanitary Treatment Facility)[c]	Ammonia nitrogen	5.0	7.0	12	17.3		100
	BOD	15	20	37	49.5		100
	Chlorine residual		0.24				100
	Dissolved oxygen	5.0[d]					100
	Fecal coliform, No./100 ml	200	400				100
	pH, units		6.0-9.0				100
	Suspended solids	30	45	74	110	1	99
	Settleable solids		0.50 ml/l				100
	Beryllium	0.0010	0.0020	0.0020	0.0050		100
	Cadmium	0.0040	0.010	0.010	0.025		100
	Mercury	0.0013	0.011	0.0030	0.027		100

TABLE 3-23
1987 NPDES COMPLIANCE AT ORGDP
ORGDP - OAK RIDGE, TN
PAGE FOUR

Discharge Point	Effluent Parameters	Effluent Limits				Number of Non-compliances	Percentage of Measurements in Compliance
		Monthly Avg (mg/l)	Daily Max (mg/l)	Monthly Avg (kg/d)	Daily Max (kg/d)		
	Selenium	0.12	0.31	0.30	0.77		100
	Silver	0.014	0.027	0.035	0.067	1	99
	Lead	0.008	0.93	0.02	2.30		100
	Zinc	0.12	1.52	0.30	3.76		100
	Perchloroethylene	0.12	0.21	0.30	0.52		100
	Trichloroethane	0.11		0.27			100
	Methylene chloride	0.035		0.087			100
	Trichloroethylene	0.41	0.61	1.01	1.51		100
	Total halomethanes	1.23	2.05	3.04	5.07		100
006							
(K-1007-B Holding Pond)	COD	20	25	120	150	7	95
	Chromium (total)		0.050		0.30		100
	Dissolved oxygen	5.0[d]					100
	Fluoride	1.0	1.5	6.1	9.1		100
	Oil and grease	10	15	61	91		100

TABLE 3-23
1987 NPDES COMPLIANCE AT ORGDP
ORGDP - OAK RIDGE, TN
PAGE FIVE

Discharge Point	Effluent Parameters	Effluent Limits				Number of Non-compliances	Percentage of Measurements in Compliance
		Monthly Avg (mg/l)	Daily Max (mg/l)	Monthly Avg (kg/d)	Daily Max (kg/d)		
	pH, units		6.0-10.0				100
	Suspended solids[a]	30	50	182	304		100
007							
(K-901-A Holding Pond)	Chromium (total)		0.05		0.68	1	99
	Fluoride	1.0	1.5	4.2	6.3		100
	Oil and grease	10	15	42	63		100
	pH, units		6.0-10				100
	Suspended solids[a]	30	50	125	210		100
	Dissolved oxygen	5.0[d]				1	99
009							
(Sanitary Water Plant)	Suspended solids[a]	30	50	34	51		100
	Aluminum	5.0	10	5.7	11		100
	Sulphate		1400		1600		100

TABLE 3-23
1987 NPDES COMPLIANCE AT ORGDP
ORGDP - OAK RIDGE, TN
PAGE SIX

Discharge Point	Effluent Parameters	Effluent Limits				Number of Non-compliances	Percentage of Measurements in Compliance
		Monthly Avg (mg/l)	Daily Max (mg/l)	Monthly Avg (kg/d)	-Daily Max (kg/d)		
	pH, units		6.0-9.0				100
Storm Drain	Diesel fuel		ND[l]			2	NA[f]

Source: Rogers et al., 1988a and b

a Limit applicable only during normal operations. Not applicable during periods of increased discharge due to surface runoff resulting from precipitation.

b During the characterization of this effluent point, more data are obtained and reported but are not subject to limits at this time.

c Because of the small flow rates at the K-710 sanitary treatment facility, a filter and tile drain field were installed May 1, 1978, eliminating the surface discharge and the need for monitoring. K-1203 is the only sanitary treatment facility presently covered by NPDES requirements.

d Daily minimum.

e ND - No discharge.

f NA - Not applicable.

be in compliance, there were still 10 measurements which gave detectable concentrations, so all 10 were in violation.

The only other exceedance occurring more often than once or twice was noted at K-1007-B holding pond, where COD limits were in violation a total of seven times in 1987. The daily maximum concentration of 25 mg/l and load of 150 kg/day were exceeded in March and May, even though in compliance the rest of the year. ORGDP believes that noncompliance for COD at K-1007-B and aluminum at K-1700 are caused by natural phenomena, and is addressing these issues during the permit renewal negotiations.

Except for the noncompliances noted above, most of the pollutants are present at small percentages of their limitations. Table 3-24 presents summaries of 1987 maximum monthly averages, showing the percentage of limits represented by the highest monthly average for any month in 1987. Most months were well below the averages shown in this table. Data are given not only for parameters which have numerical limits specified, but also for all parameters required to be monitored. For example, NPDES Point K-1407-B lists 40 parameters with no numerical limitations, but all are required to be analyzed for under terms of the current permit. TDHE will use these data in determining whether limitations need to be specified at permit renewal time in February 1989. Note that where numerical limits exist, ORGDP's effluent tends to be at less than half of those limits, even in the "worst" month represented by these data.

A similar table, Table 3-25, is given for daily maximums in 1987. The single highest concentration for the year for each parameter is given and expressed as a percentage of the daily maximum limit, where applicable. Several maximums are at or over their respective limits, and are considered to be noncompliance when over the 100 percent mark. Often the exceedance appears to be only by a few percent, while others are 1.5 to 4.5 times higher than permitted limits.

The Tennessee Department of Health and Environment (TDHE) has inspected ORGDP's monitoring stations, and has questioned the validity of flow measurement devices at most of the NPDES monitoring points. Ongoing negotiations will define which outfalls will need to be upgraded and which will be terminated as NPDES points. The forthcoming February 1989 revised permit will finalize decisions resulting from these discussions. For additional details regarding the inadequacies of the present monitoring system, refer to Finding 3.3.4.4.5.

In addition to the above monitoring issues, other problems related to new NPDES monitoring points were noted during the Survey. The proposed sampling arrangements for new NPDES point K-1407-F

TABLE 3-24

1987 MAXIMUM MONTHLY AVERAGES - NPDES OUTFALLS
ORGDP - OAK RIDGE, TN

Parameter	Units	003 K-1407-B		001 K-1700		005 K-1203		006 K-1007-B		007 K-901-A		009 K-1515-C	
		Max Month	% of Limit	Max Month	% of Limit	Max Month	% of Limit	Max Month	% of Limit	Max Month	% of Limit	Max Month	% of Limit
Aluminum	mg/l	0 36	M	<2 35	MX	-	-	-	-	-	-	1 07	21 4
Ammonia N	mg/l	<0 34	M		-	<0 38	<7 6	-	-	-	-	-	-
Antimony	mg/l	<0 059	M		-	-	-		-	-	-	-	-
Arsenic	mg/l	<0 0062	M	-		-	-		-	-	-	-	-
Barium	mg/l	<0 1	M	-		-	-	-	-	-	-	-	-
Beryllium	mg/l	<0 001	<100	<0 001	<100		-	-	-	-	-	-	-
BOD_5	mg/l	-	-	-	-	<11 2	<74 7	-	-	-	-	-	-
Boron	mg/l	0 124	M	-	-	-		-	-	-	-	-	-
Bromide	mg/l	4 4	M	-	-			-	-	-	-	-	-
Cadmium	mg/l	<0 0145	<5 6	<0 0034	<85	<0 005	<125	-	-	-	-	-	-
Calcium	mg/l	180	NR	-	-	-		-	-	-	-	-	-
COD	mg/l	26	M	<16 0	X	20 0	NR	18 9	94 5	20 9	NR	11 75	NR
Chloride	mg/l	449	M	-	-	-	-			-	-	-	-
Chlorine Res	mg/l	<0 2	M	-	-	0 10	MX			-	-	-	-
Chloroform	mg/l	<0 0082	M	-	-	-	-	-		-	-	-	-
Chromium	mg/l	<0 0135	<0 8	<0 0134	<26 8	-	-	<0 012	MX	0 04	MX	-	-

TABLE 3-24
1987 MAXIMUM MONTHLY AVERAGES - NPDES OUTFALLS
ORGDP - OAK RIDGE, TN
PAGE TWO

Parameter	Units	003 K-1407 B		001 K-1700		005 K-1203		006 K-1007-B		007 K-901-A		009 K-1515-C	
		Max Month	% of Limit	Max Month	% of Limit	Max Month	% of Limit	Max Month	% of Limit	Max Month	% of Limit	Max Month	% of Limit
Cobalt	mg/l	<0 1	M		-	-	-	-	-	-	-	-	-
Copper	mg/l	0 0121	0 6	-	-	0 013	NR	-	-	-	-	-	-
Cyanide	mg/l	0 006	0 9		-	-		-	-	-	-	-	-
Dis Oxygen	mg/l	-	-		-	11 0	45 5	12 9	38 8	12 3	40 6	-	-
Dis Solids	mg/l	1790	M	602	X	233	NR	-	-	-	-	-	-
Fecal Coliform	#100/ml	-	-	-		2 0	1 0	-				-	-
Fluoride	mg/l	5 99	M	1 7	X		-	0 18	18 0	0 24	24 0	-	-
Freon-113	mg/l	0 0114	NR	-			-	-	-	-	-	-	-
Iron	mg/l	1 38	M	-	-			-	-	-	-	-	-
Kjeldahl-N	mg/l	0 92	NR	-	-			-	-	-	-	-	-
Lead	mg/l	<0 028	<6 5	<9 0077	<96 2	0 0385	481	-	-	-	-	-	-
Lithium	mg/l	0 0132	NR	-	-	-		-	-	-	-	-	-
Magnesium	mg/l	28 5	M	-					-	-	-	-	-
Manganese	mg/l	0 30	M	-	-	-	-		-	-	-	-	-
Mercury	mg/l	<0 0003	M	<0 001	<76 9	0 0004	30 8			-	-	-	-
Methylene Cl	mg/l	<0 0139	M	<0 005	<14 3	<0 005	<14.3	-		-		-	-

TABLE 3-24
1987 MAXIMUM MONTHLY AVERAGES - NPDES OUTFALLS
ORGDP - OAK RIDGE, TN
PAGE THREE

Parameter	Units	003 K-1407-B		001 K-1700		005 K-1203		006 K-1007-B		007 K-901-A		009 K-1515-C	
		Max Month	% of Limit	Max Month	% of Limit	Max Month	% of Limit	Max Month	% of Limit	Max Month	% of Limit	Max Month	% of Limit
Molybdenum	mg/l	<0.0146	M	-	-	-	-	-	-	-	-	-	-
Nickel	mg/l	<0.51	<21.4		-	<0.05	NR	-	-	-	-	-	-
Nitrate-N	mg/l	6.67	M	3.83	MX	4.87	NR	-	-	-	-	-	-
Oil & Grease	mg/l	2.1	<8.1	<2	<20.0	-	-	<2.2	<22.0	2.5	25.0	-	-
PCB	mg/l	<0.0049	MX	-			-	-	-	-	-	-	-
pH	Std Unit	9.0	MX	8.9	MX	8.3	MX	9.8	MX	9.9	MX	8.6	MX
Phenols	mg/l	<0.006	M	-		<0.0027	NR	-	-	-	-	-	-
Phosphate	mg/l	88	M	-	-		-	-	-	-	-	-	-
Potassium	mg/l	<6.8	NR	-	-			-	-	-	-	-	-
Selenium	mg/l	<0.005	M	<0.005	<4.2	<0.05	<41.7		-	-	-	-	-
Settleable Solids	ml/l	-	-	-	-	<0.13	MX	-	-	-	-	-	-
Silver	mg/l	<0.011	<4.6	<0.01	<72.4	<0.0153	<109		-	-	-	-	-
Sodium	mg/l	195	NR	-	-	-	-			-	-	-	-
Sulfate	mg/l	648	M	-	-	-	-			-	-	26	MX
Sulfide	mg/l	<1	M	-	-	-	-			-	-	-	-
Sulfite	mg/l	4.8	M	-	-	-	-	-		-	-	-	-

TABLE 3-24
1987 MAXIMUM MONTHLY AVERAGES - NPDES OUTFALLS
ORGDP - OAK RIDGE, TN
PAGE FOUR

Parameter	Units	003 K-1407-B		001 K-1700		005 K-1203		006 K-1007-B		007 K-901-A		009 K-1515-C	
		Max Month	% of Limit	Max Month	% of Limit	Max Month	% of Limit	Max Month	% of Limit	Max Month	% of Limit	Max Month	% of Limit
Surfactants	mg/l	0 22	M	-	-	-	-	-	-	-	-	-	-
Susp Solids	mg/l	12.3	39.7	14.94	49 8	19.2	64.0	12 6	42 0	23 5	78 3	7 8	26 0
Temperature	°C	31 1	M	23.3	X	-	-	-	-	-	-	-	-
Tetrachloro-ethene	mg/l	0 0126	M	<0.005	<4.2	<0.005	<4 2	-	-	-	-		-
Thallium	mg/l		<0 01	M	-		-	-	-	-	-	-	-
Tin	mg/l	<0 014	M	-				-	-	-	-	-	-
Titanium	mg/l	0 0133	M	-	-		-	-	-	-	-	-	-
TOC	mg/l	22 0	M	-	-	37	NR	-	-	-	-	-	-
TON	mg/l	0 67	M	-	-	-		-	-	-	-	-	-
Total Halomethane	mg/l	-	-	<0 010	<0 8	<0 010	0.8	-	-	-	-	-	-
TTO	mg/l	0 213	MX	-	-	-	-		-	-	-	-	-
T-1,2 DCene	mg/l	<0 0117	M	-	-	-	-			-	-	-	-
1,1,1-Trichloro-ethane	mg/l	<0 0106	M	<0 005	<4.5	<0.005	<4 5			-	-	-	-
TCE	mg/l	0 0316	M	0 116	28 3	<0 005	<1.2	-	-		-		-

TABLE 3-24
1987 MAXIMUM MONTHLY AVERAGES - NPDES OUTFALLS
ORGDP - OAK RIDGE, TN
PAGE FIVE

Parameter	Units	003 K-1407-B		001 K-1700		005 K-1203		006 K-1007-B		007 K-901-A		009 K-1515-C	
		Max Month	% of Limit	Max Month	% of Limit	Max Month	% of Limit	Max Month	% of Limit	Max Month	% of Limit	Max Month	% of Limit
Turbidity	NTO	-	-	20 3	X	-	-	-	-	-	-	-	-
Uranium	mg/l	0 778	M	-	-	-	-	-	-	-	-	-	-
Zinc	mg/l	<0 211	<14 3	<0 0695	<57 9	0 079	65 8	-	-	-	-	-	-

Source: Adapted from Rogers et al , 1988a and b

-	Parameter not regulated at this source No numerical limits, and no monitoring required
M	Permit requires monitoring only No numerical limits
MX	No average units, but a daily maximum limit is in effect
NR	ORGDP collects data but parameter is not regulated at this source
X	Regulated under previous permit, now expired ORGDP continues to monitor

TABLE 3-25

1987 MAXIMUM DAILY CONCENTRATIONS - NPDES OUTFALLS
ORGDP - OAK RIDGE, TN

Parameter	Units	003 K-1407 B		001 K-1700		005 K-1203		006 K-1007-B		007 K-901-A		009 K-1515-C	
		1987 Max	% of Limit	1987 Max	% of Limit	1987 Max	% of Limit	1987 Max	% of Limit	1987 Max	% of Limit	1987 Max	% of Limit
Aluminum	mg/l	0 98	M	12	1200	-	-			-		2 5	25 0
Ammonia-N	mg/l	0 74	M		-	2 3	32 9	-	-	-	-	-	-
Antimony	mg/l	0 13	M		-	-	-	-	-	-	-	-	-
Arsenic	mg/l	0 01	M	-			-	-			-	-	-
Barium	mg/l	<0 1	M	-						-		-	-
Beryllium	mg/l	0.0022	M	<0 001	<50.0	<0.001	<50 0	-	-	-	-	-	-
BOD_5	mg/l	-	-	-	-	85	425	-		-	-	-	-
Boron	mg/l	0 21	M	-	-			-	-	-	-	-	-
Bromide	mg/l	6	M		-				-	-	-	-	-
Cadmium	mg/l	0 05	7 2	0 012	120	0 003	30 0	-	-	-	-	-	-
Calcium	mg/l	210	NR	-	-				-	-	-	-	-
COD	mg/l	91	M	50	X	47	NR	31	124	28	NR	16	NR
Chloride	mg/l	1095	M	-	-	-	-			-	-	-	-
Chlorine Res	mg/l	0 5	M	-	-	0 19	79 2			-	-	-	-
Chloroform	mg/l	0 051	M	-	-	-	-	-			-	-	-
Chromium	mg/l	0 038	1 4	0 023	28 8	-	-	0 016	32	0 049	98 0	-	-

TABLE 3-25
1987 MAXIMUM DAILY CONCENTRATIONS - NPDES OUTFALLS
ORGDP - OAK RIDGE, TN
PAGE TWO

Parameter	Units	003 K-1407-B		001 K-1700		005 K-1203		006 K-1007-B		007 K-901-A		009 K-1515-C	
		1987 Max.	% of Limit	1987 Max.	% of Limit	1987 Max	% of Limit	1987 Max.	% of Limit	1987 Max	% of Limit	1987 Max	% of Limit
Cobalt	mg/l	<0 1	M	-	-	-	-	-	-	-	-	-	-
Copper	mg/l	0 054	1 6		-	0 022	NR	-	-	-	-	-	-
Cyanide	mg/l	0 016	1 3		-	-	-	-	-	-	-	-	-
Dis. Oxygen	mg/l	-	-		-	4 9(min)	102	5 0(min)	100	4 5 (min)	111	-	-
Dis. Solids	mg/l	3200	M	1264	X	276	NR	-	-	-	-	-	-
Fecal Coliform	#100/ml	-	-	-	-	4	1 0	-	-	-	-	-	-
Fluoride	mg/l	21	M	6	X			0 23	15 3	0 24	16 0	-	-
Freon 113	mg/l	0 150	NR	-	-			-	-	-	-	-	-
Iron	mg/l	5	M	-	-			-	-	-	-	-	-
Kjeldahl-N	mg/l	1 62	NR	-	-	-			-	-	-	-	-
Lead	mg/l	0 068	9 9	0 036	3 9	0 05	5.4	-	-	-	-	-	-
Lithium	mg/l	0 02	NR	-	-	-	-		-	-	-	-	-
Magnesium	mg/l	35	M	-	-	-	-		-	-	-	-	-
Manganese	mg/l	0 53	M	-	-	-	-			-	-	-	-
Mercury	mg/l	<0 001	M	0 0008	7 3	0 001	9.1	-		-	-	-	-
Methylene Cl	mg/l	0 24	M	0 005	14 3	0 006	A	-		-	-	-	-

TABLE 3-25
1987 MAXIMUM DAILY CONCENTRATIONS - NPDES OUTFALLS
ORGDP - OAK RIDGE, TN
PAGE THREE

Parameter	Units	003 K-1407-B		001 K-1700		005 K-1203		006 K-1007-B		007 K-901-A		009 K-1515-C	
		1987 Max	% of Limit	1987 Max	% of Limit	1987 Max	% of Limit	1987 Max	% of Limit	1987 Max	% of Limit	1987 Max	% of Limit
Molybdenum	mg/l	0 025	M	-	-	-	-	-	-	-	-	-	-
Nickel	mg/l	1 3	32.7		-	<0 05	NR	-	-	-	-	-	-
Nitrate-N	mg/l	90 0	M	7.68	38 4	6 55	NR	-	-	-	-	-	-
Oil & Grease	mg/l	3	5 8	<2	<13.3	-	-	3	20 0	3	20 0	-	-
PCB	mg/l	0 0204	146			-	-	-	-	-	-	-	-
pH	Std Unit	6 0-9 0	100	7.8-8 9	98 9	6 7-8 3	92 2	6 4-9 8	98 0	6 0-9 9	99 0	6 9-8 6	95 6
Phenols	mg/l	0 025	M	-		0.014	NR	-	-	-	-	-	-
Phosphate	mg/l	431	M	-	-			-	-	-	-	-	-
Potassium	mg/l	9	NR	-	-			-	-	-	-	-	-
Selenium	mg/l	<0.005	M	<0 005	<1 6	<0.05	<16 1	-	-	-	-	-	-
Settleable Solids	mg/l	-	-	-	-	0 4	80 0						
Silver	mg/l	0 014	3 3	<0 01	<37 0	0 026	96 3		-	-	-	-	-
Sodium	mg/l	200	NR	-	-	-	-		-	-	-	-	-
Sulfate	mg/l	755	M	-	-	-	-			-	-	27	1 9
Sulfide	mg/l	<1	M	-	-	-	-			-	-	-	-
Sulfite	mg/l	7	M	-	-	-	-			-	-	-	-

TABLE 3-25
1987 MAXIMUM DAILY CONCENTRATIONS - NPDES OUTFALLS
ORGDP - OAK RIDGE, TN
PAGE FOUR

Parameter	Units	003 K-1407-B		001 K-1700		005 K-1203		006 K-1007-B		007 K-901-A		009 K-1515-C	
		1987 Max	% of Limit	1987 Max	% of Limit	1987 Max	% of Limit	1987 Max	% of Limit	1987 Max	% of Limit	1987 Max	% of Limit
Surfactants	mg/l	0.3	M	-	-	-	-	-	-	-	-	-	-
Susp Solids	mg/l	66	110	46	92.0	54	120	24	48.0	39	78.0	14	28.0
Temperature	°C	34.4	M	30.0	X	-	-	-	-	-	-	-	-
Tetrachloro-ethene	mg/l	0.036	M	0.029	13.8	<0.005	<2.4	-	-	-	-	-	-
Thallium	mg/l	<0.01	M				-	-	-	-	-	-	-
Tin	mg/l	0.03	M	-	-		-	-	-	-	-	-	-
Titanium	mg/l	0.023	M	-	-			-	-	-	-	-	-
TOC	mg/l	63	M	-	-	40	NR	-	-	-	-	-	-
TON	mg/l	0.7	M	-	-			-	-	-	-	-	-
Total Halomethane	mg/l	-	-	<0.01	<0.5	0.010	0.5	-	-		-	-	-
TTO	mg/l	0.60	28.2	-	-	-			-	-	-	-	-
T-1,2 DCene	mg/l	0.12	M	-	-	-	-		-	-	-	-	-
1,1,1-Trichloro-ethane	mg/l	0.090	M	0.011	A	<0.005	A			-			-
TCE	mg/l	0.100	M	0.510	83.6	<0.005	<0.8	-			-	-	-

TABLE 3-25
1987 MAXIMUM DAILY CONCENTRATIONS - NPDES OUTFALLS
ORGDP - OAK RIDGE, TN
PAGE FIVE

Parameter	Units	003 K-1407-B		001 K-1700		005 K-1203		006 K-1007-B		007 K-901-A		009 K-1515-C	
		1987 Max	% of Limit	1987 Max	% of Limit	1987 Max	% of Limit	1987 Max	% of Limit	1987 Max	% of Limit	1987 Max	% of Limit
Turbidity	NTU	-	[illegible]	180	X	-	-	-	-	77	NR	-	-
Uranium	mg/l	0 199	M	[illegible]	-	-	-	-	-	-	-	-	-
Zinc	mg/l	0 97	37 2	0 32	21 1	1 0	65 8	-	-	-	-	-	-

Source: Adapted from Rogers et al , 1988a and b

- \- Parameter not regulated at this source No numerical limits, and no monitoring required
- A No maximum concentration limit, but a monthly average limit is in effect
- M Permit requires monitoring only No numerical limits
- NR ORGDP collects data but parameter is not regulated at this source
- X Regulated under previous permit, now expired ORGDP continues to monitor
- MIN Minimum concentration observed

leads to concerns whether composite samples will be representative of true outfall concentrations. Sample line length, diameter, and direction all may contribute to sampling problems at this location. Refer to Finding 3.3.4.4.3 for details.

3.3.3.3 Storm Drain Survey

To fulfill requirements of ORGDP's modified NPDES permit, and to confirm that process wastewaters were not being routinely released through storm drains, an extensive storm drain survey was carried out from March through July 1987. Since the time selected was the normally rainy season, ORGDP expected to be able to characterize most of the storm drains during an initial sampling period of 6 weeks. When rainfall during the period was only 26.7 centimeters (10.5 inches), instead of an anticipated 47.5 centimeters (18.7 inches), and a number of normally flowing drains remained dry, the sampling period was extended to 3 months in order to obtain samples from at least some of the dry drains. However, 72 out of 119 drains remained dry during the entire survey (Scheib, 1987).

The majority of the 48 flowing storm drains proved to be discharges from once-through cooling water systems. Some steam condensate, cooling tower blowdown, and groundwater sources also tended to flow most of the time when samples were sought. Only one true process discharge, coal pile runoff, was found to be discharging directly to a storm drain (SD-170). This release was inadvertent and accidental, and was discontinued shortly after discovery. ORGDP has identified 172 individual analyses where concentrations exceeded those defined as reasonable guideline values based on EPA point source limitations, drinking water standards, or ORGDP NPDES effluent limitations. (Refer to Table 3-26.) These analyses represented 28 storm drains scattered around the site. In some cases, drains originated near some areas known by ORGDP to be candidates for remedial action (e.g., the classified burial ground/garage area which drains to SD-180; the Powerhouse ash pile which drains to SD-992; the classified scrap yard which drains to SD-280 and SD-294). Other drains remain to be further investigated to identify sources better. Refer to Figure 3-14 for location of storm drains which exceeded ORGDP's selected guidelines for at least one pollutant parameter. Table 3-27 gives data and drainage sources for the storm drains shown in Figure 3-14. The remaining storm drains either contained pollutants at levels below selected guidelines, or were never found to be flowing during the storm drain survey.

Four of the storm drains with complicated distribution systems (SD-100, SD-170, SD-180 and SD-190) are the subject of a second phase of storm drain characterization - an effort to determine sources of elevated contaminant levels more specifically. Each branch of the trunk line terminating at storm drain outfalls will be sampled (where possible) to isolate sources of contaminants to a single

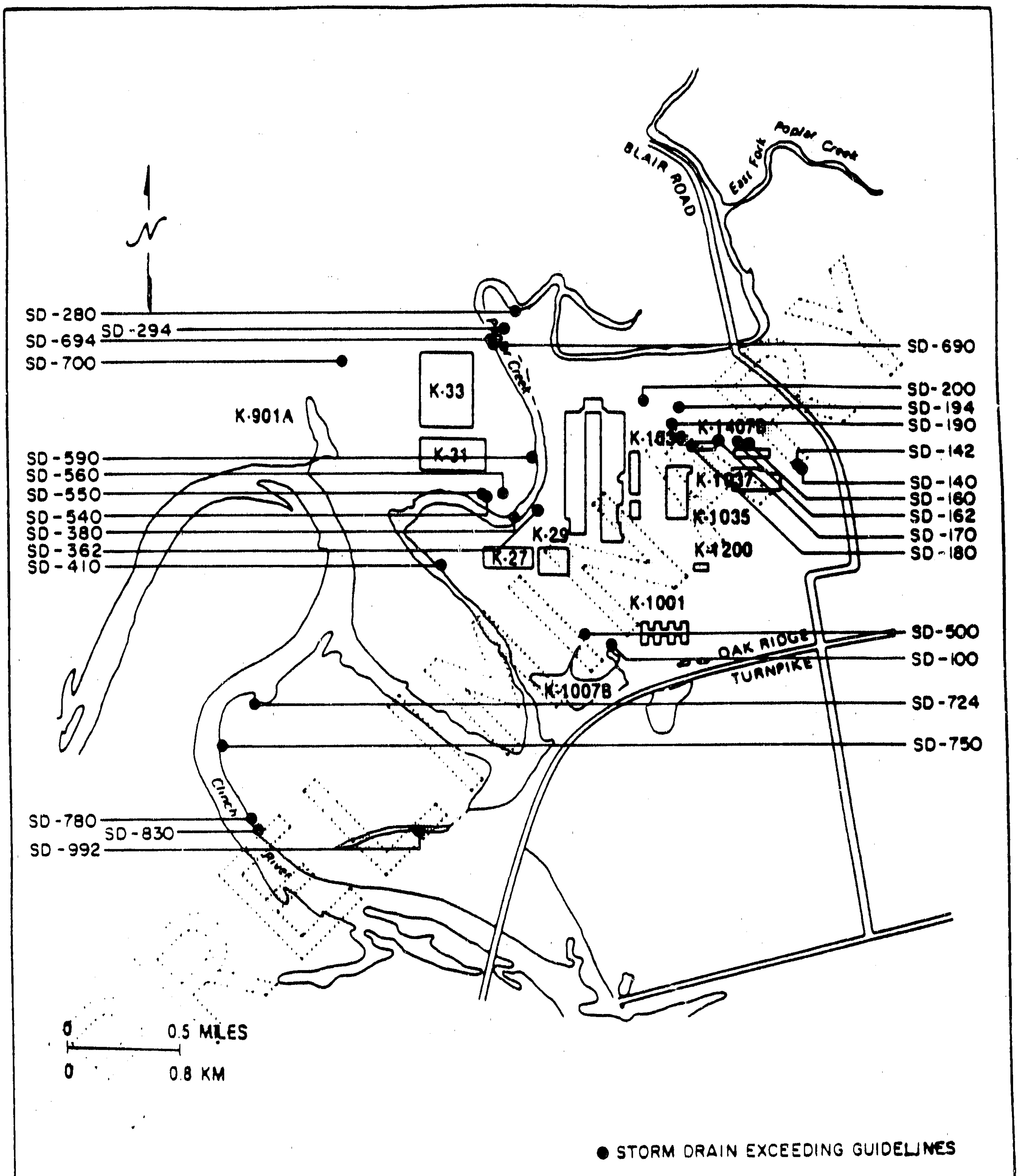
TABLE 3-26

STORM DRAIN EFFLUENT REVIEW GUIDELINES
ORGDP - OAK RIDGE, TN

Parameter	Limit (mg/l)	Reference Table[1]
Cadmium	0.69	B
Lead	0.60	A
Zinc	1.52	F
Cyanide	1.20	B
Copper	1.0	C, E
Nickel	3.98	B
Chromium	0.05	D, F
Silver	0.027	F
Total Suspended Solids	50[2]	F
Oil & Grease	15	F
Iron	1.0	C
Total Residual Chlorine	0.24	F
Arsenic	0.05	D
Barium	1.0	D
Fluoride	1.4	D
Mercury	0.002	D
Nitrate	20.0	F
Selenium	0.01	D
Gross Alpha	15 pCi/l	D
Gross Beta	50 pCi/l	D
Chloride	250.0	E
pH	6.5-8.5	E
Total Dissolved Solids	500	E
Aluminum	1.0	F
Beryllium	0.002	F
Chemical Oxygen Demand	25.0	F
Sulphate	250	E

Sources: Scheib, 1987

[1]A Electroplating Point Source Category Limitations
B Metal Finishing Point Source Category Limitations
C Steam and Electric Power Generating Point Source Category Limitations
D Primary Drinking Water Standards
E Secondary Drinking Water Standards
F ORGDP NPDES Effluent Limitations



Source: Scheib, 1988

FIGURE 3–14

STORM DRAINS EXCEEDING GUIDELINES
ORGDP – OAK RIDGE, TN

TABLE 3-27

STORM DRAIN SOURCE AND CONTAMINANT DESCRIPTION
ORGDP - OAK RIDGE, TN

Storm Drain	Maximum Concentration of Contaminants[1]	Drainage Sources
100/104	TDS 1,096; Cl 620 COD 73; Res Cl 3.1 Fe 1.8; Al 1.5 gross α 66 pCi/l gross β 60 pCi/l	Groundwater, cooling tower blowdown, laboratory rinse discharges, once-through cooling, roof drains, area runoff
140	TDS 1,096; O&G 315 COD 36 SO_4 265 gross α 33 pCi/l	Groundwater, roof drains, area runoff (O&G elevated due to an oil spill 3/13/87)
142	TDS 822 COD 30 SO_4 404	Roof drains, area runoff
160	COD 34 gross β 206 pCi/l	Oil storage area runoff, roof drains
162	COD 31 Fe 1.4 Al 1.5	Sludge fixation pour area drainage (limited use)
170	Res Cl 0.9 Al 2.9 gross α 26 pCi/l gross β 95 pCi/l	Coal pile runoff (discontinued), once-through cooling, cooling tower blowdown, roof drains, area runoff, groundwater
180	TDS 1,830; Cl 840 COD 38; Al 12 Fe 7.4 gross α [illegible] pCi/l gross β 60 pCi/l	Groundwater, garage area runoff, K-1401 floor drains, roof drains, once-through cooling, area runoff
190	TDS 672; Al 1.5 Fe 40 gross α 62 pCi/l gross β 62 pCi/l	K-1401 floor drains, roof drains, once-through cooling, area runoff
194	Fe 5.9 Al 5.8 gross α 693 pCi/l gross β 357 pCi/l	Area runoff
200	Al 1.1 gross α 26 pCi/l	Roof drains, once-through cooling, autoclave steam condensate (standby)
280	TDS 9,728; Cl 4,800 COD 97; Al 1.2 Fe 1.8 gross α 126 pCi/l	Salt storage area, classified scrap yard area runoff, Drum Deheading Area (discontinued)

TABLE 3-27
STORM DRAIN SOURCE AND CONTAMINANT DESCRIPTION
ORGDP - OAK RIDGE, TN
PAGE TWO

Storm Drain	Maximum Concentration of Contaminants[1]	Drainage Sources
294	Fe 1.7 Al 1 4 gross α 43 pCi/l	Classified scrap yard area runoff, vehicle washdown area
362	Fe 1.0 gross α 126 pCi/l gross β 141 pCi/l	Roof drains, once-through cooling, area runoff, autoclave steam condensate (standby)
380	gross α 27 pCi/l	Roof drains, area runoff; floor drains
410, 540, 550, 560, 590, 694	COD 27 to 59	K-31-K-33 area runoff
500	Res Cl 1.5 gross β 127 pCi/l	Roof drains, area runoff
690	pH 9.0	Roof drains, area runoff from firewater treatment
700	COD 27 Res Cl 3.1 pH 9.3	Roof drains, clarifier blowdown, chromate reduction unit (standby), area runoff
724	gross α 286 pCi/l gross β 377 pCi/l	Contaminated scrap yard area runoff
750	COD 27 Al 1.7 Fe 1.4	Area runoff
780	gross α 22 pCi/l	Powerhouse area runoff
830	gross β 18 pCi/l	Powerhouse area runoff, once-through cooling, building drains
992	TDS 1 [illegible]20 pH 2.5 Fe [illegible] As 0.06 Res Cl 0.7 Be 0,006 Al 37 SO4 1,280 gross α 66 pCi/l gross β 60 pCi/l	Powerhouse ash pile, area runoff

Source: Adapted from Scheib, 1987

As	Arsenic	Gross α	Gross Alpha
Cl	Chloride	Gross β	Gross Beta
Be	Beryllium	TSS	Total Suspended Solids
SO_4	Sulfate	TOC	Total Organic Carbon
O&G	Oil and Grease	pH	pH
TDS	Total Dissolved Solids	Fe	Iron
COD	Chemical Oxygen Demand	Al	Aluminum

[1] All units are mg/l except for gross α and β, which are pCi/l and pH, which are standard units

operation, building, or landfill. For example, the highest levels of contaminants on the SD-180 trunk were measured at a spring (identified as SD-180-04) just west of the classified burial ground and just below the garage area.

3.3.3.4 Sediment Sampling

Surface-water sediments are collected semiannually from six locations on Poplar Creek and at two locations in the Clinch River for analysis. Figure 3-15 shows locations for sediment sampling, and Table 3-28 provides data on metals found in these stream sediments. Clinch River samples tended to show the lowest concentrations of metals (with the exception of manganese, for which upstream analyses gave the highest concentrations). Significant amounts of metals appeared in SS-5, the East Fork of Poplar Creek, well upstream of all ORGDP activities. Impacts from ORGDP on sediments appear to be negligible.

3.3.3.5 Fish Sampling

Personnel from ORNL collect bluegills semiannually from three Clinch River locations and analyze them for radionuclides, mercury, and PCBs. Points selected are upstream of all ORR operations, downstream of ORNL, and downstream of all ORR operations, including ORGDP. Composites of 6-10 fish are ashed and analyzed. Samples were found to represent 9.4 percent of the action level for mercury in fish [1.0 microgram per gram (ug/g) wet weight] and 1.5 to 2.0 percent of the tolerance level for PCBs in fish (2.0 ug/g wet weight). Radionuclides showed no significant differences from upstream to downstream samples for cobalt-60, while strontium (total) ranged so widely that comparisons were meaningless. The highest level was observed at the farthest downstream point, and was measured as 120 picocuries per kilogram (pCi/kg) wet weight. Average strontium values were < 19 pCi/kg wet weight.

3.3.4 Findings and Observations

3.3.4.1 Category I

None

3.3.4.2 Category II

None

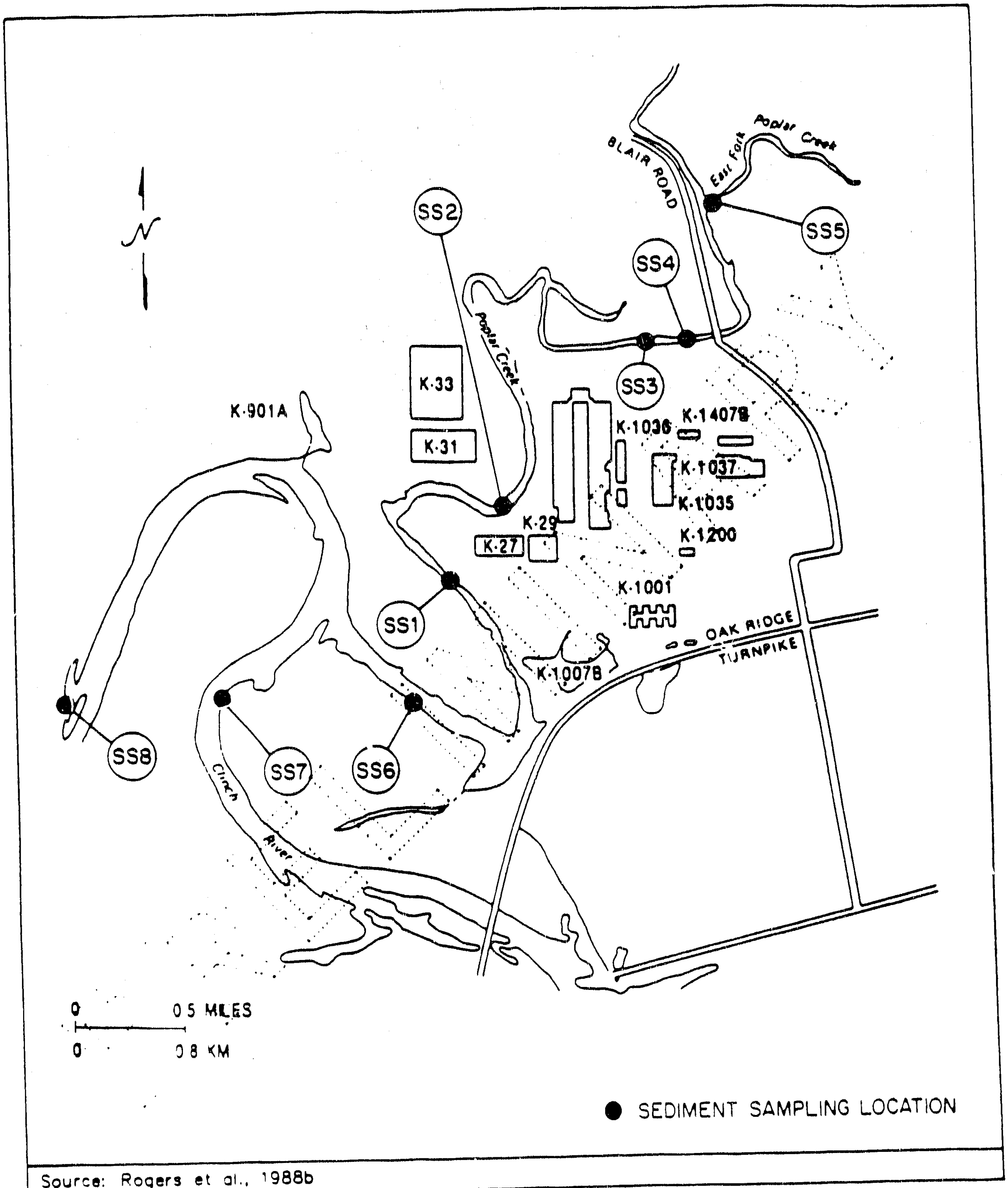


FIGURE 3–15

SEDIMENT SAMPLING LOCATIONS
ORGDP – OAK RIDGE, TN

TABLE 3-28

SEDIMENTS IN STREAM SAMPLES
ORGDP - OAK RIDGE, TN
(Concentrations in Micrograms/Gram, Dry Weight)

Element	Year	Sample Locations*							
		SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8
Aluminum	1983	35,000	23,000	38,000	34,000	28,000	53,000	37,000	25,000
	1984	44,000	34,000	34,000	29,000	30,000	44,000	21,000	19,000
	1985	28,000	25,000	25,000	26,000	31,000	38,000	18,000	13,000
	1986	12,500	19,500	15,000	17,500	21,500	17,500	14,700	8,300
	1987	11,000	9,850	10,000	77,000	72,500	10,800	5,750	3,000
Cadmium	1986	1.5	8.0	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
	1987	< 0.3	< 0.9	< 0.3	< 0.3	1.4	< 0.3	< 0.3	< 0.3
Chromium	1984	65	140	55	29	64	97	33	30
	1985	42	93	33	28	30	42	58	14
	1986	53	98	35	40	34	83	18	11
	1987	29.5	31.5	18.5	35	150	51	10.5	7.8
Copper	1986	22	89	59	81	53	91	14	6.8
	1987	21	40	23	86	66	45	8.7	3.7
Lead	1983	30	33	56	27	49	35	29	18
	1984	50	39	39	34	49	41	29	29
	1985	24	28	33	31	34	28	19	14
	1986	< 41	< 39	< 50	< 25	< 25	< 25	< 25	< 25
	1987	17	27	20	39	70	20	12	7.1
Manganese	1986	255	670	915	630	765	595	1,115	695
	1987	415	415	550	705	715	625	1,430	475
Mercury	1983	12	16	14	12	48	39	1.0	1.0
	1984	8	47	4	7	20	43	3	< 1.0
	1985	16	19	< 4	5	6	3	1.0	1.0
	1986	9.8	481	13.8	< 3.1	8.6	22.2	< 1.0	< 1.0
	1987	3.8	18.7	4.9	5.5	29	16.1	< 1.0	< 1.0

TABLE 3-28
SEDIMENTS IN STREAM SAMPLES
ORGDP - OAK RIDGE, TN
(Concentrations in Micrograms/Gram, Dry Weight)
PAGE TWO

Element	Year	Sample Locations*							
		SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8
Nickel	1983	52	54	256	54	34	85	32	18
	1984	81	120	170	49	44	120	24	22
	1985	73	110	110	48	39	73	22	16
	1986	<40	175	121	181	<30	81	<26	<21
	1987	30	76	34	154	32	53	9.9	7.2
Thorium	1986	<30	<30	<30	<30	<30	<30	<30	<30
	1987	<20	<20	<20	<20	<20	<20	<20	<20
Uranium	1983	9	9	65	9	13	13	4	1
	1984	5	23	43	6	10	11	1	1
	1985	8	13	27	5	6	20	1	4
	1986	<6	<136	<7	<82	<16	<16	<3	<3
	1987	28	3	3.5	4.7	9	4.1	1.5	<1.1
Zinc	1986	66	205	150	120	112	100	62	46
	1987	72	96	88	140	155	83	40	20

Source: Oakes et al., 1987a and b; Rogers et al., 1988b

* Refer to Figure 3-15 for locations of all sample points.

3.3.4.3 Category III

1. Contaminated storm drains. Pollutants are being released to certain storm drains resulting in potential off-site surface water contamination. ORGDP is currently identifying the contaminated storm drains and tracing the sources of the contamination. ORGDP has identified the following contaminated storm drains:

   - SD 100/104 - receives laboratory rinses, groundwater, and cooling tower blowdown from southeast part of site; analyses showed concentrations of total dissolved solids (TDS), COD, TRC, ammonia, sulfates, Fe, Al, Cl, and gross alpha and beta to be above background. Maximum concentrations are shown in Table 3-27, and pH levels, which ranged between 7.3 and 8.6, were also higher than background levels;

   - SD-170 - receives cooling tower blowdown, once-through cooling water from K-501 and K-1037; groundwater and area runoff; formerly received coal pile runoff; analyses showed concentrations of Al, Fe, Cl, TDS, and gross alpha and beta to be above background. Maximum concentrations are shown in Table 3-27, and pH levels, which ranged between 7.6 and 8.3, were also higher than background levels;

   - SD-180 - receives runoff from garage area, effluent from K-1401 machine shop sink drains floor drains and roof drains, groundwater and once-through cooling water; analyses show concentrations of Al, Fe, COD, Cl, TDS, and gross alpha and beta to be above background. Maximum concentrations appear in Table 3-27, and pH levels, which ranged between 7.6 and 8.8, were also higher than background levels;

   - SD-190 - receives effluent from K-1401 machine shop sink drains floor drains and roof drains, once-through cooling water, and area runoff; analyses show concentrations of Al, Fe, TDS, and gross alpha and beta to be above background. Maximum concentrations appear in Table 3-27;

   - SD-280 - receives runoff from road salt pile in K-1064 area; analyses show elevated concentrations of Na (3,600 mg/l), Cl (4,800 mg/l), TDS (9748 mg/l). ORGDP uses secondary drinking standards for chlorides and TDS of 250 mg/l and 500 mg/l respectively as review guidelines to indicate reasonable levels There is no guideline for sodium, but the average site-wide sodium concentration, omitting this sample, was 14 6 mg/l;

- SD-500 - receives runoff from the K-27/29 purge cascade area and east side of K-25; analyses show gross beta between 34 and 127 pCi/l;

- SD-992 - receives runoff from ash pile area at the Powerhouse; analyses show concentrations of Al, As, Be, TRC, Fe, sulfate, and TDS, to be above background. Maximum concentrations appear in Table 3-27, and pH levels, which ranged from 2.5 to 2.6, were also much lower than background levels.

Flows from most storm drains eventually pass through NPDES monitoring stations on their way off-site, so the chance of major releases going undetected for long periods is remote. However, the sediment sampling program at ORGDP has identified a number of on-site locations where deposition of metals and radioactive particles on stream bottoms has occurred (Ashwood et al., 1986). The most heavily contaminated sediments were found in Mitchell Branch and K-901-A Holding Pond prior to release through their respective NPDES monitoring points. Mitchell Branch receives three of the more contaminated storm drains (SD-170, 180, and 190), and their cumulative effect may be contributing to sediment contamination in the on-site surface water of Mitchell Branch. The actual effects on off-site portions of Poplar Creek and the Clinch River are not obvious.

2. Integrity of the sanitary sewage collection system. Lack of integrity of the sewage collection system results in infiltration of groundwater to the system during saturated soil conditions (most of the year), and exfiltration of untreated sewage from the system during unsaturated soil conditions (drought periods). Infiltration may contribute to overloads and permit exceedances at the STP during periods of heavy rainfall (see related Surface Water Finding 3.3.4.4.4). Exfiltration, although infrequent, results in the release of untreated sewage to the soil and possibly the groundwater. Estimating the typical volumes of infiltration/exfiltration is a complicated task, since many interrelated factors are involved. The K-1203 Sewage Treatment Plant does report higher flows during rainfall events, but the average increase varies from a few thousand to several hundred thousand liters per day. How much of the increase is due to actual infiltration of the sanitary sewer system rather than diversion to collection system is not readily measurable. Also during dry seasons when soil moisture is low, the amount of leakage which may be occurring cannot be estimated from available records because other measured losses (evaporation, transfers of once-through cooling waters to the

storm drain systems) make up the bulk of the total sanitary water usage data. ORGDP has estimated that the current year-round average daily loss of treated water to "leakage" is about 0.4 million liter per day (0.1 mgd) or about 5 percent of the present daily total flow (Oakes et al., 1987a).

Moreover, if some accidental release of hazardous or radioactive materials to the sanitary sewage collection system were to occur during dry periods, ORGDP could not prevent some portion of such loads from percolating away through leaks in the system, even though the bulk of the release were diverted to the Imhoff tank for holding and proper disposal. Depending on the material inadvertently released, the impact on groundwater could be serious.

3.3.4.4 Category IV

1. Washdown pad deficiencies. The oil trap (an inverted flow sump) at the concrete washdown pad in the K-1064-C area was not functioning because it was filled with silt and debris from the washdown of fly-ash trucks and other heavy equipment. In addition, the discharge from the sump is not monitored as required in the NPDES permit. The permit requires monthly sampling of discharges from vehicle and equipment cleaning facilities. Sample parameters include oil and grease and total suspended solids. Biological oxygen demand (BOD) and fecal coliform are required if sanitation equipment is washed. Effluent (potentially contaminated with oil and grease) from the sump enters Poplar Creek via storm drain SD-294. The silt and debris were removed from the sump on 3/21/88, allowing the oil trap to once again function as it was intended.

2. Coal pile runoff bypasses treatment. Runoff from the south coal pile appears to bypass collection and treatment systems during periods of heavy rainfall and may enter Mitchell Branch via storm drains SD-170 or 180. The ditch draining the south coal pile is partially filled with coal and silt which reduces drainage capacity, and the roadway shows evidence of bypass (reddish-brown stains) The release of untreated coal pile runoff, which typically has low pH and high levels of iron, TSS, and TDS, to surface waters of the state, is a violation of the NPDES permit.

ORGDP staff have taken steps to prevent further releases to the SD-170 and SD-180 storm drain systems. Drainage ditches will be modified to permit proper drainage. Also, the scheduled elimination of the south coal pile will prevent further discharges from that source.

3. Improper sampling line for K-1407-F. The narrow-diameter sample line and long distance (approximately 200 feet in an uphill direction) between the sample collection container and the new NPDES point K-1407-F will result in nonrepresentative composite samples. The length and diameter of the sample line (plastic tubing) allow for plugging due to solids deposition, freezing during the winter, particle sorting by size, and adsorption of metals on the tubing walls. Analytical data based on these composite samples could lead to incorrect assumptions about ORGDP's compliance efforts at this location.

4. Operations at K-1203 during heavy rainfall event. Partially treated sewage is routed around the K-1203 STP aeration system during some heavy rainfall events (greater than 0.5 inch in 24 hours), resulting in potential exceedances of NPDES total suspended solids (TSS) limits and possible noncompliance with an NPDES reporting requirement. Based on data for past rainfall events, STP flows, and effluent concentrations, the Survey team estimates that routings of partially treated sewage around the STP aeration system occur two to three times per year, with one to two TSS exceedances. Depending on the interpretation of NPDES permit requirements and whether the "routing" is considered to be an "established operating mode" for collecting excess flow, such "routings" may be considered a bypass under the NPDES permit and may need to be reported to the TDHE each time they occur. This issue will be resolved during the NPDES permit negotiations in February 1989.

5. Inadequate flow measurement devices. Inappropriate flow measurement devices at several NPDES monitoring stations may result in inaccurate results. The following monitoring stations have flow measurement devices that do not meet the NPDES permit requirement of a plus or minus 10 percent maximum deviation from "true" discharge rates throughout the range of flows:

- K-901-A - weir is tilted 0.7 centimeter (9/32 inch);
- K-1007-B - weir widths incorrect; flow level indicator too close to weir;
- K-1407-B - flow sensing unit located improperly; no chart recorder to provide continuous flow measurements as required;
- K1515-C - weir crest too close to bottom of approach channel; flow level indicator too close to weir;

- K1700 - weir crest too close to bottom of approach channel; this issue may become moot if K-1700 becomes a downstream ambient station to the proposed 010, 011, and 012 upstream stations; and

- General - sharp-crested weir formulas are used to calculate flow measurements even though none of the weirs are sharp crested; ORGDP may physically modify these flow monitoring stations or develop appropriate formulas to correct the flow measurements rather than install sharp-crested weirs. ORGDP has contracted for assistance in solving the flow measurement problems. The contractor's report was due in April 1988.

Flow measurements were biased both high and low from use of inappropriate formulas, but not likely to be an order of magnitude in error from "true" discharge rates. The most serious potential underestimations would occur at K-901-A. If the measured height of water was actually overflowing around the entire circumference of the effluent pipe evenly, flows would be underestimated by a factor of two or three to one (i.e., a reported flow of 0.46 million liters per day (0.12 mgd) would actually be about 1.08 million liters per day (0.285 mgd). However in this case, the measurable height of overflow used in the calculation was greater than the "true" height if the flows were evenly distributed, so the error would be reduced due to a lower true height. However, at point K-901-A, most regulated parameters are at 20 to 30 percent of their weight-based limits, so even a three-fold error in flow measurement would indicate compliance with load limits. Dissolved oxygen levels occasionally drop below 5.0 mg/l but that limit is concentration-based only, so errors in flow measurement would not affect compliance. Similar conditions prevail at all other points, except for point K-1407-B, where all limits are concentration-based. As a result, effluent quality at K-1407-B passes or fails independent of the accuracy of the flow measurements.

The above deficiencies were identified during a May, 1987, field evaluation by EPA and remain outstanding. The TDHE has authorized ORGDP to re-examine the need for major expenditures related to points K-901-A, K-1007-B, K-1407-B, and K-1700 since the TDHE does not intend to permit these outfalls after 2/89. K-1407-B will be replaced by two new outfalls. The other three stations will become ambient monitoring points rather than NPDES points.

3.4 - Hydrogeology

3.4.1 Background Environmental Information

3.4.1.1 Geology

The site area for the ORGDP lies within the folded Appalachian Mountains characterized by a series of northeast-southwest-trending parallel ridges and flat-bottom valleys. The rocks occurring there are lower Paleozoic-era sandstones, shales, dolomite, and limestones. Structural features typical in the Valley and Ridge Physiographic Province include folding and thrust-faulting associated with the Appalachian Orogeny that occurred during the late Paleozoic era.

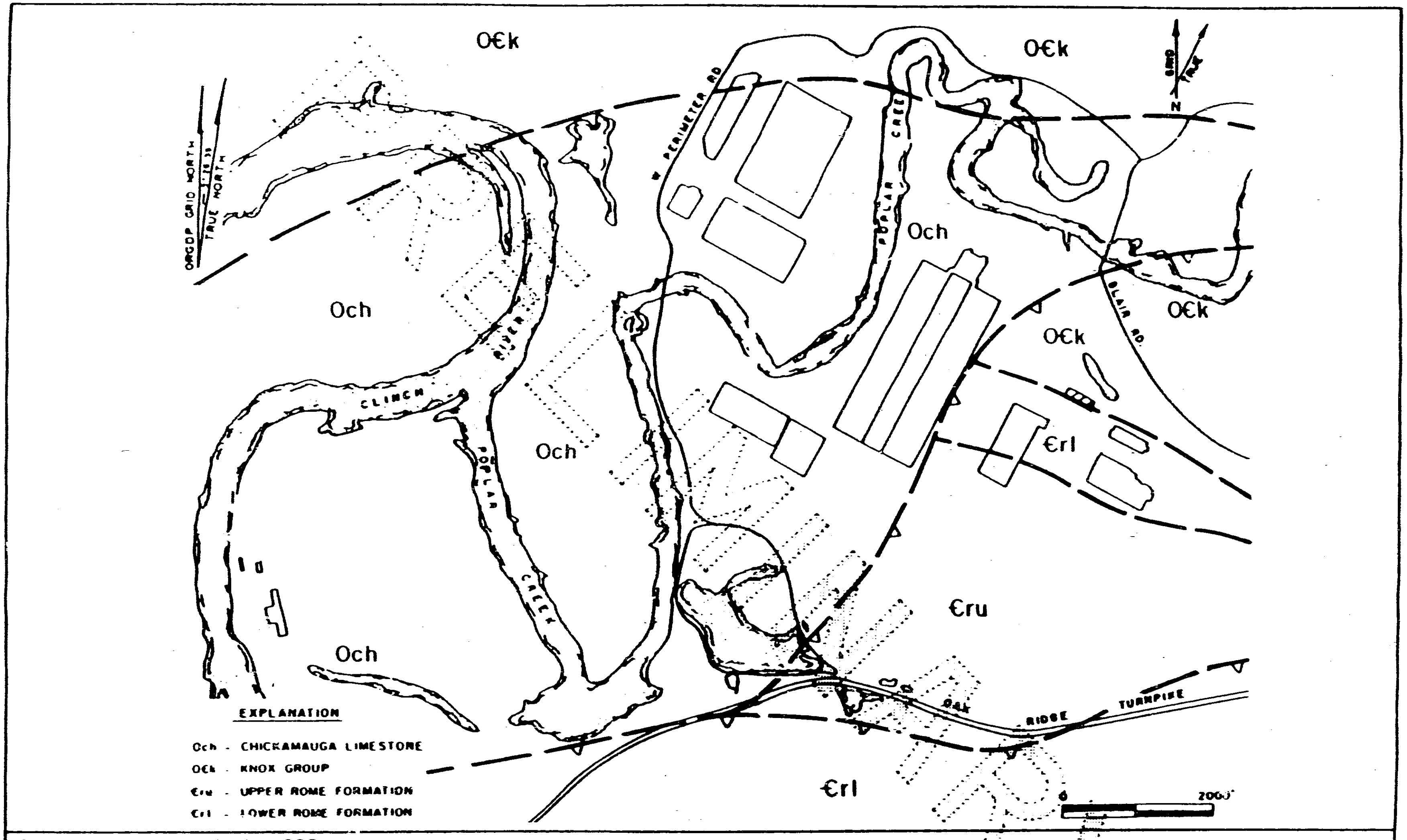
The bedrock at ORGDP is composed of three separate formations. Figure 3-16 presents a generalized bedrock map of the site. The weathering products from these formations, referred to as residuum, alluvium, and fill form the soil constituents that make up the shallow subsurface at the site. In general, depth to rock ranges from 7.6 to 12.2 meters (25 to 40 feet), but can be less than 1.5 meters (5 feet) or more than 15 meters (50 feet). The rock formations (from oldest to youngest) and soils are as follows:

Rome Formation - Cambrian period interbedded sandstones, siltstones, and shales of variegated olive, maroon, and drab (Kuhlmeier et al., 1986a).

Knox Group - Upper Cambrian and Lower Ordovician period silicified, solution-prone, thin to thick-bedded gray to blue-gray dolomite with interbeds of limestone (Kuhlmeier et al., 1986a).

Chickamauga Limestone - Ordovician period argillaceous nodular limestone, thin-bedded with intercalations of silty limestone and shale. The limestone is also solution-prone (Kuhlmeier et al., 1986a).

Residuum - The in-place weathering of the bedrock results in clayey, dense soil with chert or shale fragments. The soil's physical properties vary with depth and degree of weathering. Generally, soils developed on shale will change gradually into rock in both appearance and character with increasing depth. The limestone-derived soils are characteristically different in that the contact between soil and rock is much more abrupt but highly variable with respect to local changes in depth to rock.



Source: Kuhlmeier et al., 1986a

FIGURE 3–16

GENERALIZED BEDROCK MAP
ORGDP – OAK RIDGE, TN

Alluvium - The creeks contain alluvium composed of a mixture of sand, silt, and clay derived from erosion of the bedrock. Alluvium is relatively thin, and occurs only close to the surface streams.

Fill - Fill materials used for site grading and construction of roads are composed of residuum, usually from nearby excavation required to level the site during construction of the facility.

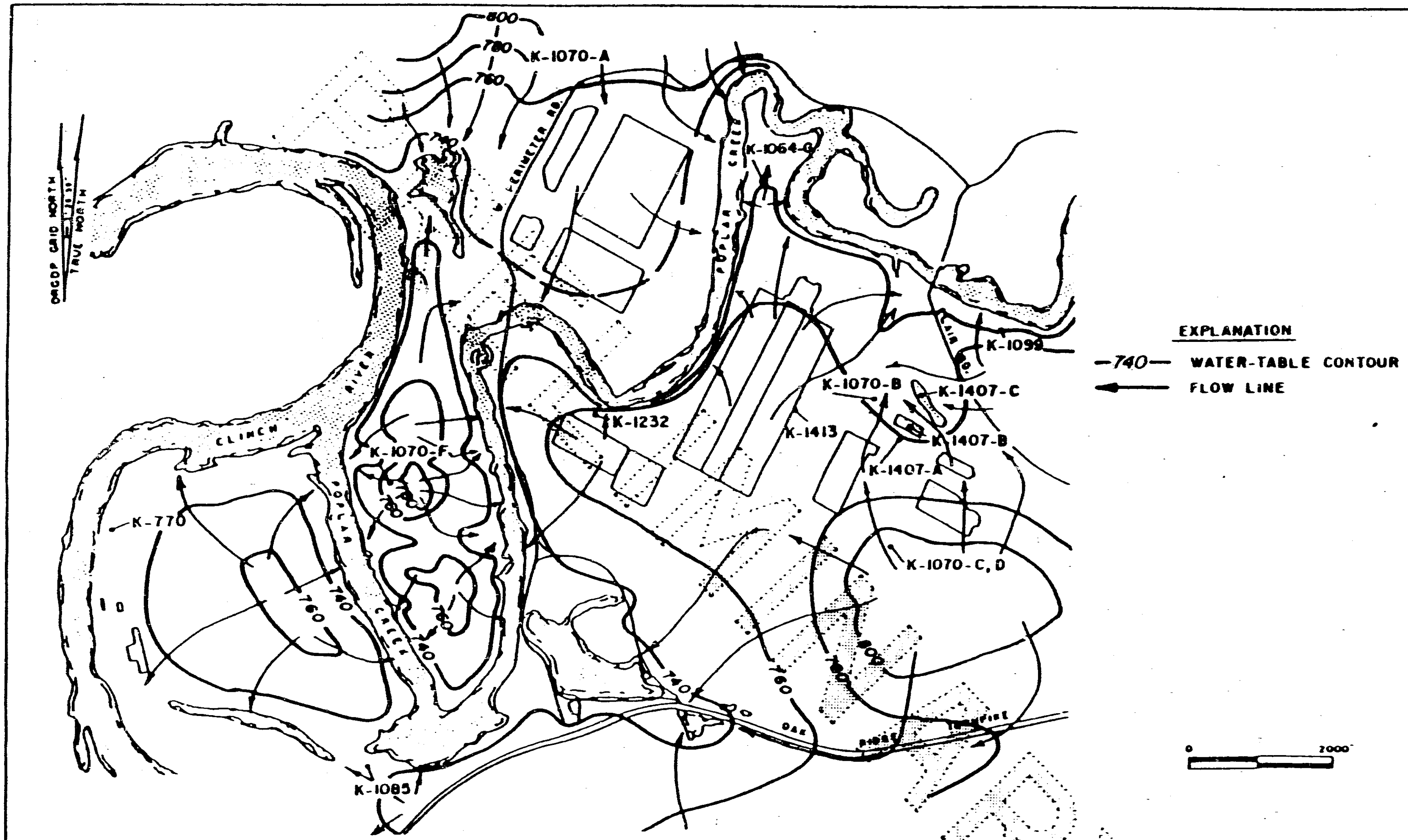
3.4.1.2 Groundwater Regime and Use

Groundwater occurs in an interconnected aquifer composed of the unconsolidated residuum and bedrock. Gradients are generally downward to the rock in the higher areas of the site, and upward from the rock to the unconsolidated soil in the lower areas near the creeks and drainages. Numerous springs occur in the lower areas of the site in part because of this reversal in gradient. Figure 3-17 shows a generalized map of contours on the top of the water table. Depths to water in the higher portions of the site may be as much as 7.6 meters (25 feet), whereas the water table may be at or near the surface in lower areas of the site near the creeks and ponds. In general, groundwater moves from areas of higher elevation toward areas of lower elevation where it discharges into creeks and drainages.

The surficial part of the aquifer is composed primarily of the residuum, and acts as a relatively homogeneous unit. Due to the low permeability, averaging between 1×10^{-5} and 1×10^{-4} centimeter per second (cm/sec) [2×10^{-5} and 2×10^{-4} foot per minute (ft/min)] combined with the low gradients typically observed at the site, groundwater flow velocities are calculated to be on the order of 3×10^{-3} centimeter per day (cm/day) [1×10^{-4} foot per day (ft/day)] (Kuhlmeier et al., 1986a).

Groundwater flow in the bedrock part of the aquifer is controlled by anisotropic secondary porosity associated with the jointing, fracturing, and solution features within the rock mass. Permeability testing subsequent to piezometer and monitoring well installation indicates values ranging from 1×10^{-5} and 1×10^{-3} cm/sec (2×10^{-5} to 2×10^{-3} ft/min) (Kuhlmeier et al., 1986a). Flow rates, which are also dependent on gradient, are likely to be variable because of the anisotropic nature of the secondary porosity and the variable gradients.

The site does not use groundwater for domestic or industrial purposes. The domestic wells closest to ORGDP are north of the site approximately 1.6 kilometer (1 mile) on the opposite flank of Black Oak Ridge, an apparent groundwater divide. Thus, they are not likely to be impacted by ORGDP activities.



Source: Kuhlmeier et al., 1986a

FIGURE 3–17

GENERALIZED CONTOURS ON THE WATER TABLE
AND INFERRED GROUNDWATER PATHS IN THE UPPERMOST AQUIFER
ORGDP – OAK RIDGE, TN

3.4.1.3 Groundwater Quality

Because the monitoring wells at ORGDP facilities have been installed only recently (starting in 1985), little is known about on-site background water quality. The monitoring wells intended to monitor upgradient water quality are either in the process of having four quarters of data collected or possibly contaminated by the facility they are intended to monitor, as in the case of the K-1407-B and C ponds (see Section 3.4.2). The lack of groundwater monitoring wells or data for background water quality at ORGDP precludes assessing present monitoring well data in relation to a background water quality baseline.

Wells at private residences in the nearby towns of Harriman and Kingston, approximately 16 kilometers (10 miles) southwest of the plant, were sampled in 1986 as part of a study performed by Oak Ridge Associated Universities (ORAU). Only limited analytical data, relative to the amount collected from a hazardous waste facility groundwater sample, were reported. Additionally, water samples were collected from the distribution systems at the residences and were intended to provide data for assessment of only the water being consumed; thus, results relative to parameters likely affected by the distribution system (some metals, organics, chlorides, etc.) may not be indicative of the formation water quality. However, gross alpha and gross beta reported from the study can provide insight into background values for these parameters in groundwater from a limited area near the plant. Ranges for gross alpha and gross beta measured in samples from 11 wells were <0.271 to 2.968 picocuries per liter (pCi/l) and <0.564 to 2.891 pCi/l, respectively (Gist, 1988).

3.4.2 General Description of Pollution Sources and Controls

This section discusses the actual and potential sources of groundwater contamination, and the controls used by ORGDP to inhibit or reduce impacts to groundwater quality from those sources. Although this section focuses on the sources of groundwater contamination, Finding 3.4.4.3.1 focuses on the extent to which these sources have actually impacted the groundwater. Additional details and findings related to the physical characteristics of the actual and potential sources of groundwater contamination discussed below can be found in Sections 4.1.2 and 4.5.2.3.

ORGDP, with assistance from their consultants, has identified and categorized Solid Waste Management Units (SWMUs), spill sites, and inactive waste sites into a series of approximately 70 SWMUs. Of these, 39 are considered by the site to require further investigation. Although a finite number of sites has been selected, in many cases there are numerous known or potential sources at some of the sites. Often these source areas have been grouped into one site, referred to as a Waste

Area Grouping (WAG) for purposes of logistics. The numerical quantity in itself is not a valid measure of waste quantity nor is it indicative of environmental problems. The facts pertaining to each of the units or sites must be evaluated in order to assess the true nature of the environmental problem associated with each of the SWMUs or WAGs. Finding 4.5.2.3.1 discusses each of the waste units and source areas. This section discusses the waste units that are either known or suspected sources of potential groundwater contamination, regardless of the degree of subsurface or environmental characterization for the areas in question. Known and potential sources that have groundwater data available are as follows:

- K-1407-B Holding Pond WAG - This WAG contains three closely located, but separate, source areas: K-1070-B Old Classified Burial Ground, K-1407-A Neutralization Pit, and K-1407-B Holding Pond. The K-1070-B facility has been closed since the early 1970s, but was believed to have received radioactive and nonradioactive materials including uranium and trace quantities of transuranium elements. Hazardous wastes were also likely to have been disposed of there (Bowers, 1986). The K-1407-A neutralization pit postdates the K-1407-B pond, and is now used to neutralize runoff from the coal piles and liquid from some process areas. Prior to construction of the K-1407-A pit, the K-1407-B pond was used to neutralize acidic solutions containing uranium and other metals. Leakage from the pond is not controlled. See Findings 3.4.4.3.1.a and 4.5.2.3.1.g.

- K-1070-A Contaminated Burial Ground - This approximately 1.2-hectare (ha) (3-acre) site was used as a disposal area for radioactive liquid, sludges, and mixed wastes until 1975 (Kuhlmeier et al., 1986b). The site is estimated to contain approximately 14.1 curies total from uranium, thorium, beryllium chips, boron, UF_6 cylinders, and contaminated NaF, oil, and rags (Bowers, 1986). Most of the disposal was into shallow pits and trenches that have been covered with earth. There are no controls to prevent any leachable contaminants from migrating off-site or to the groundwater. See Findings 3.4.4.3.1.b and 4.5.2.3.1.e.

- K-1070-C/D Classified Burial Ground - These two sites have been used to dispose of both liquid and solid hazardous and nonhazardous classified wastes. Prior to 1979, liquid wastes were dumped in trenches at K-1070-C. The K-1070-D site was also used for storage of drums containing organic solvents and waste oils (Kuhlmeier et al., 1986b). The two areas of this site have been combined because of their proximity and physiographic location on a hilltop east of the site. This area is a potential source for the contamination associated with a spring located downslope from the facility. No controls are in place to prevent or contain migration of contamination from the facility. See Findings 3.4.4.3.1.c and 4.5.2.3.1.f.

- K-1413 Treatment Facility and Process Lines - This facility was used to neutralize and precipitate metal-laden wastes in a 4.5-meter (15-foot) deep, 26,500-liter (7,000-gallon) in-ground concrete tank (Kuhlmeier et al., 1986b). Nearby wells indicate that the tank apparently leaked contaminants. No controls are in place to prevent further leakage from the tank. See Findings 3.4.4.3.1.e and 4.5.2.3.1.h.

- K-1407-C Retention Basin WAG - This WAG includes both the K-1407-C pond and the K-1407-C and K-1417 soil piles. The K-1407-C pond previously received liquids and solids dredged from the K-1407-B pond and lime to stabilize the metals in solution. The pond is in the process of closure, and the wastes are being solidified with cement and stored on-site. The K-1407-C and K-1417 soil piles occupy an area covering approximately 0.4 to 0.8 hectare (1 to 2 acres) adjacent to the north side of the K-1407-C pond area. The soil piles are basically one large pile, and are known to be contaminated with radioactivity, reportedly 68 picocuries per gram (pCi/g) (Motley, 1987). The species of radionuclide is not reported, but is noted to be below a DOE derived de minimis level for soils in the area (Motley, 1987). No controls are in place to prevent either surface runoff or contaminated groundwater migration from the area. See Findings 3.4.4.3.1.d and 4.5.2.3.1.g.

- K-770 Scrap Metal Yard - The use of the K-770 scrap yard, an area covering approximately 9 hectares (22 acres) on the east bank of the Clinch River, has been used primarily for storage of uranium-contaminated metal process piping. Polychlorinated biphenyls (PCBs), mercury, and asbestos were also stored there prior to 1977 (Kuhlmeier et al., 1986b). Evidence of scrap metals and other small pieces of waste materials such as plastic, wire, and wood is visible on the surface of the floodplain area cleared during the current scrap segregation project (Bowers, 1986). No controls exist to prevent migration of any leachable contaminants remaining at the site. See Findings 3.4.4.3.1.f and 4.5.2.3.1.b.

- K-1064 Peninsula Storage and Burn Area - This area was used for both storage and disposal by burning of paint, waste oils, waste solvents, and other combustible materials prior to 1980 (Kuhlmeier et al., 1986b). Solid residue from burning was shoved aside and is likely to be beneath the surface on the sloping banks of the peninsula. No controls are in place to prevent any leachable contaminants remaining in the subsurface or waste residues from migrating from the site. See Findings 3.4.4.3.1.g and 4.5.2.3.1.d.

- K-1232 Treatment Facility - This facility contains three open-top in-ground concrete tanks used to store or treat liquid waste that may be corrosive, EP toxic, or listed as toxic (Kuhlmeier et al., 1986b). Pipelines from the tanks inside the building to tanks outside were found to be leaking (Goldsmith et al., 1988). No controls are in place to prevent further leakage from the facility. See Findings 3.4.4.3.1.h and 4.5.2.3.1.j.

- K-1414 Leaking Underground Fuel Tank - A diesel fuel tank located underground just north of the K-1414 Building was found to be leaking at the rate of 0.3 liter per hour (l/hr) [0.08 gallon per hour (gal/hr)] during a leak test in February 1987 (Kuhlmeier, 1987). During tank removal in March 1987, evidence of leakage to the surrounding soil was apparent, and a subsequent groundwater investigation revealed subsurface contamination. The contamination has not been removed, although the leaking tank has been removed. No controls are in place to prevent further migration of the subsurface contamination. See Findings 3.4.4.3.1.i and 4.5.2.3.1.i.

- K-1070-F Old Contractors Burial Ground - An area covering the higher elevations of the peninsula bounded by Poplar Creek between the site and the power plant was used as a dumping ground by construction contractors for an unknown period of time. There are no records of materials dumped there, but ORGDP personnel believe that mostly inert materials were disposed of there. The K-900 Bottle Smasher is now located in what appears to be the approximate center of the area. No controls are in place to prevent contamination from leaving the site. See Findings 3.4.4.3.1.j and 4.5.2.3.1.m

- K-1085 Old Firehouse Burn Area - The former site of the old firehouse was also used for open burning of paint, waste oil, and waste solvents prior to 1970 (Kuhlmeier et al., 1986b). The exact location and amount of materials disposed of are unknown. Wells installed to investigate the area believed to contain the facility are contaminated. The only structures still at the site are two concrete slabs and what appear to be abandoned underground storage tanks beneath one of the slabs possibly associated with an abandoned gasoline filling station. No controls are in place to prevent contaminants from migrating from the site. See Findings 3.4.4.3.1.k and 4.5.2.3.1.n.

- K-1099 Blair Road Quarry - The quarry was used to dispose of radioactively contaminated paper and wood prior to 1970 (Kuhlmeier et al., 1986b). The quarry was apparently partially filled at some later date with soil and rock, and evidence of rusted steel drums and other metal debris is apparent in the area adjacent to the north wall, indicating there is a potential for other materials to have been disposed of or stored there. The quarry is presently abandoned; however, no controls are in place to prevent contamination from migrating from the site. See Findings 3.4.4.3.1.l and 4.5.2.3.1.o.

Other potential sources of groundwater contamination that either have characterization wells installed or have not been investigated are as follows:

- K-901-A Holding Pond - This 2-hectare (5-acre) pond received chromium-hydroxide precipitates, lead, nickel, copper, and uranium from the early 1970s until 1985 (Motley, 1987). There are reports that it was also a disposal area for UF_6 cylinders that had been damaged. The pond no longer receives wastes because the process is not in operation. See Finding 4.5.2.3.1.c.

- K-1420 Facility Process Lines and Oil Storage Area WAG - This WAG includes facilities, process lines, contaminated oil storage pads, and oil incineration facilities associated with decontamination of scrap metals, UF_6 cylinders, mercury recovery, and disposal of contaminated oil. Although it is not known if the abandoned lines have leaked, some have been exhumed and found to contain PCBs, mercury, and uranium (Bowers, 1986). The oil drum storage pad is stained from apparent oil leaks from the drums in an area approximately 15.25 meters by 83.8 meters (50 feet by 275 feet) located about 22.9 meters (75 feet) north of the building (Motley, 1987). This facility (WAG) is partially in the apparent upgradient direction of the K-1407-B WAG and the K-1407-C WAG, and thus could contribute to both groundwater and surface-water contamination in those areas. The Cylinder Cleaning Facility is still in operation, but the remaining facilities are no longer operating. See Finding 4.5.2.3.1.r.

- K-901 Sanitary Disposal Area (Lonnie's Landfill) - An area covering approximately 2 hectares (5 acres) north of the K-901-A Holding Pond was used for an undetermined number of years as an apparent disposal area. There are numerous areas on the surface where concrete, coal ash, and metal debris are visible. See Finding 4.5.2.3.2.a.

- K-720 Fly Ash and Coal Piles - The former power plant operated on coal and oil in the 1940s and 1950s (Motley, 1987). Coal and fly ash were stored and disposed of respectively in this 6.1-hectare (15-acre) area. Iron and sulfur compound staining from coal pile runoff is evident on the surface where remnants of the old coal pile exist. The fly ash pile is reported to contain hazardous constituents (Motley, 1987). No controls of surface runoff or lined impoundments for the waste are in place. See Finding 4.5.2.3.1.a.

- Cooling Tower Basins and Associated RCW Lines - The cooling tower basins and associated recirculating cooling water (RCW) lines which encircle most of the process buildings contained and still contain residual amounts of hexavalent chromium, zinc, and phosphorous used as corrosion inhibitors in the water. The lines and basins were in service for as long as 35 years prior to plant shutdown in 1985 (Motley, 1987). Although cathodic protection was used to reduce erosion of the piping, leakage from the basins and lines was known to occur, but is not quantified or detailed as to locations for all the line breaks or leaks. The piping and basins are still present, but are no longer in use because the process is not operating. See Finding 4.5.2.3.1.l.

- K-1203 Sewage Treatment Plant - The operating Sewage Treatment Plant (STP) processes effluent from numerous facilities within the plant. It represents a potential source of contamination to the groundwater through leaks in the clarifier and sludge drying beds. Although ORGDP has not sampled sludge from this facility for hazardous chemicals such as PCBs or for radioactivity, it is a likely source based on results of sewage sludge analyses at similar gaseous diffusion plants at both Portsmouth, Ohio, and Paducah, Kentucky. See Finding 4.5.2.3.1.p.

- K-1410 Nickel Plating Facility - This abandoned facility contained plating solutions from the early 1970s until operation was suspended in 1979. The waste solutions were piped to the K-1410 Neutralization Pit, a 59,800-liter (15,800-gallon) tank, used from 1975 until 1979. The plating solutions are corrosive, and leakage from the facilities is unknown (Bowers, 1986). No controls are known. See Finding 4.5.2.3.1.q.

- K-1401 Degreaser Tanks and Acid Lines - The acid line leading from this facility to the K-1407-A pit was found to be leaking into a storm drain in the early 1970s (Bowers, 1986). The building also contains degreasing tanks and other equipment for metal cleaning. Although the leaking acid line was sleeved, the contamination was not removed from the subsurface. Controls consist of plastic sleeves in the acid lines, but none are known to be installed for the degreaser tanks. See Finding 4.5.2.3.1.s.

- K-1515 Water Treatment Plant Sludge - The K-1515 water treatment plant lagoon contains sludge consisting of backwash from the treatment process in an area covering approximately 0.8 hectare (2 acres). Although the sludge is not considered hazardous, low levels of alpha and beta radiation have been detected in the sludge (Bowers, 1986). The impoundment is controlled as a settling basin, and no evidence of sludge being removed from the pond is apparent. See Finding 4.5.2.3.1.t.

3.4.3 Environmental Monitoring Program

There are currently 35 sites with wells or piezometers installed for compliance monitoring, detection monitoring, or characterization data collection at both active and inactive facilities. A total of 137 monitoring wells or piezometers have been installed, beginning in 1985, in response to DOE Order 5480.14. Of those, 78 wells or piezometers are being sampled for analysis. The subsections below describe the physical components, sample collection, and analytical aspects of the program. Groundwater analytical data indicative of environmental problems potentially associated with SWMUs or WAGs are discussed in Section 3.4.4.3 in the particular subfinding dealing with that specific location.

3.4.3.1 <u>Physical Components of the Monitoring Program</u>

Currently, two sites have had four quarters of background data collected, and are being monitored on a semiannual schedule. These sites are as follows:

- K-1407-B Pond
- K-1407-C Pond

Ten sites have had wells installed for monitoring, and have had three quarters of background data collected. These sites are as follows:

- K-1070-A Old Contaminated Burial Ground
- K-1070-C/D Classified Burial Ground
- K-1070-F Old Contractors Burial Ground
- K-770 Scrap Metal Storage Yards

- K-1064 Peninsula Storage and Burn Area
- K-1085 Old Firehouse Burn Area
- K-1099 Blair Road Quarry
- K-1232 Treatment Facility
- K-1413 Treatment Facility
- K-1407 WAG (includes K-1407-B WAG and K-1407-C WAG)

Three of the above sites -- K-1070-F, K-1064, and K-1232 -- had additional wells installed in July or August 1987 for the purpose of supplying background data because no upgradient locations for wells were available at those sites. At the time of the on-site Survey, none of these new wells had been sampled. See Finding 3.4.4.4.1.f.

Characterization wells have been installed at 23 sites or facilities, but have not been monitored. Sites with wells are as follows:

- K-802-H Cooling Tower Basin
- K-802-B Cooling Tower Basin
- K-862-E Cooling Tower Basin
- K-892-G & K-892-H Cooling Tower Basins
- K-892-J Cooling Tower Basin
- K-832-H Cooling Tower Basin
- K-1007 Gasoline Underground Storage Tank (UST)
- K-1401 Degreaser
- K-1004-N Cooling Tower Basin
- K-1700 Mitchell Creek
- K-27 & K-29 RCW Lines
- K-31 RCW Lines
- K-33 RCW Lines
- K-1004-L RCW Lines
- K-1413 Lines, North Sump & East Sump
- K-720 Fly ash and Coal Pile Areas
- K-1410 Neutralization Pit
- K-901-A Holding Pond
- K-1004 Laboratory Drain
- K-1503 Neutralization Pit
- K-1004-L Vaults in K-1004-J Building

- K-1401 Acid Line
- K-1420 Process Lines (North & South), & Oil Storage Area

Well construction was reviewed during the on-site Survey at all the facilities that are currently being monitored for compliance or background data collection, and at some of the area where characterization is being performed. Monitoring wells and piezometers installed for use as the first group of characterization wells were constructed of 10-centimeter (4-inch) and 5-centimeter (2-inch) diameter polyvinyl chloride (PVC) flush-joint casing, respectively. These include wells UNW-1 through 11 and BRW-1 through 9, and piezometers UNP-1 through 17. See Finding 3.4.4.4.1.e. All wells constructed since 1985 have used 10-centimeter (4-inch) diameter stainless steel casing. The casings have slotted screens and are sandpacked and sealed with bentonite. Cement-bentonite grout is used to backfill the annulus to the surface. The surface completions consist of either below-grade valve boxes (Kristi boxes), or lockable steel protective casings above-grade set in 1-meter (3-foot) square concrete pads. The above-grade completions were typically protected by four bright orange steel posts anchored in the ground, with the casings locked. Well identification numbers were stencil-painted on the casings. The below-grade completions, in many cases, had broken tops, leaked mud or water, did not have identification numbers that could be found, and were not lockable. The site personnel responsible for the monitoring program recognized the potential problems associated with unsecured wells after observing standing water in one of the Kristi boxes, and no longer allow their consultant to use subsurface well completions. See Finding 3.4.4.4.1.a.

3.4.3.2 Sample Collection and Analysis

Sampling is performed on a periodic basis at each of the monitoring wells at a particular facility depending on which phase of sampling is being conducted. As mentioned in the previous section, two sites are being sampled on a semiannual basis for compliance, and 10 other sites are in the last quarter of a 1-year background data collection requirement for detection monitoring.

Monitoring well sampling was observed during the on-site Survey at well UNW-20 in the K-1407-B WAG. Sampling is performed by a team of two personnel from the ORGDP Analytical Chemistry Department (ACD) in accordance with written procedures (Burnett and Dill, 1988; Dill, 1988a). In preparation for sampling, the samplers mark each sample container with sampler's name, site/subproject number, date, analysis to be run, and preservatives (if used). Field equipment is decontaminated, and equipment for field monitoring of pH, temperature, specific conductivity, dissolved oxygen content, and redox potential is calibrated in the laboratory. Once the team is at the well site, the water level in the well is measured to the nearest 3 centimeters (0.1 foot) and recorded on a field logsheet. The pumping time necessary to purge three well volumes is calculated based on well construction records and on the measured water level. Purging of three well volumes is performed by a nitrogen-driven piston pump adjusted to operate at 5.7 liters per minute [1.5 gallons per minute (gpm)]. The indicator parameters, pH, specific conductivity, and temperature, are measured during purging, but are not used to monitor the effectiveness of purging. See Finding 3.4.4.4.1.b. After purging, sampling is performed by bailing with a closed-top Teflon bailer attached to a hand-held windlass by nylon string. The samples to be analyzed for organics are recovered first and poured directly from the bailer into amber sample bottles. The purge pump is left in the well during sampling for organics. Upon completion of sample collection for organics, the purge pump is restarted and used to fill polyethylene bottles used to contain analytes other than organics. The samples are placed in a cooler with cold packs for temporary storage during shipment back to the laboratory. A chain-of-custody sheet is filled in with the well identity, date, and number of sample bottles. The chain-of-custody form is given to the sample custodian upon transfer of the samples at the laboratory, and does not accompany the samples through the analytical process (see Section 4.4.1).

The samples are analyzed on-site at the Analytical Chemistry Laboratory for the parameters as defined in the QA/QC Procedures (Dill, 1988a). Typical classes of analytes include inorganics, volatile organics, semi-volatile organics, pesticides/PCB, herbicides, and radioactivity. Groundwater samples that exhibit beta radioactivities greater than 50 pCi/l are required to be analyzed to determine the specific emitters. This analysis has not been performed although several samples have exceeded this guideline value. See Finding 3.4.4.4.1.d. Analyses are performed in accordance with EPA protocols.

3.4.4 Findings and Observations

3.4.4.1 Category I

None

3.4.4.2 Category II

None

3.4.4.3 Category III

1. On-site groundwater contamination. Based on ORGDP monitoring data, there are at least 12 areas on-site where groundwater is contaminated with organics (such as chlorinated solvents), radionuclides (expressed as alpha and beta radioactivity), and other materials (such as metals, sulfates, and coliform). Concentrations of some contaminants in on-site groundwater have exceeded drinking water standards. The extent of monitoring thus far at known sites has revealed concentrations as follows for the principal contaminants listed:

   a. K-1407-B Holding Pond WAG - The use of this pond for neutralization and the disposal of contaminated materials in the burial ground at K-1070-B and the neutralization pit at K-1407-A have apparently contaminated the groundwater with organic solvents, metals, low pH, and radioactivity. Analytical results for the major contaminants in samples collected at monitoring wells at the WAG are listed in Table 3-29. Figure 3-18 shows the location of monitoring wells and inferred groundwater flow directions. Details regarding the physical characteristics of the actual and potential sources of contamination are discussed in Finding 4.5.2.3.1.g.

   b. K-1070-A Contaminated Burial Ground - This site was used for disposal of radioactively contaminated liquids, sludges, and other miscellaneous mixed waste in unlined pits and trenches. Monitoring wells sampled at the facility indicate the principal contaminants to be organic solvents, metals, high pH, and radioactivity. Contaminant concentrations as listed in Table 3-30 are only for the principal constituents. Figure 3-19 presents a map of well locations and groundwater level contours of the facility. Details regarding the physical characteristics of the actual and potential sources of contamination are discussed in Finding 4.5.2.3.1.e.

   c. K-1070-C/D Classified Burial Ground - The burial and disposal of organic solvents and contaminated materials have resulted in groundwater contamination. Monitoring well analyses indicate that the principal contaminants are organic solvents, metals, high pH, and radioactivity. Table 3-31 lists the principal contaminant concentrations. Figure 3-20 shows monitoring well locations and inferred groundwater flow directions. Details regarding the physical characteristics of the actual and potential sources of contamination are discussed in Finding 4.5.2.3.1.f.

TABLE 3-29

PRINCIPAL GROUNDWATER CONTAMINANTS
K-1407-B HOLDING POND WAG
ORGDP - OAK RIDGE, TN

Contaminant	Maximum Detected Value	Maximum Contaminant Level*	Units	Well No.
trichloroethylene	6500	5	µg/l	UNW-5
1,1,1-trichloroethane	280	200	µg/l	UNW-2
1,1,2-trichloroethane	100	NA	µg/l	UNW-1
1,1-dichloroethylene	210	7	µg/l	UNW-2
1,1-dichloroethane	410	NA	µg/l	UNW-5
carbon tetrachloride	120	5	µg/l	UNW-5
1,2-dichloroethane	29	5	µg/l	BRW-7
tetrachloroethylene	240	NA	µg/l	UNW-2
trans-1,2-dichloroethylene	2000	NA	µg/l	UNW-5
vinyl chloride	4800	2	µg/l	UNW-5
Freon 113	970	NA	µg/l	UNW-5
Freon 123	250	NA	µg/l	UNW-20
tributyl phosphate	65	NA	µg/l	UNW-3
alpha activity	117.4	15	pCi/l	UNW-22
barium	1.7	1.0	mg/l	UNW-3
beta activity	3169	50	pCi/l	UNW-2
boron	1.1	NA	mg/l	BRW-7
chloride	441	250	mg/l	UNW-3
chromium	0.17	0.05	mg/l	UNP-3
fluoride	3.4	1.4	mg/l	UNP-5
lead	0.21	0.01	mg/l	UNW-3
sodium	180	250	ug/l	UNW-3
sulfate	646	250	ug/l	UNW-3
total coliform	117	1	col/100 ml	UNW-23
uranium	0.043	NA	mg/l	UNP-5
pH	5.6	6.5-8.5	NA	UNW-2

Source: MMES, undatedb

* or drinking water standard
NA = Not available

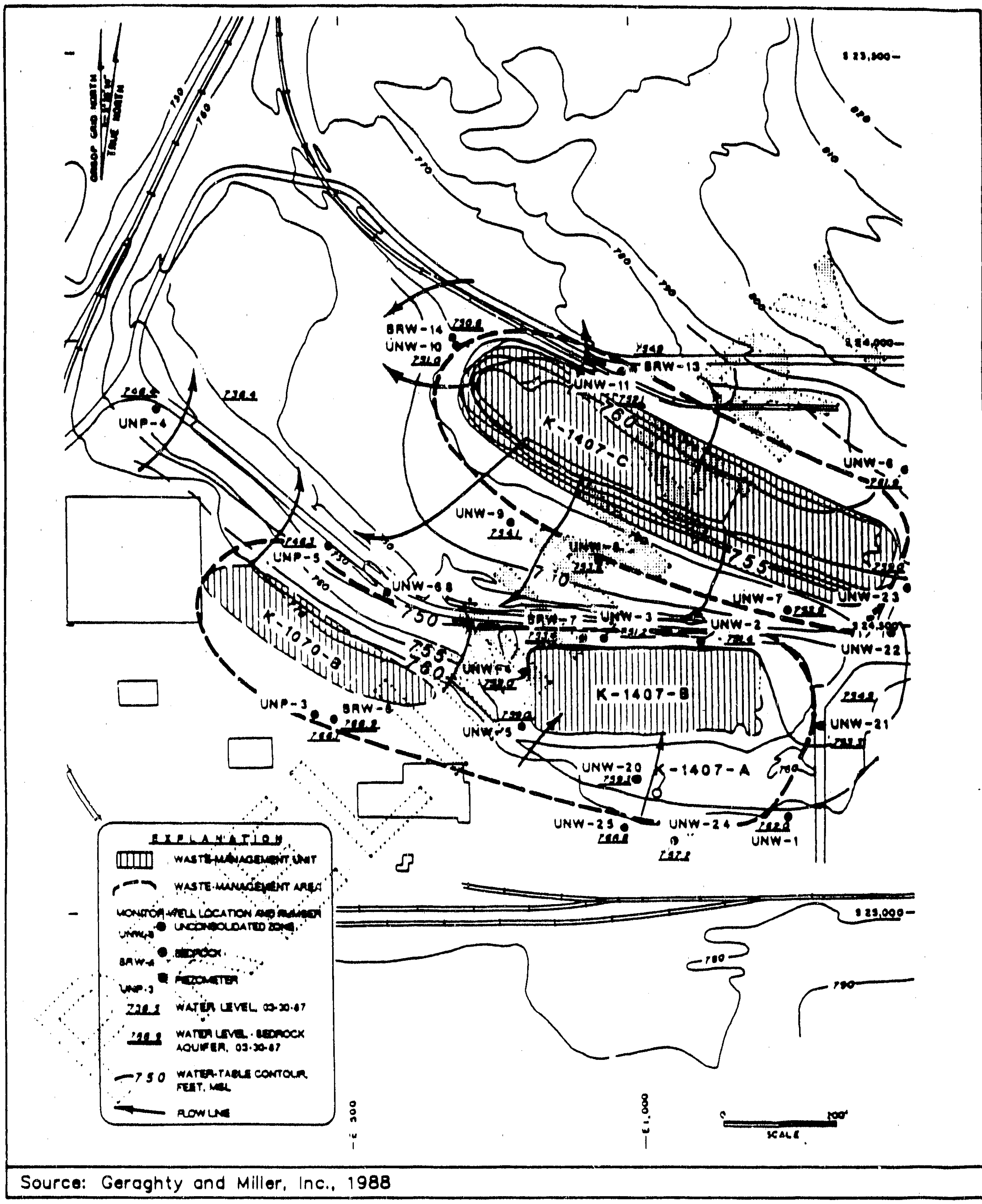


FIGURE 3-18

K-1407-B WAG AND K-1407-C WAG MONITORING WELL LOCATIONS AND INFERRED GROUNDWATER FLOW DIRECTIONS ORGDP - OAK RIDGE, TN

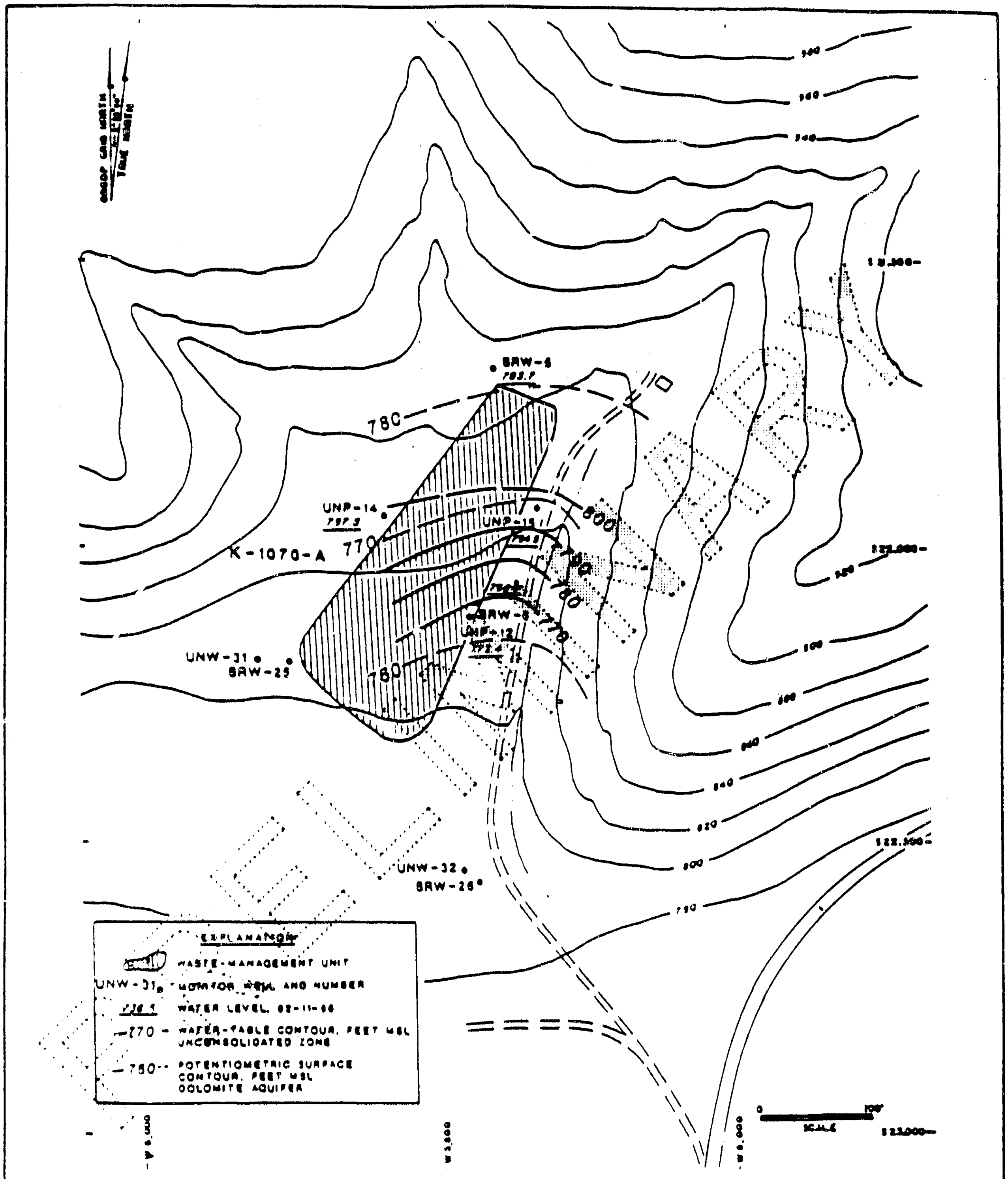
TABLE 3-30

PRINCIPAL GROUNDWATER CONTAMINANTS
K-1070-A CONTAMINATED BURIAL GROUND
ORGDP - OAK RIDGE, TN

Contaminant	Maximum Detected Value	Maximum Contaminant Level*	Units	Well No.
trichloroethylene	4500	5	µg/l	UNP-14
1,1,1-trichloroethane	9000	200	µg/l	UNP-14
1,1-dichloroethylene	1240	7	µg/l	UNP-14
carbon tetrachloride	180	5	µg/l	UNP-12
tetrachloroethylene	160	NA	µg/l	BRW-5
alpha activity	44	15	pCi/l	UNW-32
beryllium	0.0094	NA	mg/l	UNW-32
beta activity	986.1	50	pCi/l	BRW-25
chromium	0.092	0.05	mg/l	UNP-12
lead	0.56	0.01	mg/l	UNP-12
uranium	0.011	NA	mg/l	UNW-32
pH	10.2	6.5-8.5	NA	BRW-5

Source: MMES, undatedb

* or drinking water standard
NA = Not applicable



Source: Kuhlmeier and Motley, 1987

FIGURE 3–19

K–1070–A MONITORING WELL LOCATIONS AND GROUNDWATER LEVEL CONTOURS ORGDP – OAK RIDGE, TN

TABLE 3-31

PRINCIPAL GROUNDWATER CONTAMINANTS
K-1070-C/D CLASSIFIED BURIAL GROUND
ORGDP - OAK RIDGE, TN

Contaminant	Maximum Detected Value	Maximum Contaminant Level*	Units	Well No.
trichloroethylene	300	5	ug/l	UNW-17
1,1,1-trichloroethane	600	200	ug/l	UNW-17
1,1-dichloroethylene	380	NA	ug/l	UNP-2
tetrachloroethylene	300	NA	ug/l	UNW-17
trans-1,2-dichloroethylene	200	NA	ug/l	UNW-17
vinyl chloride	3	2	ug/l	UNW-17
benzene	2	5	ug/l	UNP-2
alpha activity	15.8	15	pCi/l	UNW-17
beta activity	608.8	50	pCi/l	UNW-17
chromium	0.12	0.05	mg/l	UNW-17
fluoride	1.8	1.4	mg/l	BRW-11
lead	0.12	0.01	mg/l	UNW-17
total coliform	49	1	col/100 ml	UNW-18
uranium	0.010	NA	mg/l	BRW-12
pH	10.7	6.5-8.5	NA	BRW-9

Source: MMES, undatedb

* or drinking water standard
NA = Not applicable

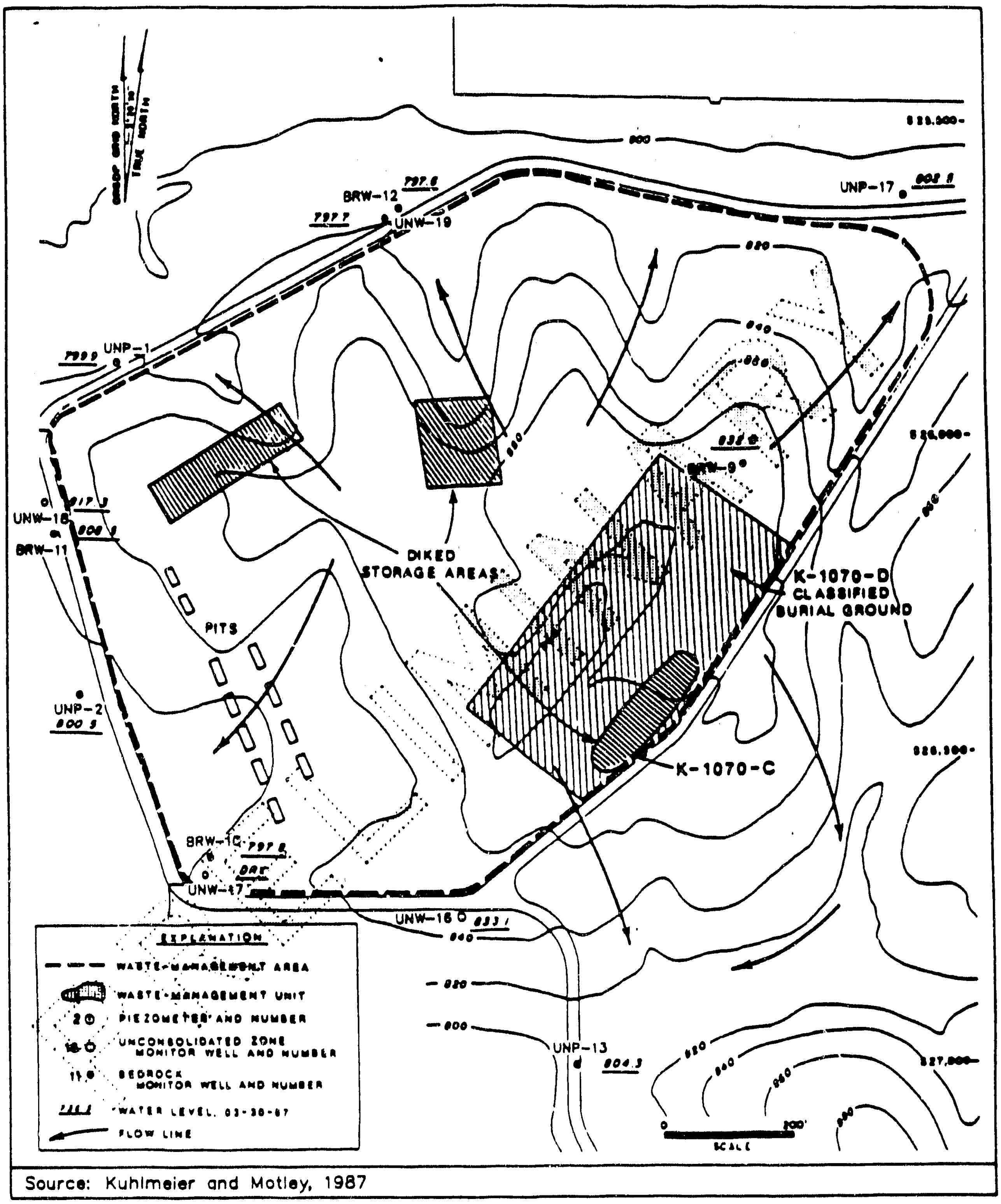


FIGURE 3–20

K–1070–C/D MONITORING WELL LOCATIONS
AND INFERRED GROUNDWATER FLOW DIRECTIONS
ORGDP – OAK RIDGE, TN

d. K-1407-C Retention Basin WAG - The retention basin, which received solids and slurry wastes from the K-1407-B pond, and two soil piles contaminated with radioactivity comprise this source of contaminated groundwater. Monitoring wells at the WAG indicate that contamination consisting of organic solvents, metals, low and high pH, and radioactivity is present. Table 3-32 lists concentrations of the principal contaminants. Figure 3-18 shows monitoring well locations and inferred groundwater flow directions. Details regarding the physical characteristics of the actual and potential sources of contamination are discussed in Finding 4.5.2.3.1.g.

e. K-1413 Treatment Facility and Process Lines - The use of this in-ground concrete tank for neutralization of metal-laden wastes has apparently contributed to groundwater contamination in the form of organic solvents, low pH, and radioactivity. Principal contaminant concentrations are listed in Table 3-33. Monitoring well locations and inferred groundwater flow directions are shown in Figure 3-21. Details regarding the physical characteristics of the actual and potential sources of contamination are discussed in Finding 4.5.2.3.1.h.

f. K-770 Scrap Metal Yard - The storage of demolition debris and process piping during the Cascade Improvement Program/Cascade Upgrade Program (CIP/CUP) has resulted in apparent groundwater contamination at the facility. Monitoring data from wells at the facility indicate that contamination consists primarily of low levels [less than 5 parts per billion (ppb)] of organic solvents, low pH, metals, and radioactivity. Principal contaminant concentrations are listed in Table 3-34. Figure 3-22 shows monitoring well locations and inferred groundwater flow directions. Details regarding the physical characteristics of the actual and potential sources of contamination are discussed in Finding 4.5.2.3.1.b.

g. K-1064 Peninsula Storage and Burn Area - The former use of this area as a disposal site by burning combustible waste oils, paints, solvents, and solids has resulted in contamination of the groundwater. Monitoring well data indicate that contamination principally consisting of organic solvents, PCB (Aroclor-1254), metals, and radioactivity is present at the facility. Table 3-35 lists the principal contaminant concentrations. Figure 3-23 shows monitoring well locations and inferred groundwater flow directions. Details regarding the physical characteristics of the actual and potential sources of contamination are discussed in Finding 4.5.2.3.1.d.

TABLE 3-32

PRINCIPAL GROUNDWATER CONTAMINANTS
K-1407-C RETENTION BASIN WAG
ORGDP - OAK RIDGE, TN

Contaminant	Maximum Detected Value	Maximum Contaminant Level*	Units	Well No.
trichloroethylene	45	5	µg/l	UNW-8
trans-1,2-dichloroethylene	42	NA	µg/l	UNW-9
vinyl chloride	26	2	µg/l	UNW-9
chloroform	7	NA	µg/l	UNW-8
Freon 123	30	NA	µg/l	UNW-8
acetone	67	NA	µg/l	BRW-14
alpha activity	74	15	pCi/l	UNW-8
barium	4.6	1.0	mg/l	UNW-6
beta activity	145	50	pCi/l	UNW-8
boron	0.20	NA	mg/l	UNW-9
cadmium	0.011	0.01	mg/l	UNW-11
chloride	260	250	mg/l	UNW-7
chromium	0.12	0.05	mg/l	UNW-9
fluoride	2.8	1.4	mg/l	UNW-10
lead	0.334	0.01	mg/l	UNW-11
nickel	0.095	NA	mg/l	UNW-9
sodium	380	250	mg/l	UNW-7
sulfate	269	250	mg/l	UNW-9
total coliform	25	1	col/100 ml	BRW-13
uranium	0.19	NA	mg/l	UNW-10
pH	5.6	6.5-8.5	NA	UNW-8
pH	10.0	6.5-8.5	NA	BRW-13

Source: MMES, undatedb

* or drinking water standard
NA = Not applicable

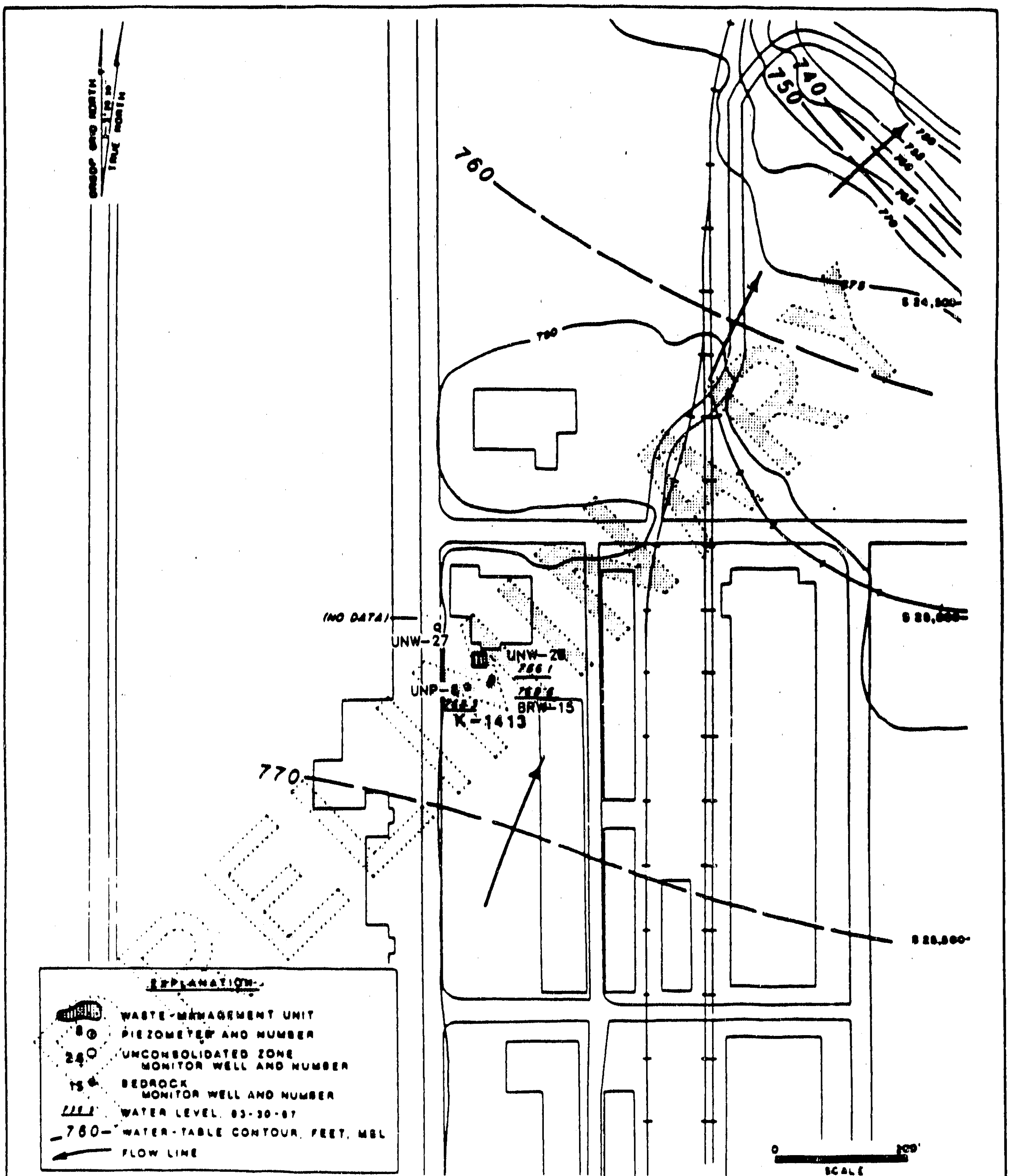
TABLE 3-33

PRINCIPAL GROUNDWATER CONTAMINANTS
K-1413 TREATMENT FACILITY AND PROCESS LINES
ORGDP - OAK RIDGE, TN

Contaminant	Maximum Detected Value	Maximum Contaminant Level*	Units	Well No.
trichloroethylene	3300	5	ug/l	UNW-27
tetrachloroethylene	2	NA	ug/l	UNW-26
trans-1,2-dichloroethylene	110	NA	µg/l	UNW-27
chloroform	11	NA	µg/l	UNW-27
alpha activity	21	15	pCi/l	UNW-26
beta activity	42.1	50	pCi/l	UNW-26
lead	0.17	0.01	mg/l	UNW-27
total coliform	6	1	col/100 ml	UNP-8
pH	5.1	6.5-8.5	NA	UNW-26

Source: MMES, undatedb

* or drinking water standard
NA = Not applicable



Source: Kuhlmeier and Motley, 1987

FIGURE 3-21

K-1413 MONITORING WELL LOCATIONS,
GROUNDWATER TABLE CONTOURS, AND INFERRED FLOW DIRECTIONS
ORGDP - OAK RIDGE, TN

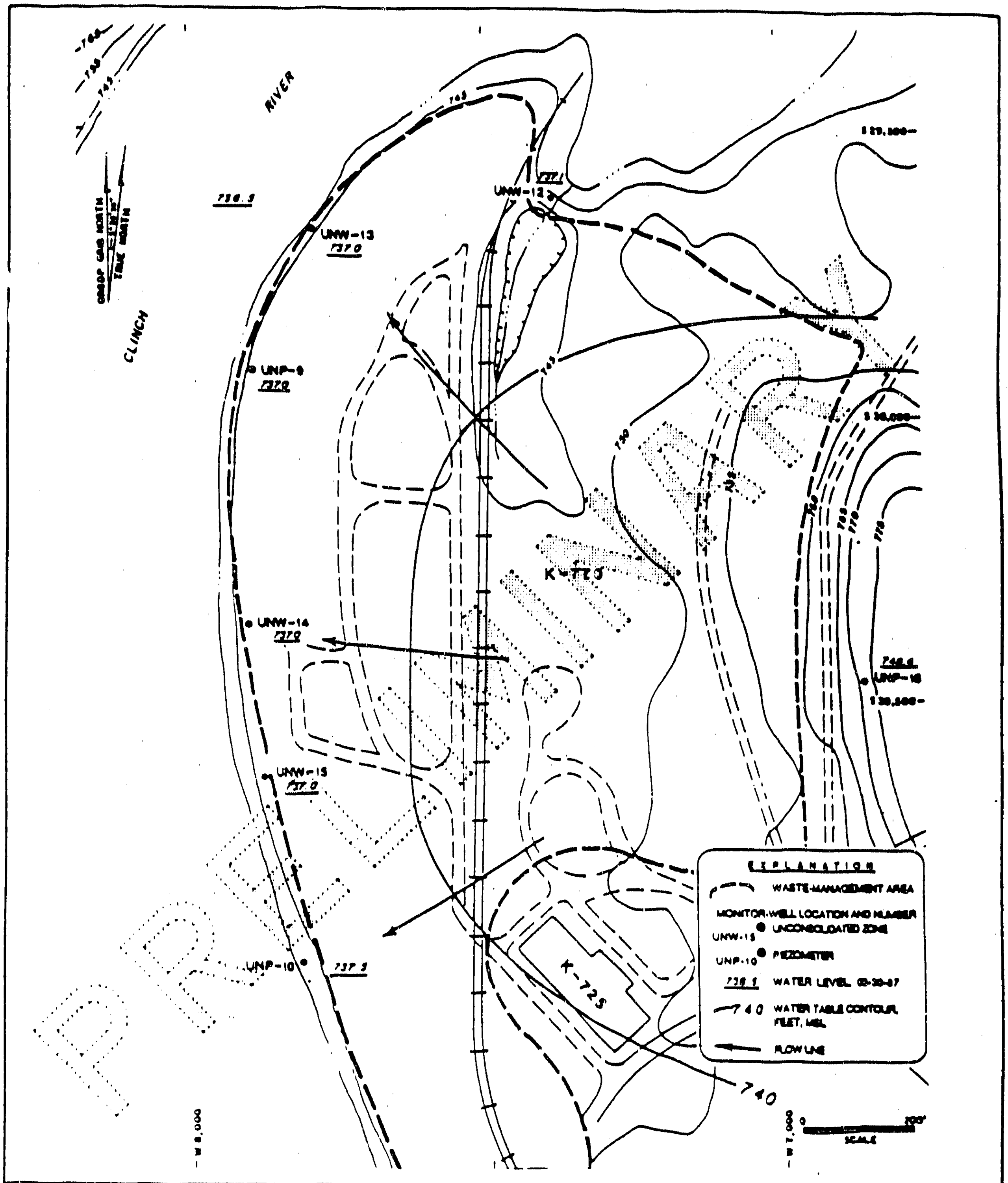
TABLE 3-34

PRINCIPAL GROUNDWATER CONTAMINANTS
K-770 SCRAP METAL YARD
ORGDP - OAK RIDGE, TN

Contaminant	Maximum Detected Value	Maximum Contaminant Level*	Units	Well No.
trichloroethylene	2	5	µg/l	UNP-16
tetrachloroethylene	1	NA	µg/l	UNP-10
alpha activity	19	15	pCi/l	UNW-15
barium	1.6	1.0	mg/l	UNP-10
beta activity	1588	50	pCi/l	UNW-13
cadmium	0.010	0.01	mg/l	UNP-10
chromium	0.19	0.05	mg/l	UNP-10
fluoride	1.4	1.4	mg/l	UNW-12
lead	0.091	0.01	mg/l	UNP-10
total coliform	8	1	col/100 ml	UNW-15
uranium	0.023	NA	mg/l	UNW-15
pH	4.0	6.5-8.5	NA	UNW-13

Source: MMES, undatedb

* or drinking water standard
NA = Not applicable



Source: Kuhlmeier and Motley, 1987

FIGURE 3–22

K–770 MONITORING WELL LOCATIONS, GROUNDWATER TABLE CONTOURS, AND INFERRED FLOW DIRECTIONS ORGDP – OAK RIDGE, TN

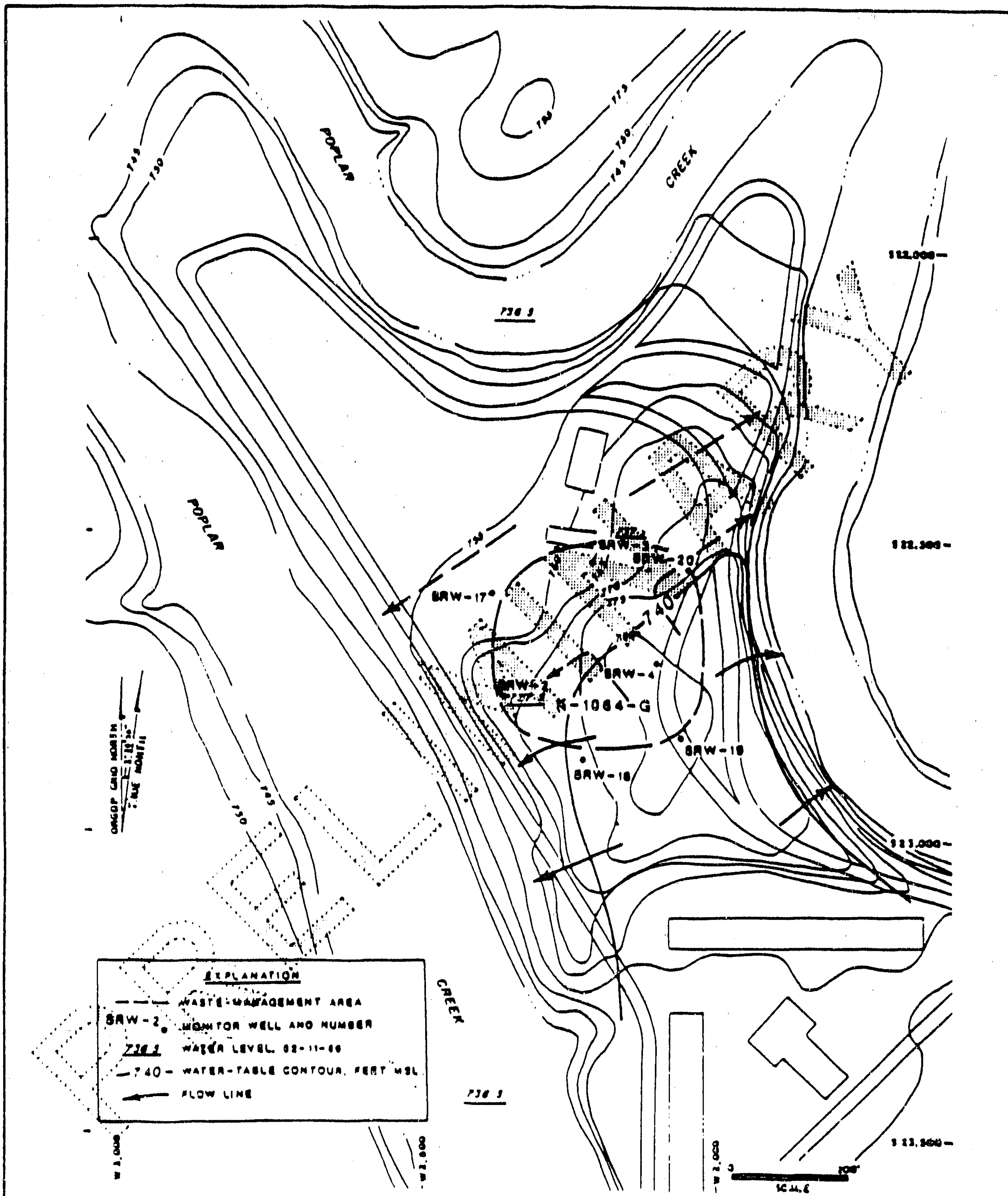
TABLE 3-35

PRINCIPAL GROUNDWATER CONTAMINANTS
K-1064 PENINSULA STORAGE AND BURN AREA
ORGDP - OAK RIDGE, TN

Contaminant	Maximum Detected Value	Maximum Contaminant Level*	Units	Well No.
trichloroethylene	51	5	ug/l	BRW-2
1,1,1-trichloroethane	150	200	ug/l	BRW-18
1,1,2-trichloroethane	24	NA	ug/l	BRW-18
1,1-dichloroethylene	22	7	ug/l	BRW-18
1,1-dichloroethane	48	NA	ug/l	BRW-20
trans-1,2-dichloroethylene	18	NA	ug/l	BRW-3
Freon 113	37	NA	ug/l	BRW-2
PCB (Aroclor-1254)	4.9	NA	ug/l	BRW-3
alpha activity	56	15	pCi/l	BRW-2
arsenic	0.20	0.05	mg/l	BRW-17
beta activity	95	50	pCi/l	BRW-2
boron	4.8	NA	mg/l	BRW-19
fluoride	7.0	1.4	mg/l	BRW-19
total coliform	54	1	col/100 ml	BRW-18
uranium	0.044	NA	mg/l	BRW-18
sodium	780	250	mg/l	BRW-19
sulfate	960	250	mg/l	BRW-19

Source: MMES, undatedb

* or drinking water standard
NA = Not applicable



Source: Kuhlmeier and Motley, 1987

FIGURE 3–23

K–1064 MONITORING WELL LOCATIONS,
GROUNDWATER TABLE CONTOURS, AND INFERRED FLOW DIRECTIONS
ORGDP – OAK RIDGE, TN

h. K-1232 Treatment Facility - Three concrete in-ground storage tanks at this treatment facility have apparently leaked contaminants to the groundwater. Monitoring well data indicate that contamination consisting primarily of organic solvents, metals, high and low pH, and radioactivity is present. Table 3-36 lists the principal contaminant concentrations. Figure 3-24 shows monitoring well locations and inferred groundwater flow directions. Details regarding the physical characteristics of the actual and potential sources of contamination are discussed in Finding 4.5.2.3.1.j.

i. K-1414 Leaking Underground Fuel Tank - A leaking underground diesel fuel storage tank has contributed to groundwater contamination at the facility. Soil samples collected from investigation borings indicate principal contaminants to be benzene, toluene, and related aromatic hydrocarbons. Groundwater has not been sampled at the facility. Table 3-37 lists the principal contaminants in the soil samples collected during the subsurface investigation. Figure 3-25 shows the locations of the soil borings and groundwater monitoring wells at the facility. Details regarding the physical characteristics of the actual and potential sources of contamination are discussed in Finding 4.5.2.3.1.i.

j. K-1070-F Old Contractors Burial Ground - This area of the plant was used as a burial ground for construction debris for several years. Although intended for inert materials only, other wastes may have been disposed of there. In addition, the K-900 bottle smasher has been operated near the center of the facility for disposing of explosive chemicals. Monitoring well data indicate that groundwater contamination consists of organic solvents, metals, high pH, and radioactivity elevated above background levels. Table 3-38 lists the principal contaminant concentrations. Figure 3-26 shows monitoring well locations, groundwater contours, and inferred flow directions. Details regarding the physical characteristics of the actual and potential sources of contamination are discussed in Finding 4.5.2.3.1.m.

k. K-1085 Old Firehouse Burn Area - The former disposal of paints, oils, and other liquid wastes by burning in an area near the location of the former firehouse has apparently contaminated the groundwater. Monitoring well data indicate the principal contaminants to be organic solvents, metals, and radioactivity. Table 3-39 lists the principal contaminant concentrations. Figure 3-27 shows the monitoring well locations and inferred groundwater flow paths. Details regarding the physical characteristics of the actual and potential sources of contamination are discussed in Finding 4.5.2.3.1.n.

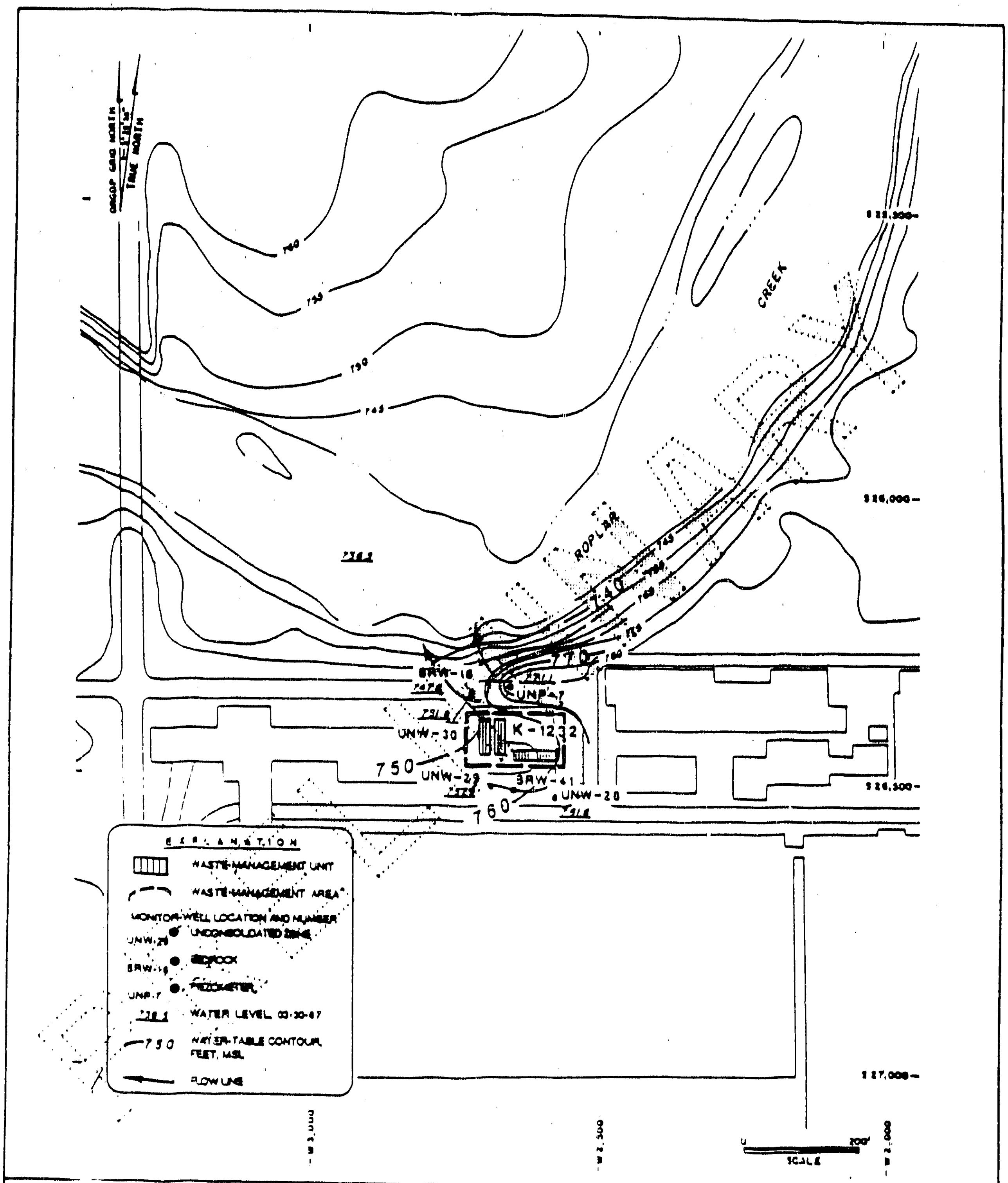
TABLE 3-36

PRINCIPAL GROUNDWATER CONTAMINANTS
K-1232 TREATMENT FACILITY
ORGDP - OAK RIDGE, TN

Contaminant	Maximum Detected Value	Maximum Contaminant Level*	Units	Well No.
trichloroethylene	88	5	µg/l	UNW-29
1,1,1-trichloroethane	24	200	µg/l	UNW-30
tetrachloroethylene	3	NA	µg/l	UNW-28
vinyl chloride	3	2	µg/l	BRW-16
alpha activity	13.2	15	pCi/l	UNP-7
beta activity	80.1	50	pCi/l	UNW-28
chromium	0.067	0.05	mg/l	UNW-28
fluoride	11.5	1.4	mg/l	UNW-30
lead	0.47	0.01	mg/l	UNP-7
mercury	0.0015	0.002	mg/l	UNP-7
total coliform	64	1	col/100 ml	UNW-29
uranium	0.014	NA	mg/l	UNP-7
pH	5.0	6.5-8.5	NA	UNW-28
pH	11.7	6.5-8.5	NA	UNW-30

Source: MMES, undatedb

* or drinking water standard
NA = Not applicable



Source: Geraghty and Miller, Inc., 1988

FIGURE 3-24

K-1232 MONITORING WELL LOCATIONS,
GROUNDWATER TABLE CONTOURS, AND INFERRED FLOW DIRECTIONS
ORGDP - OAK RIDGE, TN

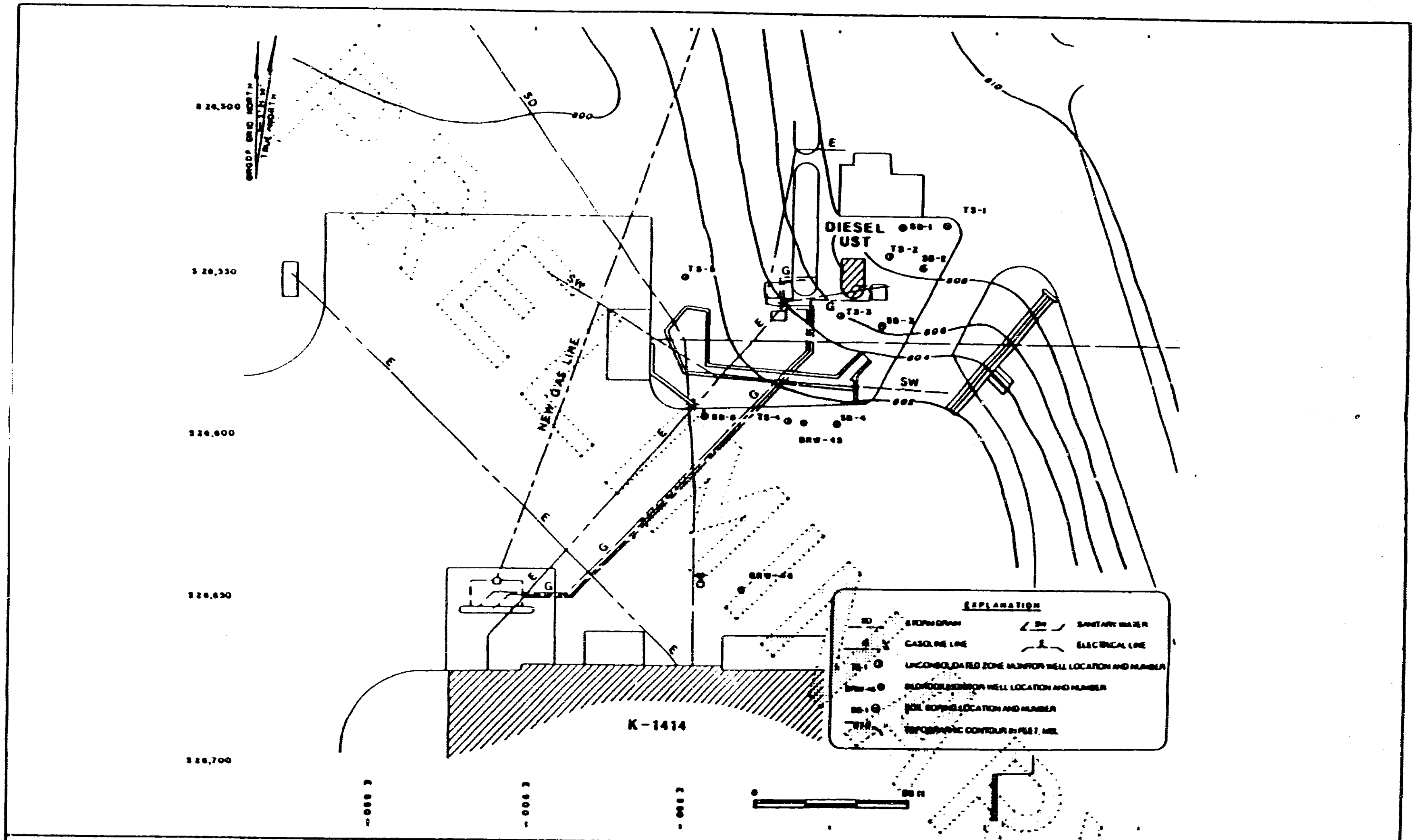
TABLE 3-37

PRINCIPAL GROUNDWATER CONTAMINANTS
K-1414 LEAKING UNDERGROUND FUEL TANK
ORGDP - OAK RIDGE, TN

Contaminant	Maximum Detected Value	Maximum Contaminant Level*	Units	Well No.
benzene	550	5	µg/kg	TS-3
chlorobenzene	520	NA	µg/kg	TS-3
ethylbenzene	6100	NA	µg/kg	TS-3
toluene	1600	NA	µg/kg	TS-3
naphthalene	6.1	NA	µg/g	TS-3
phenanthrene	5.5	NA	µg/g	TS-3

Source: MMES, undatedb

* or drinking water standard
NA = Not applicable



Source: Motley, 1988a

FIGURE 3–25

K–1414 SOIL BORING AND MONITORING WELL LOCATIONS
ORGDP – OAK RIDGE, TN

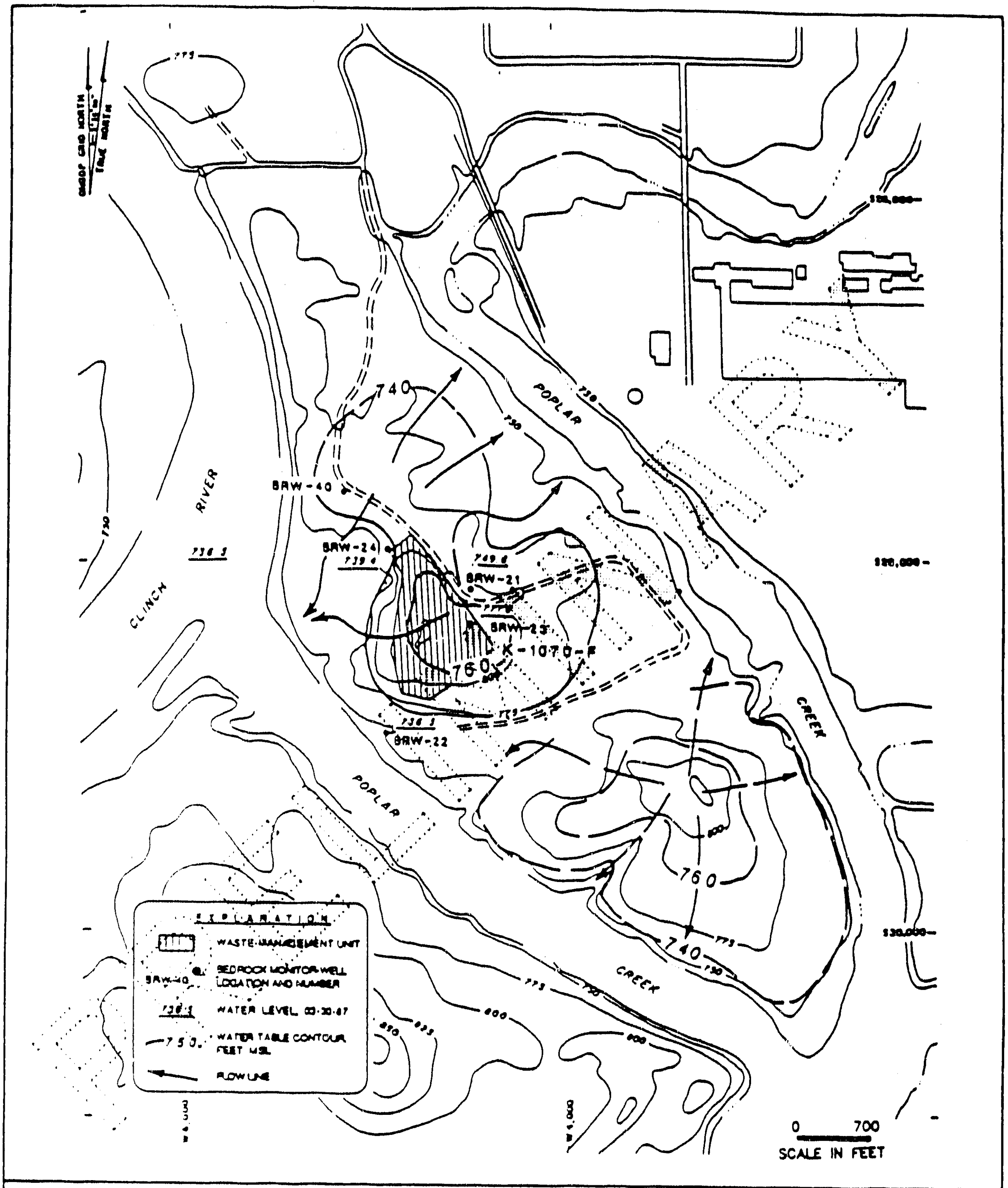
TABLE 3-38

PRINCIPAL GROUNDWATER CONTAMINANTS
K-1070-F OLD CONTRACTORS BURIAL GROUND
ORGDP - OAK RIDGE, TN

Contaminant	Maximum Detected Value	Maximum Contaminant Level*	Units	Well No.
trichloroethylene	10	5	µg/l	BRW-21
acetone	43	NA	µg/l	BRW-23
alpha activity	4	15	pCi/l	BRW-23
beta activity	34	50	pCi/l	BRW-21
boron	2.3	NA	mg/l	BRW-23
lead	0.106	0.01	mg/l	BRW-23
total coliform	15	1	col/100 ml	BRW-21
uranium	0.011	NA	mg/l	BRW-23
pH	9.9	6.5-8.5	NA	BRW-21

Source: MMES, undatedb

* or drinking water standard
NA = Not applicable



Source: Geraghty and Miller, Inc., 1988

FIGURE 3–26

K–1070–F MONITORING WELL LOCATIONS, GROUNDWATER TABLE CONTOURS, AND INFERRED FLOW DIRECTIONS ORGDP – OAK RIDGE, TN

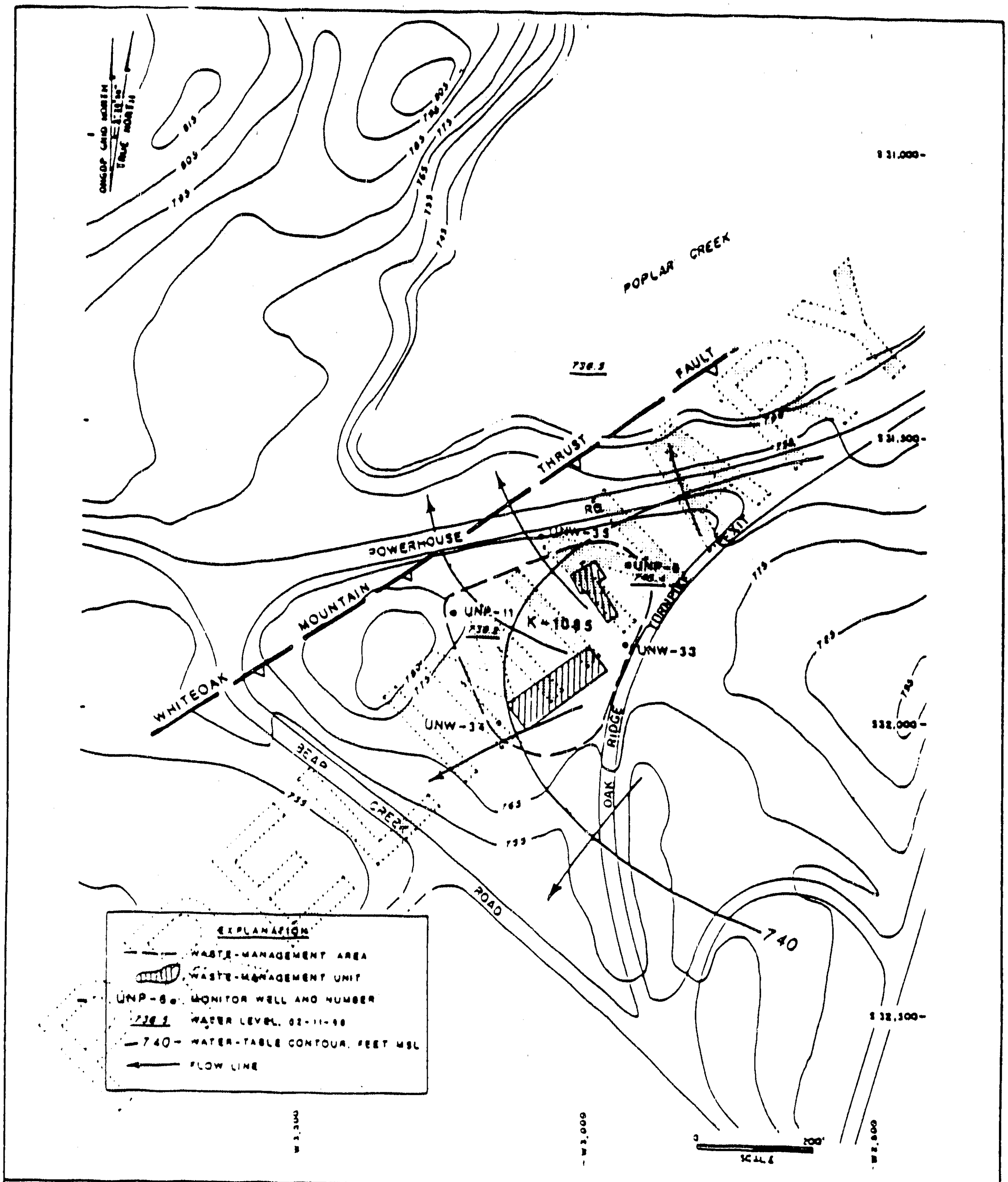
TABLE 3-39

PRINCIPAL GROUNDWATER CONTAMINANTS
K-1085 OLD FIREHOUSE BURN AREA
ORGDP - OAK RIDGE, TN

Contaminant	Maximum Detected Value	Maximum Contaminant Level*	Units	Well No.
trichloroethylene	8	5	µg/l	UNW-34
tetrachloroethylene	1	NA	µg/l	UNW-33
alpha activity	70	15	pCi/l	UNP-6
arsenic	0.059	0.05	mg/l	UNP-11
barium	1.3	1.0	mg/l	UNP-6
beta activity	102	50	pCi/l	UNP-11
beryllium	0.029	NA	mg/l	UNP-6
chromium	0.025	0.05	mg/l	UNW-35
lead	0.045	0.01	mg/l	UNP-6
total coliform	6	1	col/100 ml	UNW-33
uranium	0.019	NA	mg/l	UNP-6

Source: MMES, undatedb

* or drinking water standard
NA = Not applicable



Source: Geraghty and Miller, Inc., 1988

FIGURE 3–27

K–1085 MONITORING WELL LOCATIONS, GROUNDWATER TABLE CONTOURS, AND INFERRED FLOW DIRECTIONS ORGDP – OAK RIDGE, TN

1. K-1099 Blair Road Quarry - The use of the quarry to dispose of radioactively contaminated paper and wood has apparently contaminated the groundwater. Monitoring well data from the one well at the facility indicate that radioactivity and uranium are present above background levels, with alpha activity above drinking water standards. Table 3-40 lists the concentrations of the principal contaminants at the quarry. Details regarding the physical characteristics of the actual and potential sources of contamination are discussed in Finding 4.5.2.3.1.o.

2. Inadequacies in the present groundwater monitoring system. So far, investigation of the spatial extent--horizontally and vertically--of the concentration of contaminants associated with specific facilities has not been performed. The facility assessment investigations in progress at ORGDP have, up to the present, concentrated on establishing the groundwater vertical gradient and hydraulic conductivity, and the presence and constituents of the groundwater contamination at or adjacent to the physical borders of the waste disposal cells or in a ring encircling the facilities. The facilities and WAGS listed in Finding 3.4.4.3.1, all of which have contamination associated with them, have not been investigated beyond the nearby monitoring wells used for their initial assessment. In some instances, there are no upgradient monitoring wells or so-called background monitoring wells that are being sampled. Of these, some of the wells have been installed, but not monitored (see Finding 3.4.4.4.1.f). At other facilities, it appears that some of the monitoring wells intended for background monitoring data are contaminated, possibly by either the facility they are intended to be monitoring or by other upgradient sources that are presently unidentified. The facilities with apparently contaminated upgradient background wells include K-1407-B wells UNW-1 and UNW-25; K-1070-A well BRW-5; K-1413 wells UNP-8, UNW-26, and BRW-15; K-770 well UNP-16; K-1232 wells UNW-28 and UNW-29; and K-1085 well UNW-33. In the areas of known contamination, further areal characterization of contaminant plume direction and concentration has not been performed beyond sampling monitoring wells at or near the facility limits. These deficiencies in the groundwater monitoring system may result in potential undetected groundwater contamination.

TABLE 3-40

PRINCIPAL GROUNDWATER CONTAMINANTS
K-1099 BLAIR ROAD QUARRY
ORGDP - OAK RIDGE, TN

Contaminant	Maximum Detected Value	Maximum Contaminant Level*	Units	Well No.
alpha activity	36	15	pCi/l	BRW-1
beta activity	36	50	pCi/l	BRW-1
total coliform	7	1	col/100 ml	BRW-1
uranium	0.021	NA	mg/l	BRW-1

Source: MMES, undatedb

* or drinking water standard
NA = Not applicable

3.4.4.4 Category IV

1. Groundwater monitoring program deficiencies. The following inadequacies in monitoring well construction and in well sampling procedures may limit the validity and utility of some groundwater monitoring data:

   a. Monitoring wells completed below-grade in roads and parking areas are subject to vandalism due to non-lockable covers, and to misidentification due to lack of permanent identification labels. In addition, these wells may be contaminated from surface runoff leaking into the casing by way of the unsealed manhole covers on the Kristi box.

   b. The Survey team observed a sampler commence sampling before the indicator parameters (pH, temperature, and specific conductivity) stabilized. This could result in nonrepresentative samples. Best industry practice prescribes purging three to five well volumes or until the indicator parameters stabilize, whichever takes longer.

   c. During sampling, the Survey team observed the sampler cover the bailer inlet with a gloved hand in order to pour the sample into bottles. The sampler handled a hand-held windlass with that same gloved hand. Cross-contamination may occur as a result of this handling.

   d. ORGDP guidelines require that groundwater samples with beta concentrations greater than 50 pCi/l be analyzed to determine the specific beta emitters. Groundwater samples with beta radioactivity greater than 50 pCi/l have been archived for further analysis but no analysis has been completed. Facilities with groundwater sample analyses in excess of 50 pCi/l include K-770, K-1064, K-1070-A, K-1070-C/D, K-1407-B, K-1407-C, and K-1232.

   e. PVC construction materials used for some wells (UNW-1 through 11, BRW-1 through 9, UNP-1 through 17) may affect the results for organics. PVC is known to deteriorate when in contact with ketones, esters, and aromatic hydrocarbons. In addition, PVC may adsorb and leach constituents that may affect the quality of groundwater samples. Use of PVC in well construction at ORGDP was discontinued in 1985.

f. Wells BRW-40, BRW-41, and BRW-29, installed in July-August 1987, have not been sampled. These wells are background for the K-1070-F, K-1232, and K-1064 areas. Without background data from these wells, the current monitoring data for these areas will be less useful because statistical evaluation of contamination cannot be performed relative to a background well.

4.0 NON-MEDIA-SPECIFIC FINDINGS AND OBSERVATIONS

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

The section on Oak Ridge Gaseous Diffusion Plant (ORGDP) waste management describes sources of wastes; handling procedures for wastes; treatment, storage, and disposal (TSD) areas for wastes; and regulatory concerns regarding waste management. Issues relating to decontamination and decommissioning (D&D) of the production facilities are discussed in Section 4.1.1.2 of the Pollution Sources and Controls section. Findings related to waste management are described in Section 4.1.2. The wastes evaluated include hazardous, radioactive, polychlorinated biphenyl (PCB), mixed (radioactive plus hazardous and/or PCB), and solid (nonradioactive and nonhazardous) wastes.

U.S. Department of Energy (DOE) Order 5480.2, titled Hazardous and Radioactive Waste Management, issued December 13, 1982 (rescinded October 5, 1987, but still serving as guidance), and DOE Order 5820.2, titled Radioactive Waste Management, issued December 6, 1984, are the principal DOE orders used in evaluating waste management at DOE sites. The Resource Conservation and Recovery Act (RCRA) of 1976, the 1984 RCRA amendments, and associated regulations issued by the U.S. Environmental Protection Agency (EPA) establish the standards used by the Survey for evaluating hazardous and mixed waste handling facilities. Tennessee hazardous waste regulations are similar to those of EPA and since Tennessee has RCRA primacy, the state serves as the hazardous waste regulatory agency for ORGDP. Solid waste regulations of Tennessee regulate solid waste facilities of ORGDP. "Good Management" techniques, which are practices not specifically required by regulation or DOE orders, are also used by the Survey when appropriate.

4.1.1 General Description of Pollution Sources and Controls

4.1.1.1 Hazardous Waste Management*

ORGDP was built in 1945 for production of enriched uranium (enriched in the uranium-235 isotope) for use in defense and later civilian nuclear power plant applications. Until recently, ORGDP produced enriched uranium from a pre-enriched feedstock using uranium hexafluoride (UF_6) enriched to approximately 3 percent uranium-235. In September 1985, ORGDP production facilities were placed in a "ready-standby" mode because of excess world-wide capacity for production of enriched uranium. In December 1987, the production facilities were officially placed in a shutdown mode.

Two experimental uranium isotope separation processes were also operated at ORGDP. These were the Atomic Vapor Laser Isotope Separation (AVLIS) Process, and the Gas Centrifuge Separation Process (GCEP). Both processes have been shut down. Wastes generated by the shutdown of these facilities as well as wastes that will be generated by the D&D of production facilities will be discussed in Section 4.1.1.2.

Despite the shutdown of production facilities, previously accumulated and stored hazardous low-level and mixed waste will continue to be managed on-site. Also, four ongoing activities will continue to generate hazardous, radioactive, mixed (radioactive/hazardous, PCB/radioactive), and solid wastes. In addition, the ORGDP process buildings will be utilized for the secure long-term storage of radioactive and mixed waste generated by DOE Oak Ridge Operations Office (DOE/ORO) facilities [Oak Ridge National Laboratory (ORNL), Y-12 Plant, Portsmouth Gaseous Diffusion Plant (PORTS), Paducah Gaseous Diffusion Plant (PGDP), Feed Materials Production Center, Fernald (FMPC), and RMI Extrusion Plant (RMI)] for which disposal options do not presently exist or which will be incinerated at the K-1435 Incinerator. A second waste management function of ORGDP will be incineration of radioactive, mixed, and PCB wastes at the Toxic Substances Control Act/RCRA (TSCA/RCRA) incinerator, generated by ORO facilities.

Ongoing ORGDP activities that will generate wastes are described as follows:

- D&D activities will result in the generation of a variety of wastes ranging from radioactive, asbestos, and PCB wastes from the process building to liquids and solids at the K-1420 Decontamination Facility from the decontamination of process equipment and scrap.

- Laboratory operations will generate a variety of acids, bases, solvents, discarded chemicals, and sample wastes.

- Utilities required for continuing of ongoing operations will generate wastes, such as ash.

- Maintenance activities for utilities, D&D activities, and the operation of waste management activities will generate waste such as oils, solvents, incinerator ash, and mixed waste sludges.

Table 4-1 describes by category the types and quantities of wastes managed by ORGDP during fiscal years (FY) 1985 and 1986. Table 4-2 describes in greater detail, by quarter, the types and quantities of wastes managed at ORGDP, including wastes received from off-site DOE facilities for treatment, incineration, or storage at ORGDP facilities.

Waste Accumulation Areas

Hazardous, radioactive, mixed wastes, PCB, and solid wastes are generated at ORGDP at a variety of sites. This results in a need for temporary (less than 90-day) storage areas called Waste Accumulation Areas (WAAs) in which wastes are temporarily stored prior to pickup and transportation to the appropriate TSD facility. RCRA permits are not required for WAAs storing hazardous wastes. However, where hazardous wastes are accumulated, certain RCRA regulations are applicable, including, among others, requirements for separation of incompatible wastes, labeling containers holding hazardous wastes, recording accumulation start dates on each container, and not exceeding the 90-day storage limit. Regulatory requirements, applicable to permitted (greater than 90-day) hazardous waste storage areas such as impermeable surfaces, and secondary containment do not apply to WAAs. However, it is a good management practice to comply with such requirements, given that the nature of the hazardous waste is similar whether stored in WAAs or permitted storage areas, and that these WAAs also frequently contain liquid, radioactive and/or mixed wastes.

Eleven WAAs were observed by the Survey team. Several deficiencies regarding WAAs were noted during the Survey. These included the lack of secondary containment, permeable surfaces, the condition of containers, and leaks as evidenced by stains. Finding 4.1.2.4.1 describes these observations in detail.

TABLE 4-1

SOLID WASTES GENERATED
ORGDP - OAK RIDGE, TN

Waste Category	Radioactive	Hazardous	Weight (lb) FY1985	Weight (lb) FY1986
Scrap Metal			1,827,002	1,376,982
Scrap Metal	X		916,947	744,960
Chemicals		X	656,079	4,763,322
Chemicals	X	X	1,081,799	4,621,299
Sanitary			1,395,512	1,562,973
Sanitary	X		12,650	67,392
Demolition			1,098,750	672,000
Demolition	X		366,250	165,000
Classified			249,429	274,325
Fly Ash			1,440,000	1,584,000
Solvents and Oils	X	X	1,065,296	343,000

Source: Goillher, 1987

FY - Fiscal Year

TABLE 4-2

SOLID WASTES MANAGED
ORGDP - OAK RIDGE, TN

Material Category	Units	1st Quarter 1986	2nd Quarter 1986	3rd Quarter 1986	4th Quarter 1986	1st Quarter 1987	2nd Quarter 1987	3rd Quarter 1987	4th Quarter 1987	1st Quarter 1988
A - Chemicals	lb	5,442	5,126	3,883	1,380	528	38	19	236	8214
AA - Sludge from treatment of Y-12 wastes at K-25	lb	107,775	63,707	9,588	39,757					
AB - Sludge from treatment of Y-12 wastes at Y-12	lb	22,673	27,681	38,337	45,026					
AC - K-25 Low-Level Waste	drums									
AD - Spill Cleanup	tons		17.5	938			5			
AE - BMP Laboratory Wastes	gal		650	1,400	1,050	500				2,350
AF - Photographic Solutions (Recycle)	gal						110			50
AG - Aerosol Cans	lb			40		275				
AH - Incinerator Ash from K-1435	drums									76
AJ - Y-12 Mixed Waste	drums									
AK - Sludge from K-1407 B/C Pond	drums									1,635
B - Solvents, Paints, Bulk Organics	gal		4,732	481	850		9.5	1,301		3,430
C - Oils	gal	1,648	7,453	669	161	3,980	1			6,365
D - Nonhazardous, Unclassified Non-radioactive Scrap Metal	tons	7.14	86.2	226	3.9	222	309	114	178	22
E - Nonhazardous, Unclassified Radioactive Scrap Metal	tons	29.2	49.2	32	21	25	28	13	30	40
F - Salvage Sales	lb	8,015	29,585	18,750	22,220	17,270	18,460	31,694	5,953	22,800

TABLE 4-2
SOLID WASTES MANAGED
ORGDP - OAK RIDGE, TN
PAGE TWO

Material Category	Units	1st Quarter 1986	2nd Quarter 1986	3rd Quarter 1986	4th Quarter 1986	1st Quarter 1987	2nd Quarter 1987	3rd Quarter 1987	4th Quarter 1987	1st Quarter 1988
G - Sanitary Nonhazardous, Nonradioactive, Unclassified (Including wood, paper, etc.)	tons	113	126	83	1,320	116	145	142	140	99
H - Sanitary, Nonhazardous, Unclassified, Radioactive (Including wood, paper, sweepings, comp , [illegible]	tons	0.9	1.3	1.4	3.3	14	5.3	5.0	2.0	134
I - Asbestos	ft^2			90	240		13	840		1,056
J - Demolition/Construction Debris	yd^3	120	14	48	50	26	19	14	20	
K - PCB Liquids	gal									4,705
L - PCB Solids	lb	75	1,000	1,936	31,880					7,493
M - Sludge	gal									
N - Classified Solids	ft^3	3,934	2,959	455	77	8,485	8,068	3,368	1,893	1,814
O - Classified Liquids	gal									
OA - PGDP	drums									
OC - PORTS	drums									
OE - Fernald	drums									
OG - RMI	drums									
P - Glass and Plastic	lb	1,407	3,250	4,328	1,400	5,280	3,750	2,050	12,820	17,750

TABLE 4-2
SOLID WASTES MANAGED
ORGDP - OAK RIDGE, TN
PAGE THREE

Material Category	Units	1st Quarter 1986	2nd Quarter 1986	3rd Quarter 1986	4th Quarter 1986	1st Quarter 1987	2nd Quarter 1987	3rd Quarter 1987	4th Quarter 1987	1st Quarter 1988
Q - Gases	lb	68	30	22			44		35	210
R - X-10 Low-Level Waste	drums									
S - Y-12 Low-Level Waste	box	4.89								
T - Coal Pile Runoff and K-1501 Blowdown	Mgal	4.89	5.4	5.3	10	10	7			8.4
U - Fly Ash	tons	270	7.6	100	65	212	195		6.4	192
V - Waste Minimization	lb	830	130	30		23,592	1,570	680		3,000
W - Water	gal	200	6,100	7,507			24,000	1,000	1,000	4,650
X - Waste Received at K-1232 from Y-12	gal	160,502	125,252	73,100	52,914	72,339	14,562			
Y - K-1232 Discharge to K-1203	gal	75,700	17,015							
Z - K-1232 Treated Waste Returned to Y-12	gal	84,802	169,844	73,100	38,858	72,339	14,562			

Source: Goillher, 1987; Jackson, 1988

Note: Blanks indicate no wastes of that category handled during that period.

BMP - Best Management Plan
lb - pound(s)
drums - 55-gallon drums
ft^2 - square feet
gal - gallon(s)
yd^3 - cubic yard(s)
Mgal - million gallons

ORGDP RCRA Facilities

The ORGDP has 21 RCRA waste management facilities which are utilized not only for hazardous, but also for radioactive mixed, and PCB wastes. These include storage, treatment, and incineration facilities, and also surface impoundments currently being closed out. Most facilities including the storage areas and the TSCA/RCRA incinerator will be used for the ongoing treatment, storage, and/or incineration of hazardous, radioactive, and mixed wastes generated by other DOE facilities (PORTS, ORNL, Y-12, PGDP, RMI). These RCRA facilities will handle hazardous, radioactive, and mixed waste (PCB and/or hazardous and radioactive). Following is a list and a description of these facilities.

- K-1435 TSCA-RCRA Incinerator
- K-1420-A Flammable Waste Storage Tank
- K-1419 Sludge Fixation Plant
- K-1417 Costing and Storage Area
- K-1407-H Central Neutralization Facilities
- K-1232 Treatment Unit
- K-1413 Treatment Tank
- K-900 Thermal Treatment/Bottle Smasher Unit
- K-1407-A Neutralization Facility
- K-1407-B Holding Pond
- K-1407-C Sludge Retention Basin
- K-1425 Waste Oil/Hazardous Waste/PCB Storage Area
- K-301-1 Vault 4, Hazardous Waste Storage Facility
- K-306-1 Vault 23A Hazardous Waste Storage Facility
- K-311-1 Radiogenic Level Storage Vault
- K-1305-A Satellite Drum Storage Area
- K-1302 Gas Cylinder Storage Unit
- K-711 Mixed Waste Storage
- K-1025-C Container Storage
- K-305 Vault 19 and 19B Hazardous Waste Storage

K-1435 TSCA/RCRA Incinerator

The K-1435 TSCA/RCRA Incinerator is used to incinerate solid and liquid wastes containing PCBs, mixed waste, and hazardous waste generated by ORGDP and other DOE facilities. These facilities include: ORGDP, Y-12 Plant, ORNL, PGDP, PORTS, FMPC, and RMI.

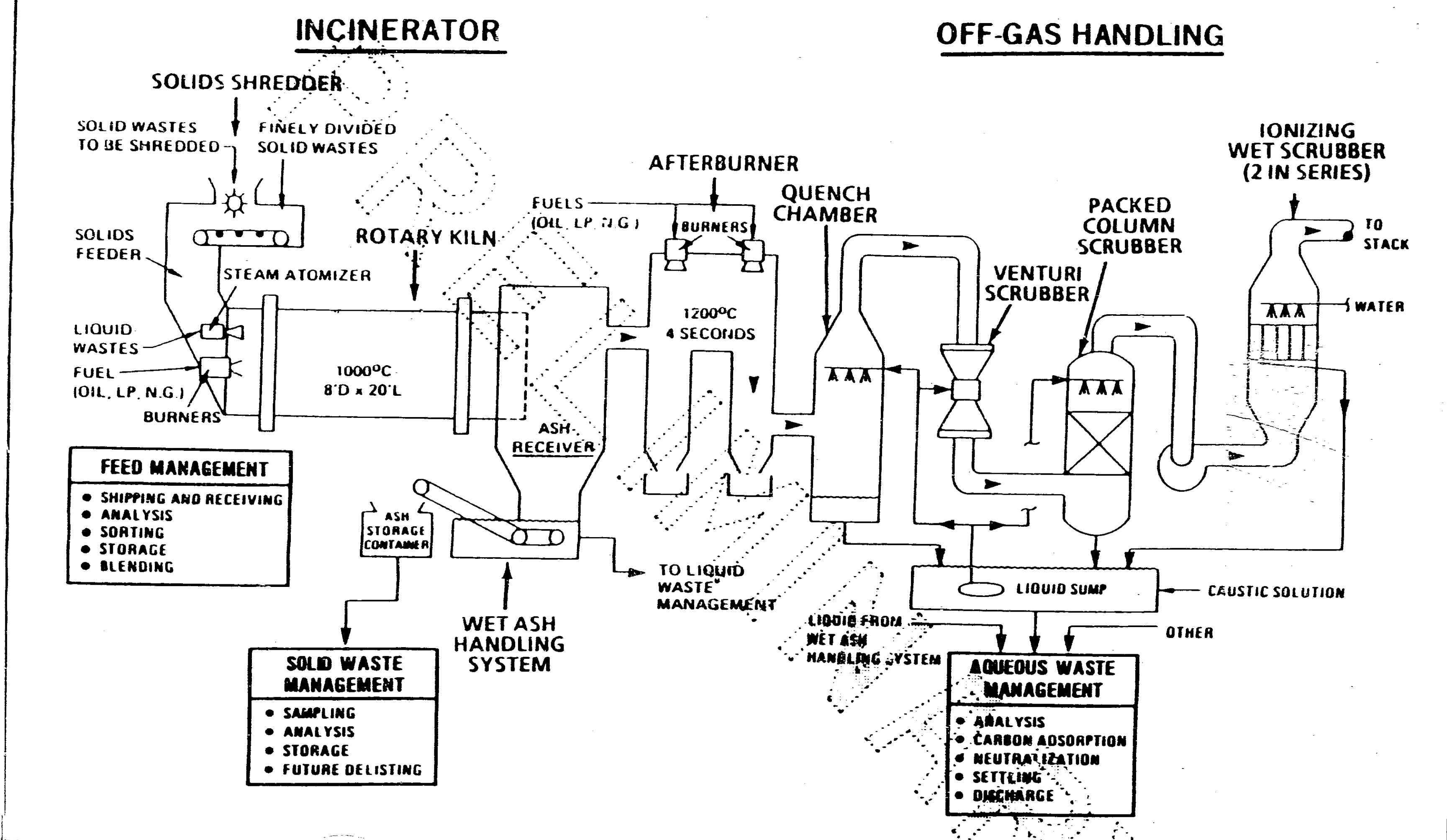
Five permits are required for the incinerator. These are:

- RCRA Hazardous Waste Permit
- TSCA PCB Waste Incineration Permit
- National Emission Standards for Hazardous Air Pollutants (NESHAP) Radionuclide Stack Emission Permit
- Air Permits
- National Pollutant Discharge Elimination System (NPDES) Wastewater Discharge Permit.

ORGDP has obtained the required permits. The RCRA and TSCA permits are conditional pending successful trial burns.

Three major categories of waste will be burned in the incinerator: solids, liquids, and sludges. Solid materials include PCB electrical items, contaminated soil and concrete, absorbents, rags, paper, animal bedding and animal carcasses, metal and fiber containers, and wooden pallets. Liquids include various hydrocarbon and synthetic oils, halogenated and nonhalogenated solvents, PCB fluids drained from electrical components, and water having organic chemical contamination. Sludges include high-viscosity, high-solids materials, such as paint sludge, degreaser residues, solids precipitated during wastewater treatment, and grease and oil sludges. Many of these wastes are contaminated with low levels of radioactivity. Uranium is the predominant radionuclide, but in all, 12 different radionuclides have been identified in the waste streams.

The TSCA Incinerator was manufactured by International Waste Systems. It consists of liquid, solid and sludge waste feed systems, a rotary kiln incinerator, and a secondary combustion chamber (SCC). Components of the system include a rotary kiln with liquid injection burners firing into the kiln, a mixing chamber, an SCC, a water spray quench column, a venturi scrubber, a packed-column acid gas absorber, followed by an ionizing wet scrubber and induced draft fan, and an exit stack. Figure 4-1 outlines the incinerator system.



Source: Adapted from Ambrose, 1986

FIGURE 4–1

TSCA INCINERATOR
ORGDP – OAK RIDGE, TN

Air emissions from the incinerator are cleaned by several devices in the off-gas cleaning system. Combustion gases from the incinerator are cooled to approximately 160°F to 200°F (71°C to 93°C) in the quench chamber with fresh water and a recycle water system. Exit gases from the quench chamber are routed to an automatic variable-throat venturi scrubber for particulate removal. The venturi scrubber has a Chevron demister on the outlet section to remove entrained liquids. Hydrochloric acid is removed from gases exiting the venturi scrubber in a packed-bed absorber. From the absorber, gases go to the ionizing wet scrubber (IWS) system for removal of sub-micron particulate matter. The IWS provides cross-flow contact of the flue gases with recycled scrub solution. The IWS consists of an ionizer module, where particulates are electrically charged by corona discharge electrodes and a charged particle scrubber where particulate matter is collected on a wetted surface. Scrub solutions are recycled to minimize liquid blowdown from the off-gas cleaning system.

Two trial burns were planned to be conducted during the second quarter 1988, one for TSCA and one for RCRA, after the conclusion of the Survey. During the trial burns, waste input and off-gases are to be monitored to ensure that the appropriate destruction removal efficiencies (DREs) were attained (99.9999 for TSCA and 99.99 for RCRA). The trial burns are also to established waste feed rates.

Ash is discharged from the rotary kiln into a flooded ash pit and moved by a drop conveyor to a discharge bin. Ash from the off-gas cleaning system is collected in a drum. Since the incinerator burns listed wastes, including waste subject to the land ban, any wastes produced by the incinerator (including emission scrubbing wastes) will have to meet standards being promulgated in the land ban regulations prior to being land-disposed. In addition, when listed hazardous wastes are incinerated, the ashes are considered hazardous, under the "RCRA derived from rule," until delisted. ORGDP intends to submit the required data for delisting the ashes when the facility is in routine operation and the required data are obtained from analysis and characterization of the ashes. Until the delisting petition is granted, the incinerator ash [generation rate estimated at 35,000 cubic feet per year (ft^3/yr) (991 m^3/yr)] will be considered a hazardous waste, since it contains radionuclides, a mixed waste.

If the delisting petition is successful, disposal problems for the ash will be significantly reduced. It can then be handled solely as a low-level waste. If the delisting petition is not successful, disposal options will not exist since mixed waste disposal sites are not currently available. In such a case, ORGDP may be potentially required to solidify the ash for long-term storage, which would result in much larger costs for ash disposal.

Bulk solids, including drums, are handled via the drum handling system and the shredder. The drum handling system receives, transports, opens, and dumps drums and then forwards all solid waste materials including the drum to the shredder feeder hopper. There are two drum handling units, each with liquid drain tanks to collect PCB and non-PCB liquids from each unit.

The shredder system receives, shreds, and discharges solid waste including drums, wooden pallets, capacitor units, scrap metal, and other refuse such as gloves, shoes, plastic, and clothing. Shredded material is reduced to 2-inch (5.0-cm) wide strips or coils, with an average bulk density of 60 pounds per cubic foot (lb/ft^3) or 911kg/m^3.

Liquid wastes incinerated at the facility include oils, solvents, chemicals, and sludges. PCB-contaminated liquids and other liquid wastes having a heat content of less than 10,000 British thermal units per pound (Btu/lb), are classified as Primary Liquid Wastes and are fed directly to the primary combustion chamber. Low-ash liquid wastes (less than .005 percent ash) with a high heat content (Btu) are classified as Secondary Liquid Wastes and are fed directly to the SCC. Aqueous Liquid Wastes are organic-contaminated wastes with a low heat content, and are fed to the primary combustion chamber for incineration. Sludge Wastes are fed through a sludge lance in the primary combustion chamber. Direct Burn Wastes are wastes which should not be mixed with other wastes being burned and can be fed directly from a tanker truck to the primary and secondary waste burners through their associated direct burn waste lines. Whether each liquid waste is burned by itself or blended with other liquid wastes depends on its characteristics: heat value, organic halogen content, ash content, water content, viscosity, and reactivity. Table 4-3 describes the characteristics of the liquid waste streams for which the incinerator has been designed and design waste loads. Table 4-4 describes the major parameters of the wastes to be incinerated, including anticipated annual burn rates and significant waste constituents.

Seventeen tanks provide storage for liquid wastes at the K-1435 Incinerator. Each of these tanks is supported vertically above ground on pipe legs. All except two tanks associated with the drum shredder are located in the K-1435 Tank Farm. The tank farm is diked and sealed in accordance with RCRA regulations. Inert gas blankets are provided to reduce volatilization of hazardous materials. The tank farm is under a roof. Table 4-5 describes the tanks at the K-1435 Incinerator and their capacity.

Containerized wastes will be stored at two sites at the incinerator. K-1435-C is a curbed, contained storage area for non-PCB wastes. It has a canopy-style roof. The floor slab is sloped to a grated

TABLE 4-3

INCINERATOR DESIGN WASTE CHARACTERISTICS
ORGDP - OAK RIDGE, TN

• Primary Liquid Waste to Primary Combustion Chamber (kiln) Burner	
Gross Heating Value (GHV):	7,000 Btu/lb
Flow Rate (gpm):	1.8
Specific Gravity:	1.03
Viscosity (CST):	2.7
Temperature (F):	68
• Secondary Liquid Waste to Secondary Combustion Chamber Burner	
Gross Heating Value (GHV):	10,000 Btu/lb
Flow Rate (gpm):	1.0
Specific Gravity:	0.95
Viscosity (CST):	16.0
Temperature (F):	68
• Aqueous Liquid Waste to Kiln	
Gross Heating Value (GHV):	1,200 Btu/lb
Flow Rate (gpm):	Variable (1.0 maximum)
Specific Gravity:	0.99
Viscosity (CST):	1.2
Temperature (F):	68
• Sludge Waste to Kiln	
Gross Heating Value (GHV):	5,100 Btu/lb
Flow Rate (lb/hr):	30
Specific Gravity:	1.03
Viscosity (CST):	234
Temperature (F):	68
• Direct Burn Waste	
Gross Heating Value (GHV):	11,300 Btu/lb
Flow Rate (gpm):	As Available (1.0 Maximum)
Specific Gravity:	1.15
Viscosity (CST):	50
Temperature (F):	68
• Solids to Kiln	
Gross Heating Value (GHV)	690 Btu 116
Flow Rate (lb/hr)	700
Temperature (F)	68

Source: MMES, undatedc

TABLE 4-4

K-1435 WASTE CHARACTERIZATION SUMMARY - MAJOR PARAMETERS
ORGDP - OAK RIDGE, TN

Primary Master Burner	Annual Burn Rate (gal)	Average Heat of Combustion (Btu/lb)	% Ash	% Chloride	% Fluoride	% H_2O	Density (g/ml)
Primary Master Burner							
PCBs							
Concentrated Waste	20,000	8,800	2.0	40.0	0	1	1.55
Dilute Waste	115,000	15,600	0.9	7.8	0	10.7	0.99
Subtotal or Weighted Average	135,000	14,600	1.06	12.6	0	9.3	1.07
Non-PCB Oil	274,000	14,700	0.9	0.06	0	15.9	0.89
Solvents & Chemicals	64,000	4,000	1.0	50.0	2.3	31.5	1.27
Total or Weighted Average	473,000 (1.08 gpm)	13,200	0.96	10.0	0.3	16.1	0.99
Aqueous Burner	81,000 (0.18 gpm)	1,200	4.0	0.04	0	86.8	0.99
Secondary Burner							
Non-PCB Waste Oils	84,000	17,900	0.3	0.2	0	1.05	0.97
Solvents & Chemicals	87,000	14,500	0.10	0.8	0.004	4.95	0.93
Total or Weighted Average	171,000 (0.40 gpm)	16,100	0.2	0.50	0.002	3.0	0.95

TABLE 4-4
K-1435-WASTE CHARACTERIZATION SUMMARY - MAJOR PARAMETERS
ORGDP - OAK RIDGE, TN
PAGE TWO

Primary Master Burner	Annual Burn Rate (lb)	Average Heat of Combustion (Btu/lb)	% Ash	% Chloride	% Fluoride	% H_2O	Density (g/ml)
Solids							
Shredder	855,000	5,100	50	6.7	0	21	N/A
Bulk Solids	6,727,000	130	59	0	0	22	0.94
Total or Weighted Average	7,582,000 (1,039 lb/hr)*	690	58	0.76	0	22	
Lance (Sludges)	220,000 (30 lb/hr)	5,100	10	0	0	65	1.03

Source: MMES, undatedc

*Burn rate will be limited to 700 lb/hr.

N/A - Not Available

TABLE 4-5

K-1435 INCINERATOR TANKS
ORGDP - OAK RIDGE, TN

Tank No.	Tank Name	Capacity (gal)
T-201	Concentrated PCB Waste Receiving Tank	5,000
T-202	Dilute PCB Waste Receiving Tank	5,000
T-203	Aqueous PCB Waste Receiving Tank	5,000
T-204	Primary Waste Receiving Tank	5,000
T-205	Secondary Waste Receiving Tank	5,000
T-206	Aqueous Waste Receiving Tank	5,000
T-207	PCB Storage Tank	10,000
T-208	Primary Waste Storage Tank	10,000
T-209	Secondary Waste Storage Tank	10,000
T-305-A	Primary Liquid Waste Feed Tank A	5,000
T-305-B	Primary Liquid Waste Feed Tank B	5,000
T-306-A	Secondary Liquid Waste Feed Tank A	5,000
T-306-B	Secondary Liquid Waste Feed Tank B	5,000
T-307-A	Aqueous Liquid Waste Feed Tank A	5,000
T-307-B	Aqueous Liquid Waste Feed Tank B	5,000
T-401	Non-PCB Waste Drain Tank	900
T-402	PCB Waste Drain Tank	900

Source: ORGDP, 1985a

trench, with the trench draining to a sump. Drums are stored on pallets with sufficient capacity to store 148 pallets each with four drums. The K-1435-B Building is also used for storage of PCB wastes. It has container storage area, temporary storage area for drums to be processed, and a drum dumping system. The floor is sloped and drains to a trench, which in turn drains to a sump. Capacity is rated at 448 drums.

K-1420-A Flammable Waste Storage Tank

The K-1420-A tank is an aboveground, 22,000-gallon tank. It is used for the storage of flammable and ignitable liquid wastes prior to their incineration at the K-1435 Incinerator. The principal wastes stored are gasoline, spent oxygenated solvents, discarded paint waste, and spent aromatic solvents. Some of the solvents may contain radioactive constituents. Secondary containment for the K-1420-A tank is provided by a concrete dike.

Containerized liquid wastes are transferred to the tank by a portable drum pump. While their contents are being transferred, the drums are placed on a portable pan to provide spill containment. The Survey team observed that the lip of the pan was flattened; thus, the pan would not serve its intended purpose (i.e., spill containment). The pan was immediately repaired by ORGDP (see Finding 4.1.2.4.1).

K-1419 Sludge Fixation Plant

This facility consists of a storage tank area for hazardous wastes and a series of storage tanks for nonhazardous mix materials, feed tanks, and ancillary equipment and mixers. The facilities used for the mixing and preparation were formerly a concrete production facility. Hazardous sludge and liquids are mixed with nonhazardous fixation agents (fly ash, concrete, sand, and clay) in two mixers. The exact fixation recipe for each type of sludge specifies the fly ash, sand, and/or clay in various mixtures, depending upon the wastes to be solidified.

Wastes that are stabilized at K-1419 include K-1407-B surface impoundment wastes, various sludges from treatment operations, and potentially incinerator ash. Some treated materials contain low-level radioactive contaminants. Since the sludges that are stabilized sometimes contain listed wastes (e.g., incinerator ash, K-1232 sludges, etc.) and radioactive constituents, technically the stabilized sludges are mixed wastes. ORGDP is planning on obtaining a delisting from EPA for the solidified product.

EPA has proposed that stabilized wastes have a minimum compressive strength of 50 pounds per square inch (psi). The stabilized product from K-1419 typically has compressive strengths of 500 to 2,000 psi, well in excess of EPA proposed requirements. Recent proposals by EPA to modify the toxicity characteristics leaching procedure (TCLP) would allow stabilized wastes to be tested on a monolith, rather than after size reduction. This would increase the possibility that the stabilized K-1419 product would pass the TCLP (EPA, 1988b). Figure 4-2 describes the K-1419 sludge fixation facility.

K-1417 Casting and Storage Area

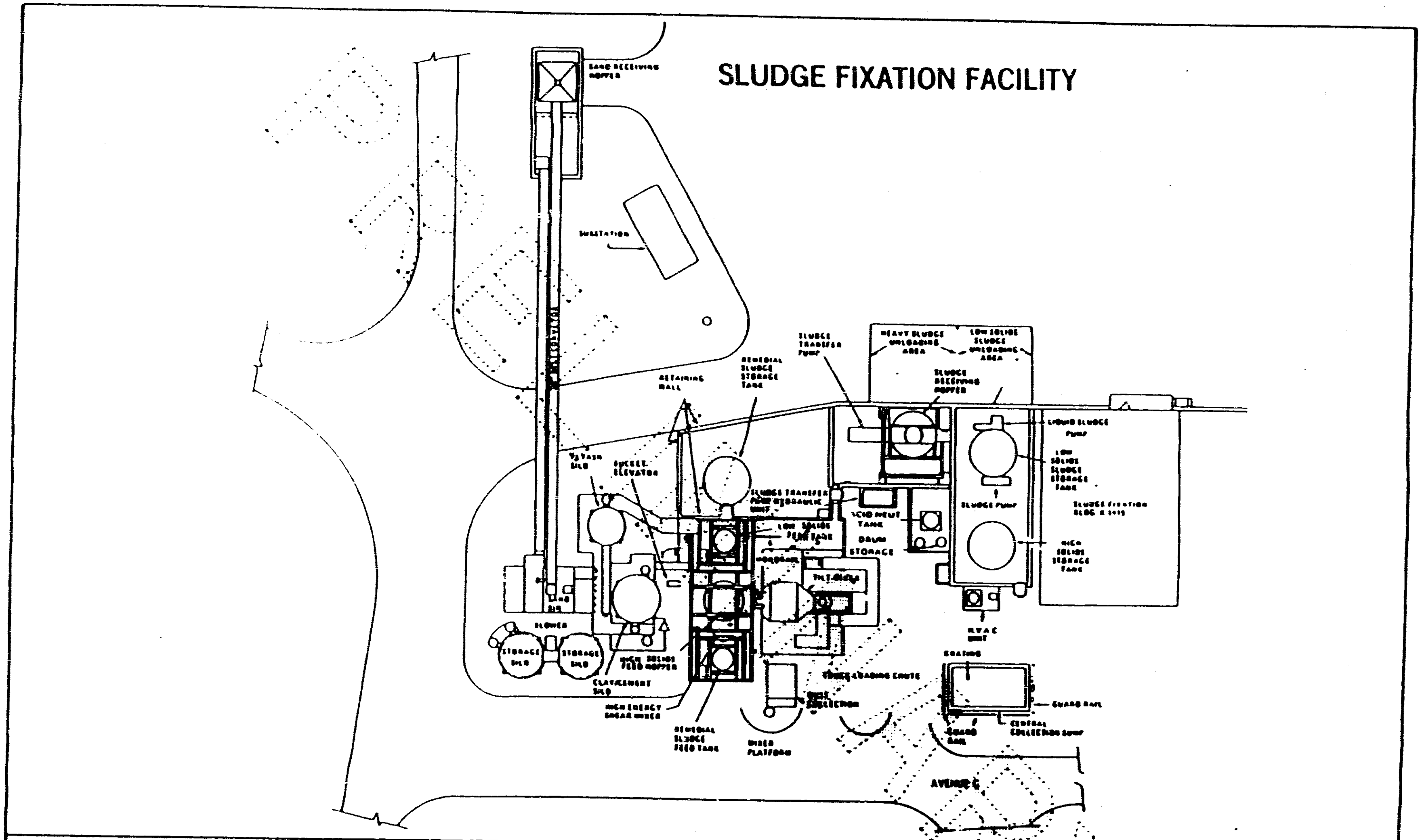
The K-1417 area is used for the pouring, setting, and storage of stabilized wastes in steel drums. Aggregate mixtures are received for casting from the K-1419 facility in cement mixer trucks. Liquids generated during the casting operation are returned to K-1419 for fixation. Wastewaters from the truck and equipment washing system, and wastewaters from the casting buildings are routed to K-1407-H for treatment. Drums containing the solidified product are stored in the K-1417 storage area.

K-1407-H Central Neutralization Facility

The K-1407-H facility, which was activated November 1, 1987, provides pH adjustment and chemical precipitation for the following aqueous waste streams (MMES, 1985b):

- K-1401 Metals Cleaning HCl Bath [Extraction Procedure (EP) Toxic]
- K-1401 Metals Cleaning Alkali Bath (EP Toxic, Corrosive)
- K-1501 Steam Plant Softener (Corrosive)
- K-1501 Coal Pile Runoff (Corrosive)
- K-1420 Acid Stripping Bath (EP Toxic)
- K-1420 HCl Cleaning Bath (EP Toxic)
- K-1420 Metals Finishing (EP Toxic)
- K-1435 Scrubber Effluent (Derived from treatment of listed wastes)
- Laboratory Wastes (Corrosive, listed)
- K-1413 Laboratory Wastes (Hazardous characteristics vary).

The treatment system consists of two 25,000-gallon reaction tanks and a 60,000-gallon (227,100-liter) sludge thickener tank, all aboveground, closed-top and in a diked area. Acid wastes are neutralized with a lime slurry and basic wastes neutralized with sulfuric acid. Treated effluents are discharged



Source: Connors, 1988

FIGURE 4-2

SLUDGE FIXATION FACILITY
ORGDP - OAK RIDGE, TN

through an NPDES outfall into Poplar Creek (see Section 3.3 for details). K-1435 scrubber effluent is treated separately in one of the two batch tanks. Most of the waste streams treated will contain radionuclides. Wastewaters from the K-1435 Incinerator are kept separate from other wastewaters.

Sludges that are radioactively contaminated are precipitated out in the sludge thickener tank and either sent to the K-1419 Sludge Fixation Plant or stored in an aboveground storage area. They are technically a mixed waste until delisted.

K-1232 Treatment Unit

The K-1232 Treatment Unit formerly provided chemical precipitation and pH adjustment for wastewaters principally from the DOE Y-12 site. These wastewaters are the following:

- Nitric Acid Waste (Corrosive, EP Toxic)
- Acid Wastes (Corrosive, EP Toxic)
- Basic Wastes (Corrosive, EP Toxic)
- Mop Water and Rinsewater (EP Toxic).

Wastes were received, treated, and stored in two tanks, neither lined with membrane liners. After feed chemicals were added and mixed, the wastewaters were discharged to two lagoons, for precipitation of solids. Settled sludges were collected, dewatered, drummed, and transported to K-306-Vault-23-A for storage. Liquid effluents went to the NPDES discharge at the K-1203 Sewage Treatment Plant with one exception. Nitrate wastes from Y-12 were not discharged, but instead were taken to K-1232 for neutralization only and then were returned to Y-12.

This facility is currently no longer receiving Y-12 wastewaters since Y-12 has constructed its own treatment facilities. (Section 4.3.3 has additional details.) Leaks from lines leading from the K-1232 tanks to the lagoons are covered later in the discussion on RCRA regulated tanks.

K-1413 Treatment Tank

The K-1413 Treatment Tank provides chemical precipitation and pH adjustment for hazardous wastes. It has a 21,000-gallon (79,485-liter) capacity and is constructed of reinforced concrete with a fiberglass-reinforced epoxy lining The tank serves as backup to the K-1232 treatment system and is used only in an emergency.

K-900 Thermal Treatment Bottle Smasher

The K-900 Bottle Smasher is used to dispose of small quantities of ignitable or reactive chemical wastes. It is a steel rectangular box (3 feet by 5 feet by 2 feet high) with a steel lid and electrical coil at the bottom. Wastes are either ignited with the electrical coil or exploded by impact of the steel lid.

K-1407-A Neutralization Facility

The currently idle K-1407-A facility provides chemical precipitation after pH adjustment for aqueous waste streams. It consists of a 124,905-liter (33,000-gallon) concrete retention pit where corrosive wastewaters were neutralized. The tanks are constructed of reinforced concrete and coated acid-proof bricks. The waste streams treated were the same as those listed for the K-1407-H Central Neutralization Facility with the exception of the K-1435 Incinerator scrubber waters which were not discharged to this facility. Some of the waste streams treated (those from the K-1420 Uranium Decontamination Facility) were radioactive. The facility has been replaced by K-1407-H, but will remain in place as a backup unit (Section 3.3 has more details).

K-1407-B Holding Pond

The K-1407-B Holding Pond received the neutralized effluent from the K-1407-A Neutralization Facility (pit). The pond is a 1.3-acre impoundment with a 3,785,000-liter (1,000,000-gallon) storage capacity. Effluent from the pond was discharged through an NPDES outfall. This outfall was moved to K-1407-H. ORGDP plans to use the pond for storage of K-1407-H treated wastewaters after final decontamination of the pond in accordance with RCRA requirements.

Accumulated sludges from K-1407-B were sent on a one-time basis to the K-1407-C Sludge Retention Basin. However, the pond still contains 7,080 cubic meters (250,000 cubic feet) of metal hydroxide precipitates accumulated since 1973. The sludge is considered a hazardous waste. Leachate tests (MMES, undatede) indicate that the sludge-contaminated soil would pass the Extraction Procedure. However, the sludge and sludge-contaminated soil do contain radionuclides including technetium and uranium. Since the K-1407-B treated wastes contained some listed F006 wastes, they would technically be considered a mixed waste and, therefore, the impoundment is subject to RCRA closure by November 1988, since it does not meet the minimum technology standards of RCRA for surface impoundments (i.e., it lacks a double liner and leachate collection system). ORGDP plans to close the pond in accordance with RCRA requirements by removing the sludge and stabilizing it in the K-1419 fixation plant, if necessary, for aboveground storage.

EPA has proposed regulations (EPA, 1988c) that may enable ORGDP to delay closing this facility, or at least allow the sludges to be removed at a later date.

K-1407-C Sludge Retention Basin

The K-1407-C Sludge Retention Basin is an unlined surface impoundment with a storage volume of approximately 9,462,500 liters (2.5 million gallons). The impoundment was used primarily for the storage of potassium hydroxide sludges generated at the K-402-9 Purge Cascade Scrubber facilities. It also contains the metal hydroxide precipitates removed from K-1407-B in 1973. Currently, this pond is undergoing a RCRA closure since it does not meet the RCRA minimum technology requirements. Sludge is being removed, taken to K-1419 for fixation, and then put into aboveground storage in containers. Since the sludge contains radionuclides, it is considered a mixed waste. ORGDP plans to submit a delisting petition for the stabilized K-1407-C sludge and the K-1407-B sludge. If the petition is successful, the stabilized sludges could eventually be removed from long-term storage and placed into a low-level radioactive waste disposal site. Otherwise, they will have to remain in long-term storage until DOE develops a mixed waste disposal site. Upon final decontamination, the pond will be used for the storage of nonhazardous wastewaters. See Finding 4.1.2.2.1.

K-1425 Waste Oil/Hazardous Waste/PCB Storage

The K-1425 area is used to store the following wastes:

- Waste Oil/Solvents (F001)
- Chlorinated Solvents (F001, F002)
- Degreaser Residue (F001)
- Waste Oils [PCB < 50 parts per million (ppm)]
- Waste Oil
- Discarded Paint Waste (F001)
- Spill Cleanup Waste (F001).

The storage area has four 85,162-liter (22,500-gallon) storage tanks and capacity to store 480 208-liter (55-gallon) drums. This area does not normally receive flammable wastes and does not have fire protection. The storage area is diked and all drums are stored on pallets. Some of the materials stored may contain radioactive substances. All wastes stored at K-1425 are incinerated at the K-1435 Incinerator.

K-301-1 Vault 4, Hazardous Waste Storage Facility

The K-301-1 Vault 4, 4A and 4B Hazardous Waste Storage Facility is used for the storage of containerized wastes. This vault is located in the K-25 process building and is one of several waste storage areas in K-25 and other process buildings. Table 4-6 describes the type of wastes stored.

The storage area is curbed and there are no accessible drains within the curbed area. Concrete floors and dikes have been sealed with concrete sealer. This area is used for the long-term storage of both ORGDP wastes and wastes from other DOE sites. The permitted capacity of K-301 Vault 4, 4A, and 4B is 15,200 drums.

K-306-I Vault 23-A Hazardous Waste Storage

The K-306-I Vault 23-A is located in K-25 and is used for the storage of both hazardous wastes and PCB-contaminated soils and sludges. Table 4-7 describes the wastes stored in this facility. The permitted capacity of K-306-I Vault 23-A is 3,000 drums. The storage area is curbed and there are no accessible drains within the storage area. The concrete and cement blocks are sealed with Con-Seal Extra, a polyurethane concrete sealer. All drums are stored on pallets.

K-306-I PCB/Hazardous Waste Drum Storage Area

The K-306-I storage area located in K-25 is used for the long-term storage of sludges resulting from the treatment of Y-12 wastes at K-1232, considered hazardous since they are derived from the treatment of wastewaters containing listed wastes (F001, F002, F006). The storage area is curbed to contain liquids. Capacity is 864 drums. Also stored are PCB-contaminated soils and sludges that are to be incinerated at the K-1435 Incinerator.

K-311-I Radiogenic Lead Storage Vault

The K-311-I storage area is used for the long-term storage of radiogenic lead generated from past operations at Y-12. Fifty-one tons of lead ingots, slag, and powder are stored in containers. All

TABLE 4-6

K-301 VAULT-4 WASTES
ORGDP - OAK RIDGE, TN

Hazardous Waste	Hazard	Basis for Hazardous Designation
K-1232 Lagoon sludge	None	Derived from the treatment of listed waste F001, F002, and F006
K-1232 Centrifuge cake	None	Derived from the treatment of listed waste F001, F002, and F006
K-1435 Incinerator ash	None	Derived from the treatment of listed waste F001, F002, F003, F004, D004, D005, D006, D007, D008, D0011
K-1407-H Sludge	EP toxic, corrosive	D002, D004, D005, D006, D007, D008, D009, D010, D011, D012, F001, F002, F003, F004, F005, F006, F008
Laboratory waste	EP toxic corrosive	F001, F002, D002, D004, D005, D006, D007, D008, D009, D010, D011
Miscellaneous waste	EP toxic corrosive	D002, D004, D005, D006, D007, D008, D009, D010, D011, D012, F001, F002, F003, F004, F005, F006, F008

Source: MMES, 1986a

TABLE 4-7

K-306-1 VAULT-23A WASTES
ORGDP - OAK RIDGE, TN

Hazardous Waste	Hazard	Basis for Hazardous Designation
Lagoon sludge	None	Derived from the treatment of listed waste F001, F002, and F006
Centrifuge cake	None	Derived from the treatment of listed waste F001, F002, and F006
Miscellaneous waste	EP toxic, corrosive	D001, D002, D003, D004, D005, D006, D007, D008, D009, D010, D011, F003
CPCF Sludges	None	Derived from the treatment of listed waste F001, F002, and F006
Spent carbon filtration media (organic)	None	Derived from the treatment of listed waste F001, F002, and F006
Plating sludges	None	Derived from the treatment of listed waste F006
PCB/RCRA Contaminated soils, sludges	TSCA, EP toxic	TSCA, EP toxic, metals

Source: MMES, 1987a

materials stored are solids; therefore, no secondary containment is required. It is not anticipated that any additional radiogenic lead will be stored at this facility.

K-1305-A Satellite Drum Storage Area

The K-1305-A area is used for the storage of drums of liquid hazardous wastes. The area has a capacity of 16 drums. It is located inside a building and the storage area is diked. Drums are stored on aluminum pans so as to provide both a means of separating potentially incompatible wastes and additional containment capacity.

K-1302 Gas Cylinder Storage Unit

The K-1302 storage building is the storage area for cylinders of compressed gas that are to be discarded. These gases are either toxic, corrosive, or acutely hazardous. This area is also used for the storage of usable compressed gases stored in cylinders.

K-711 Mixed Waste Storage

The K-711 building is used for storage of approximately 800 drums containing flammable wastes, oils, solvents, and mixtures of flammables, oils, and/or solvents all contaminated with uranium. These wastes were received from DOE's Fernald facility and will be incinerated at the K-1435 Incinerator. The facility meets RCRA storage standards.

K-1025-C Container Storage

K-1025-C is used for storage of containers of hazardous wastes with a capacity of 80 drums or 4,400 gallons. The storage area is diked, with separate areas for incompatible wastes. At this time, K-1025-C is used for storage of small quantities of waste that will be laboratory-packed. All wastes stored in K-1025-C are destined for off-site treatment and/or disposal facilities.

K-305 Vault 19 and 19-B Hazardous Waste Storage

The K-035 Vault 19 and 19-B area is used for the storage of plating waste sludges and miscellaneous wastes from other DOE operations. This area has the capacity to store 8,050 drums. The storage area is diked.

RCRA Regulated Storage Tanks

RCRA regulates two types of storage tanks, these being aboveground and underground hazardous waste storage tanks and underground tanks holding regulated substances. Underground storage tanks (USTs) are defined by RCRA as tanks with 10 percent of the tank volume, including piping, underground. Tanks containing hazardous wastes are subject to RCRA Section 264 (permitted) or 265 (interim status) regulations. Tanks containing "regulated" substances are subject to RCRA Section 280 regulations. EPA has promulgated regulations in Sections 264 and 265 of RCRA regarding technical requirements for hazardous waste storage tanks including USTs. Section 265.91 of RCRA regulations requires integrity testing of tank systems lacking secondary containment including underground piping.

Hazardous Waste Storage Tanks

ORGDP hired Lee Wan and Associates to conduct integrity testing of ORGDP hazardous waste tanks. Leak testing was conducted on all hazardous waste tank systems (tanks and associated lines). The report issued made the following general conclusions regarding hazardous waste tanks at ORGDP (Goldsmith et al., 1988):

- None of the facilities currently comply with all applicable requirements of 40 CFR 264, Subpart J, concerning secondary containment, leak detection, structural soundness, waste compatibility, corrosion protection, and overflow control.

- Recently constructed facilities (K-1407-H [CNF], K-1435 [TSCA]) appear to meet requirements for structural soundness. Compliance with requirements for waste compatibility and corrosion protection could not be determined at this time (during the study period).

Specific details for individual tank systems as reported by the contractor are as follows:

K-1232 Tank System: The floor drain system leading from the treatment tanks to the settling pond and the dike drain system for the acid storage tanks leaked, as determined by hydrostatic tests. The four 60,560 liter (16,000-gallon) treatment tanks were found to be in sound condition. Tanks K-1232-B and K-1232-C are suitable for reuse as secondary containment for Building K-1232, provided they are coated with a waste-stream-compatible coating. Tank K-1232-A is marginally adequate for reuse. However, it is not required and should be placed in an out-of-service status.

K-1401 Tank System: The system of fan sumps and drain lines leaked, as shown in hydrostatic testing. Visual inspection of the concrete sumps and ductwork revealed no condition indicating loss of structural integrity (except as noted below). Material compatibility with the loss of protective coating on the concrete will ultimately lead to substantial degradation of the concrete and its ultimate failure.

1. EF-1 and EF-2 Sump. Extreme corrosion, degradation of concrete slab supporting trichloroethane tank (no drain line in this sump).

2. EF-6 and EF-7 Sump. Complete corrosion, degradation of concrete sump directly below drain line inlet.

3. All Sumps/Ducts. Loss of protective coating in area outside building to transition area inside building.

K-1407-H (CNF): The system is acceptable as it is with the exception of two manholes which have leaks in the upper portion above normal levels of effluents discharged.

K-1420 Tank System: All underground gravity process drains are leaking and must be taken out of service and replaced.

K-1435 Tank System (TSCA): The system is acceptable as is with the exception of the scrubber effluent discharge line to Tanks T-602-A and T-602-B.

Tank K-1503: Tank K-1503 is suitable for use as a secondary containment for a new tank. The drain line from K-1501 to K-1503 leaked as determined by hydrostatic test. ORGDP has taken out of service all the leaking lines associated with hazardous waste tanks. The leaking lines are either being taken out of service permanently or repaired.

At the time of the Survey, ORGDP was in the process of implementing these recommendations in the Lee Wan report.

Regulated Substance RCRA Section 280 Tanks

The second type of tank regulated by the RCRA (under Section 280) is "regulated substance" USTs. "Regulated substances" means chemical substances as defined in Section 101.14 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), petroleum, and substances derived from petroleum (e.g., fuel oil, gasoline, etc.). The regulated substance tanks at ORGDP contain fuels, corrosive wastewaters, and hexavalent chromium-containing wastewaters. EPA promulgated regulations in Section 280.3 of the RCRA regulations requiring notification to agencies as designated by states of all USTs, either in service as of May 8, 1986, or taken out of service after January 1, 1974. Proposed technical standards for USTs regarding leak detection, records, releases, corrective actions, and new tank performance standards were proposed in April 1988, but are not yet in effect.

ORGDP prepared the required notification; however, the notification was incomplete (see Finding 4.1.2.4.2). The Survey team found tanks that were not on the current inventory, including fuel tanks at the GCEP (Gas Centrifuge Enrichment Process) area and process tanks at K-1420. Table 4-8 describes those 31 tanks for which notification was made to the state. Table 4-9 lists 13 additional tanks, identified both during and subsequent to the Survey, for which notification was not made.

Most of the "regulated substances" USTs were not evaluated by Lee Wan and Associates and have not been integrity tested (see Finding 4.1.2.3.1). The lack of integrity testing is of particular concern for certain USTs. The cooling tower basins are of concern since they contained hexavalent chromium. Although they are no longer in service, these basins may have leaked while in service. Leaking from associated pipelines would also be of concern since the Lee Wan audit discussed previously found many pipelines associated with hazardous waste tanks to be leaking. However, development of leaks in the pipelines would have been minimized by the cathodic protection that was in place.

During the time that the gaseous diffusion process was operating, underground steel tanks may have been subject to enhanced potential for electrolytic corrosion. The PGDP found it necessary to provide electrolytic corrosion protection for hexavalent chromium-containing recirculating cooling water (RCW) due to enhanced stray ground currents resulting from the electrical system operation. ORGDP did have cathodic protection devices installed on the steel piping associated with the hexavalent chromium cooling water system and some recently installed steel USTs. However, the effectiveness of the cathodic protection has not been verified. The steel tanks of most concern are

TABLE 4-8

REGULATED SUBSTANCE UNDERGROUND STORAGE TANKS - NOTIFIED
ORGDP - OAK RIDGE, TN

Tank No.	Location	Status	Age (years)	Capacity (gal)	Material	Int. Prot.	Ext. Prot.	Piping	Substance Stored
1	K-1652	In-Use	3	250	Steel	None	Cathodic	GAL Steel	Diesel
2	K-720-B	Out-Use	37	75	Steel	None	None	Steel	Gas Odorant
3	K-720-C	Out-Use	37	175	Steel	None	None	Steel	Gas Odorant
4	K-721	Out-Use	37	175	Steel	None	None	Steel	Gas Odorant
5	K-1407-A	In-Use	30	35,000	Acid Brick	Acid Brick	None	FRP	Corrosives
6	K-1410	Out-Use	11	15,800	Concrete	None	None	GAL Steel	Corrosives Plating Waste
7	K-1413	In-Use	11	20,870	Concrete	Yes	None	GAL Steel	Neut. pH-Hg
8	K-1232-E	In-Use	13	80,800	Concrete	None	None	Stainless Steel	MET Precip.
9	K-1232-W	In-Use	13	80,800	Concrete	None	None	Stainless Steel	MET Precip.
10	K-1232	In-Use	13	22,000	Concrete	None	None	Stainless Steel	MET Precip.
11	K-1232	In-Use	13	4,600	Concrete	None	None	Stainless Steel	Corrosives
12	K-1414	In-Use	40	500	Steel	None	None	Steel	Used Oil
13	K-1401	Out-Use	30	30,000	Steel	None	None	Steel	Water Rinse
14	K-1414-1	In-Use	6	5,500	Steel	None	Cathodic	PVC-FRP	Gasoline
15	K-1414-2	In-Use	6	2,600	Steel	None	Cathodic	FRP	Gasoline
16	K-1414-3	In-Use	37	1,500	Steel	None	Cathodic	Steel	Diesel
17	K-1413-5	In-Use	14	20,000	Concrete	Yes	None	Stainless Steel	Corrosives

TABLE 4-8
REGULATED SUBSTANCE UNDERGROUND STORAGE TANKS - NOTIFIED
ORGDP - OAK RIDGE, TN
PAGE TWO

Tank No	Location	Status	Age (years)	Capacity (gal)	Material	Int. Prot.	Ext. Prot.	Piping	Substance Stored
18	K-1413-W	In-Use	17	1,300	Concrete	None	None	Stainless Steel	Corrosives
19	K-1413-E	In-Use	36	1,300	Concrete	None	None	Stainless Steel	Corrosives
20	K-1134	Out-Use	9	12,500	Steel	Yes	None	Steel	Hydrofluoric
21	K-1200	Out-Use	40	10,000	Steel	None	None	UNK	UNK
22	K-1401-B Bay	In-Use	13	1,000	Stainless Steel	None	None	None	TCE
23	K-1401-J Bay	In-Use	13	1,000	Stainless Steel	None	None	None	TCE
24	K-1401	Out-Use	6	30,000	Steel	Acid Brick	None	Steel	HCL
25	K-892-G/H	Out-Use	31	13,500,000	Concrete	None	None	Steel/Cathodic	Chromate
26	K-862-E	Out-Use	35	4,500,000	Concrete	None	None	Steel/Cathodic	--
27	K-862-J	Out-Use	7	200,000	Concrete	None	None	Steel/Cathodic	Chromate
28	K-862-H	Out-Use	35	2,800,000	Concrete	None	None	Steel/Cathodic	Chromate
29	K-802-A/B	In-Use	43	5,800,000	Concrete	None	None	Steel	--
30	K-822	In-Use	30	100,000	Concrete	None	None	Steel	--
31	K-1210	Out-Use	15	100,000	Concrete	None	None	Steel	--

Source: Goillher, 1986

TCE: Trichloroethylene
FRP: Fiberglass Reinforced Plastic
PVC: Polyvinyl Chloride

HCL: Hydrochloric Acid
UNK: Unknown
GAL: Galvanized
MET: Metallic

TABLE 4-9

REGULATED SUBSTANCE UNDERGROUND STORAGE TANKS - NOT REPORTED
ORGDP - OAK RIDGE, TN

Tank No.	Location	Construction	Service	Size
Tank No. 1	K-1414-North End	Steel-Unlined	Gasoline	5,500 gallons
Tank No. 2	K-1414-North End	Steel-Unlined	Gasoline	2,600 gallons
----	K-1414	Steel	Waste Oil	500 gallons
----	K-1210	Steel-Coal Tar Ext	Diesel	~500 gallons
----	K-1220	Steel-Coal Tar Ext	Diesel	~500 gallons
T-0807-2	K-1220 East	FRP	Machine Coolant	Unknown
----	K-1220-S.E.	Steel-Coal Tar Ext	Diesel	~500 gallons
----	K-1210-A	Steel-Coal Tar Ext	Diesel	~500 gallons
----	K-1200-E	Steel	Diesel	~500 gallons
----	K-1652	Steel	Diesel	~250 gallons
T-8-0002	K-1401	Stainless Steel	TCE	60"x34.7"x48"
T-105, 8-0004	K-1401-J. Bay	Acid Brick	Rinsewater	11'10"x12'9"x 12'9"
T-104, 8-0003	K-1401-J. Bay	Acid Brick	HCl	11'10"x12'10"x 12'10"

Source: Goodpasture, 1988a

FRP-Fiberglass Reinforced Plastic
TCE-Trichlorethylene
HCl-Hydrochloric Acid
Ext-Exterior

those tanks described in Tables 4-8 and 4-9, which contain or contained gasoline. Finding 4.1.2.4.2 also discusses USTs.

ORGDP is in the process of preparing RCRA Facility Investigation (RFI) plans for several USTs including the cooling tower basins and the gasoline tanks located at K-1414, as part of the 3004(u) RCRA assessment. The K-1414 RFI is being carried out at the request of the State of Tennessee. As a result of inventory discrepancies, one 5,678-liter (1,500-gallon) tank was found to be leaking when tested. The tank was removed and 1,136-1,514 liters (300-400 gallons) of fuel was recovered from the excavation area in March 1987 (MMES, 1988b).

RCRA Closures

Several facilities at ORGDP have either been or will be closed in accordance with RCRA requirements. The K-1407-B holding pond and K-1407-C sludge holding pond are two surface impoundments subject to RCRA closure although the dates of closure may be changed according to proposed EPA regulations as previously discussed. K-1407-C is currently undergoing closure, with contaminated materials being solidified and put into long-term aboveground storage (see previous discussion for details). In the future, the numerous hazardous waste storage areas will have to be closed in accordance with RCRA requirements. However, it is unlikely that these areas will be closed until DOE develops a disposal option for mixed wastes and the need for their long-term storage areas no longer exists.

The K-1070 D-1, D-2, and D-3 areas were used for the storage of drums containing hazardous wastes and have been closed. Drums of waste solvents and oils were stored at these sites. The need for these sites no longer existed when the K-1425 storage facilities became available. A closure plan submitted to the State of Tennessee was approved in May 1988. Hazardous wastes were removed and soil sampling showed the soil to be free of contamination from hazardous wastes. The areas were backfilled with dirt, contoured, compacted, graded, and reseeded. Closure was certified and accepted by Tennessee in November 1986 (Oakes et al., 1987a).

Solid Waste Management Units (SWMUs)

Section 3004(u) of RCRA deals with releases of hazardous wastes and/or constituents from any SWMU at a facility obtaining a RCRA Part B permit. Corrective actions for any releases from all SWMUs must be a part of the facility RCRA Part B permit, even if the SWMU itself is not considered a RCRA unit and will not manage hazardous wastes. In the context of the permitting process, ORGDP has prepared a list of 71 SWMUs which have or may have handled hazardous wastes and thus have the potential for a release. ORGDP has evaluated these SWMUs and determined that 22 require RFI plans. All RFI plans were scheduled to be completed by the end of 1988. The need for any corrective action will be based on the results of the RFI. Table 4-10 describes SWMUs at ORGDP.

ORGDP Laboratory Wastes

The ORGDP research and analytical laboratories generate chemical wastes including acids, bases, solvents, and alcohols. Until June 1985, these wastes were discharged via drain lines into the K-1007 Holding Pond. As a result of NPDES requirements, beginning in June 1985, hazardous chemicals were no longer discharged into the pond. These chemicals are now collected and disposed of off-site through commercial vendors in accordance with the NPDES Best Management Practices (BMP) (Stone, 1984).

4.1.1.2 Radioactive Wastes

DOE Order 5480.2 defines radioactive wastes as "solid or fluid materials of no value containing radioactivity; discarded items such as clothing, containers, equipment, rubble, residues or soils contaminated with radioactivity, or soils, rubble, equipment or other items containing induced radioactivity such that the levels exceed safe levels for unconditional release."

Since the ORGDP is no longer operating the enriched uranium production facility, process-related radioactive wastes are no longer generated (e.g., uranium-contaminated oils and trapping agents). However, radioactive wastes remain on-site from past activities, and more waste will be generated by ongoing non-process-related activities. Consequently radioactive wastes will continue to be managed on-site. Activities resulting in the on-site management of radioactive waste include:

- Long-term storage of previously generated radioactive wastes from ORGDP.
- Decontamination of existing production facilities as they are decommissioned. This includes waste resulting from operation of the K-1420 Decontamination facility.
- Radioactive wastes transported to ORGDP for long-term storage and/or treatment in the K-1435 Incinerator.

TABLE 4-10

SOLID WASTE MANAGEMENT UNITS
ORGDP - OAK RIDGE, TN

Unit No.	Unit Name	Size	Function	Dates Operated	Waste Managed	Comments
001	K-1070-A Old Contaminated Burial Ground	1.0 acre	Disposal	Late 1940s through 1975	Low-level waste	RFI
002	K-1070-B Old Classified Burial Ground	3.7 acres	Waste disposal	1950s through 1972	Classified waste	RFI
003	K-1070-A Neutralization Pit	35,000 gallons	Neutralization	1940s to present	Corrosive waste	RFI
004	K-1407-B Retention Basin	1.3 acres (1.3 million gallons)	Settling	1940s through 1987	Metallic precipitates	RCRA Closure, RFI
005	K-1070-C/D Classified Burial Ground	22 acres	Burial	1972 to present	Classified nonhazardous equipment and hazardous solvents and chemicals	RFI
006	K-901-A Holding Pond	5 acres	Settling of CrOH precipitates	1940s to present	Until 1975, hexavalent chromium discharged, subsequently $Cr(OH)_3$ settling	RFI
007	K-1064 Drum Storage and Burn Area	1 acre	Open burning, solvent storage	1950s through 1960s- burning 1960 through 1979- drum storage	Waste oils, solvents, PCB liquids	RFI
008, 009	K-770 Scrap Metal Yard	30 acres	Storage	1960s to present	40,000 tons scrap metal radioactively contaminated	RFI

TABLE 4-10
SOLID WASTE MANAGEMENT UNITS
ORGDP - OAK RIDGE, TN
PAGE TWO

Unit No.	Unit Name	Size	Function	Dates Operated	Waste Managed	Comments
010	K-1420 Oil Storage	275'x50'	Storage	1960 to present	Radioactively contaminated waste oils in drums	RFI
011	K-1410 Neutralization Pit	10'x10'x20' In-ground tank (15,800 gallons)	Neutralization	1975 through 1979	Acids and bases from nickel plating process	RFI
012	K-1420 Mercury Recovery Room	12'x12'	Clean and recover used mercury	1960s through 1970s	Mercury	RFI
013	K-1401 Acid Line	10" drain 600' long	Transfer corrosives	1940s through 1987	Caustics, acids, diversy	RFI
014	K-1232	150'x100'	Treatment	1984 to present	Corrosive organic wastewaters	RFI
015	K-1413 Tank	21,000 gallons	Neutralization	1974 to present	Corrosives	RFI
016	K-1420 Lines	Several lines ~ 300' long	Wastewater transfer	1940s to present	Corrosives, detergents, and rinsewaters	RCRA Closure Plans, RFI
017	K-1004 Laboratory Drain	24" x 0.25 mile long	Storm drain intercepting laboratory drains	1940s to present	Laboratory waste until 1985	RFI
018	K-1070-F Construction Spoil Area	5 acres	Disposal	Early 1970s through 1978	Construction debris	RFI
019	K-1099 Blair Quarry	0.1 acre	Open burning of radioactive trash (low level)	---	Uranium-contaminated combustibles	----

TABLE 4-10
SOLID WASTE MANAGEMENT UNITS
ORGDP - OAK RIDGE, TN
PAGE THREE

Unit No.	Unit Name	Size	Function	Dates Operated	Waste Managed	Comments
020	K-1064-G Drum Deheading Facility	1,000-gallon tank x 75'x50' area	Remove residuals from drum	1970 through 1979	Solvents and aqueous liquids	----
021	K-1518 Land Treatment	----	----	----	----	----
022	K-1515 Lagoon	2 acres, 2,600,000 gallons	Sludge settling	1960s to present	Aluminum sulfate	----
023	K-1407-C	1,535 cubic meters	Waste pile	1983 to present	Uranium-contaminated soil from K-1417	----
024	K-1417 Soil	----	----	----	----	----
025	K-900 Bottle Smasher	3'x5'x2'	Bottle smashing	1980 to present	Waste organic chemicals	RCRA Facility
026	K-1070 D-1, D-2, D-3 Storage	D-1 - 0.15 acre D-2 - 0.25 acre D-3 - 0.21 acre	Storage	1980 through 1985	Hazardous waste liquids in drums	RCRA closure completed
027	K-1025-C Storage Building	40'x40'	Storage and labpacking	1979 to present	Hazardous waste chemicals	RCRA Facility
028	K-1035-A Drum Storage	16 drums	Storage	1980 to present	Hazardous waste liquids	RCRA Facility
029	K-311-I Radiogenic Lead Storage	2,500 square feet	Storage of radiogenic lead	1960s to present	Radiogenic lead	RCRA Facility

TABLE 4-10
SOLID WASTE MANAGEMENT UNITS
ORGDP - OAK RIDGE, TN
PAGE FOUR

Unit No.	Unit Name	Size	Function	Dates Operated	Waste Managed	Comments
030	K-306-1 Vault 23-A	290'x45'	Storage (Capacity = 3,000 drums)	1984 to present	Sludges, carbon filtration media, corrosives	RCRA Facility
031	K-306-1 PCB/HW	160'x20'	Storage (Capacity = 864 drums)	1977 to present	PCB wastes and hazardous wastes	RCRA Facility
032	K-1419 Sludge Fixation	----	Concrete Fixation	1987 to present	Hazardous and radioactive waste sludges	RCRA Facility
033	K-1417 Casting/Storage	3 acres	Storage	1987 to present	Hazardous wastes (stabilized)	RCRA Facility
034	K-1435 HW/PCB Incineration	1.0 acre	Incineration	1988 Startup	Hazardous and PCB wastes	RCRA Facility TSCA Facility
035	K-1407-H Neutralization Facility	----	Neutralization, precipitation of hazardous waste solutions	1987 Startup	Corrosives and EP toxic wastes	RCRA Facility
036	K-1425 Waste Oil/Hazardous PCB Storage	2,000-square-foot container storage, (four) 22,500-gallon tanks	Storage	1985 to present	Hazardous/PCB/waste oils	RCRA Facility
037	K-1420-A Flammable Waste Storage	22,000 gallons	Storage	1985 to present	Flammable and ignitable waste	RCRA Facility

TABLE 4-10
SOLID WASTE MANAGEMENT UNITS
ORGDP - OAK RIDGE, TN
PAGE FIVE

Unit No.	Unit Name	Size	Function	Dates Operated	Waste Managed	Comments
038	K-1302 Gas Cylinder Storage	16'x5'	Gas cylinder storage	1979 to present	Non-flammable gases	RCRA Facility
039	K-1407 Sludge Retention Basin	2,500,000 gallons	Sludge settling and storage	1973 through 1987	Hazardous/radioactive waste sludges	RCRA closure ongoing
040	K-726 PCB Storage Facility	75'x50' 500 drums	Drum storage	1978 to present	PCB capacitors, kerosene, soil and ballasts	TSCA Facility
041	K-33 ANDCO Treatment Unit	864,000 gallons per day	Chromium wastewater treatment	1970s through 1986	Hexavalent chromium	Standby
042	K-1004 Waste Accumulation Area	40'x40'	Storage	1985 to present	Flammables, solvents, corrosives	WAA in use
043	K-1085 Old Firehouse Burn Area	0.1 acre	Open burning	1950 through 1960	Unknown	----
044	K-1007-PI Holding Pond	44 acres	Flow equalization	1950s through 1985	Laboratory chemicals	NPDES Outfall
045	K-720 Fly Ash Pile	~20 acres	Waste pile	1940s through 1960s	Fly ash	----
046	K-1004 Vaults	25'x25'	Underground storage	1940s through 1950s	Spent nuclear fuel elements	----
047	K-1503 Neutralization Pit	10,000 gallons	Neutralization	1975 through 1980	Zeolite water, corrosive wastewater	----
048	K-1001-B WAA	30 gallons	Temporary storage	3/87 to present	Photographic waste	----
049	K-1001-C WAA	30 gallons	Temporary storage	3/87 to present	Photographic waste	----

TABLE 4-10
SOLID WASTE MANAGEMENT UNITS
ORGDP - OAK RIDGE, TN
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Unit No.	Unit Name	Size	Function	Dates Operated	Waste Managed	Comments
050	K-1001-D WAA	30 gallons	Temporary storage	3/87 to present	Photographic waste	----
051	K-1003 WAA	30 gallons	Temporary storage	3/87 to present	Photographic waste	----
052	K-1007 WAA	30 gallons	Temporary storage	3/87 to present	Waste photographic solutions	----
053	K-1095 WAA	20'x20'	Storage	3/87	Paint wastes	----
054	K-1070-G Burial Ground	100'x100'	Disposal	Unknown	Unknown	RFI
055	K-1031 WAA	50'x50'	Storage	1960s through 1985	Paint wastes	----
056	----	----	----	----	----	----
057	----	----	----	----	----	----
058	----	----	----	----	----	----
059	----	----	----	----	----	----
060	K-1225 Contaminated Scrap Metal Dumpster	7'x4'x3'	Collection	~1975 to present	Low-level radioactive wastes	----
061	K-1004-L Contaminated Scrap Metal Dumpster	7'x4'x3'	Collection	~1975 to present	Low-level radioactive wastes	----
062	K-1006 Contaminated Scrap Metal Dumpster	3'x3'x2'	Collection	~1975 to present	Low-level radioactive wastes	----

TABLE 4-10
SOLID WASTE MANAGEMENT UNITS
ORGDP - OAK RIDGE, TN
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Unit No.	Unit Name	Size	Function	Dates Operated	Waste Managed	Comments
063	K-1030 Contaminated Scrap Metal Dumpster	7'x4'x3'	Collection	~1975 to present	Low-level scrap	----
064	K-1030 Contaminated Scrap Metal Dumpster	3'x3'x2'	Collection	~1975 to present	Low-level scrap	----
065	K-1401-3E Contaminated Scrap Metal Dumpster	7'x4'x3'	Collection	~1975 to present	Low-level scrap	----
066	K-1401-4W Contaminated Scrap Metal Dumpster	7'x4'x3'	Collection	~1975 to present	Low-level scrap	----
067	K-1420 Contaminated Drum Storage	20'x20' 100 drums	Storage	~1975 to present	Low-level scrap	----
068	K-1401-2W Contaminated Metal Dumpster	7'x4'x3'	Collection	Mid-1970s to present	Low-level scrap	----
069	K-1420 Contaminated Metal Dumpster	7'x4'x3'	Collection	Mid-1970s to present	Low-level scrap	----
070	K-310-2 Low-Level Waste Storage	290'x45'	Storage, 3,000 drums (capacity)	Mid-1970s to present	Low-level scrap	----
071	K-310-3 Low-Level Scrap	290'x45'	Storage, 3,000 drums (capacity)	Mid-1970s to present	Low-level scrap	----
072	K-303-5 Low-Level Scrap	290'x45'	Storage, 3,000 drums (capacity)	Mid-1970s to present	Low-level scrap	----

TABLE 4-10
SOLID WASTE MANAGEMENT UNITS
ORGDP - OAK RIDGE, TN
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Unit No.	Unit Name	Size	Function	Dates Operated	Waste Managed	Comments
001	K-1414 Gas Tanks (3)	43,465 gallons (total)	Gasoline and diesel fuel storage	1950s to present	Diesel fuel leak occurred	RFI Planned
002	K-1700 Stream	3' x .75 mile	Received waste streams from treatment facilities	NA	Wastewaters	RFI Planned NBDES permit since 1974
003	K-25 Cooling Tower Basins and Transfer Lines	27 million - gallon capacity	Recirculating cooling water.	1940s through 1985	Hexavalent chromium	RFI Planned
004	K-725 Beryllium Building	100'x50'	Beryllium, uranium, and mercury development activities	1940s through 1972	Building contaminated	RFI Planned
005	K-1401 Degreaser (4)	10'x40'	TCE cleaning of processor equipment	1940s to present	Unknown release (if any)	----
006	K-1410 Plating Facility	100'x75'	Plating	1970 through 1979	None, production facility	Residuals on equipment
007	K-1007 Gas Tank	200 gallons	Gasoline storage	1950s through 1986	Gasoline leaked	Gasoline leak occurred

$Cr(OH)_3$ Chromium hydroxide - trivalent
HW Hazardous wastes
PCB Polychlorinated biphenyls
NA Not applicable
TCE Trichloroethylene
WAA Waste Accumulation Area
RFI RCRA Facility Investigation
NPDES National Pollutant Discharge Elimination System
TSCA Toxic Substances Control Act
RCRA Resource Recovery and Conservation Act
EP Tox Extraction Procedure Toxicity

Sources:
(1) Haymore, 1987a
(2) Bowers, 1987
(3) Bowers, 1988b

- Small quantities of radioactivity contaminated wastes from ORGDP analytical laboratory operations.

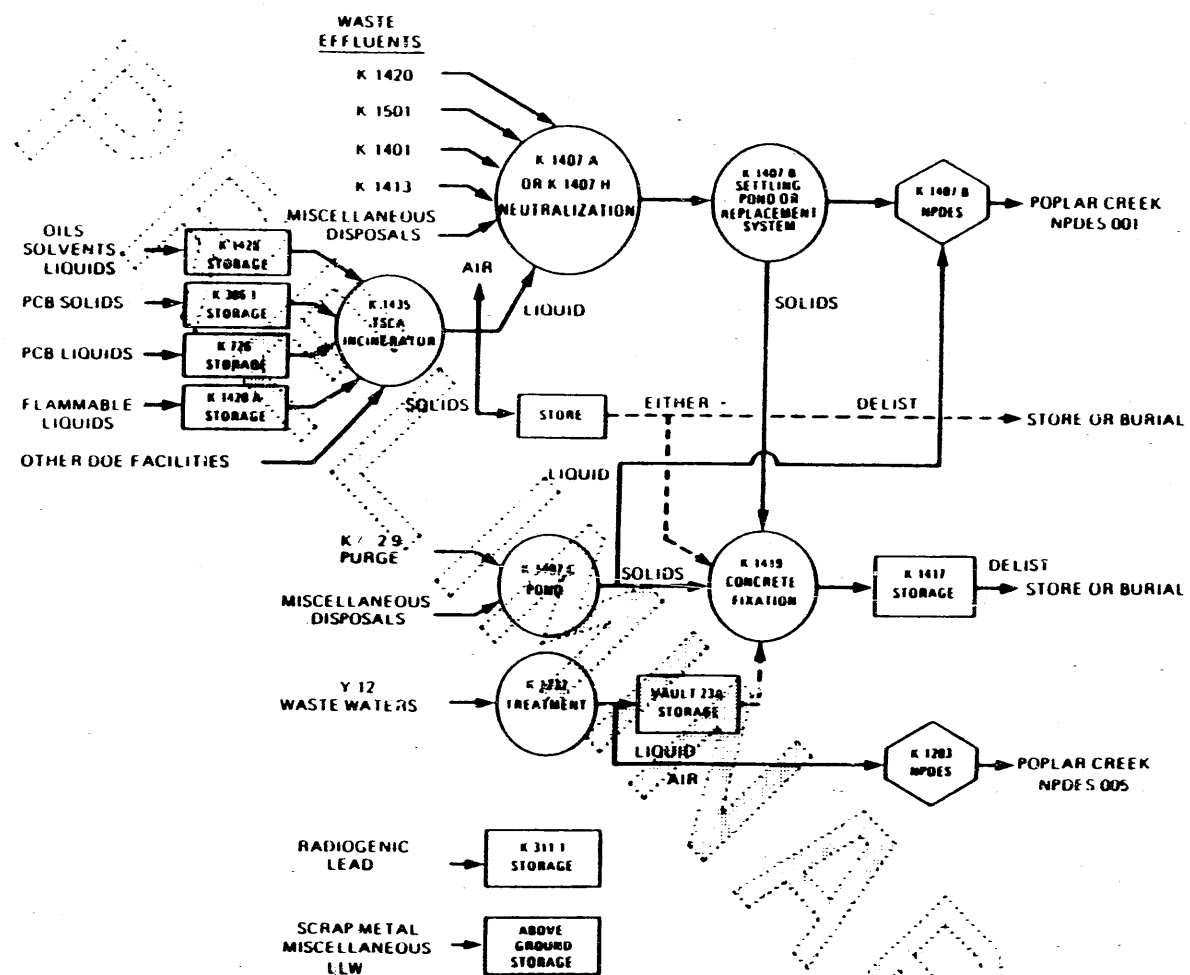
The ORGDP will be serving as the central site for the disposal of radioactive wastes by incineration and/or long-term storage of radioactive and/or mixed wastes from the DOE/ORO facilities including ORGDP, Y-12 Plant, ORNL, PGDP, PORTS, FMPC, and RMI (DOE wastes only).

Figure 4-3 outlines the general waste management scheme at ORGDP for low-level and mixed wastes. The following facilities used at ORGDP for the treatment, incineration, and long-term storage of radioactive wastes have been described previously in Section 4.1.1.1.

- K-1435 TSCA-RCRA Incinerator
- K-1420-A Flammable Waste Storage Tank
- K-1419 Sludge Fixation Plant
- K-1417 Costing and Storage Area
- K-1407-H Central Neutralization Facilities
- K-1232 Treatment Unit
- K-1413 Treatment Tank
- K-1407-A Neutralization Facility
- K-1407-B Holding Pond
- K-1407-C Sludge Retention Basin
- K-1425 Waste Oil/Hazardous Waste/PCB Storage Area
- K-301-1 Vault 4, Hazardous Waste Storage Facility
- K-306-1 Vault 23A Hazardous Waste Storage Facility
- K-311-1 Radiogenic Lead Storage Vault
- K-711 Mixed Waste Storage
- K-305 Vault 19 and 19B Hazardous Waste Storage

K-770 Scrap Metal Yard

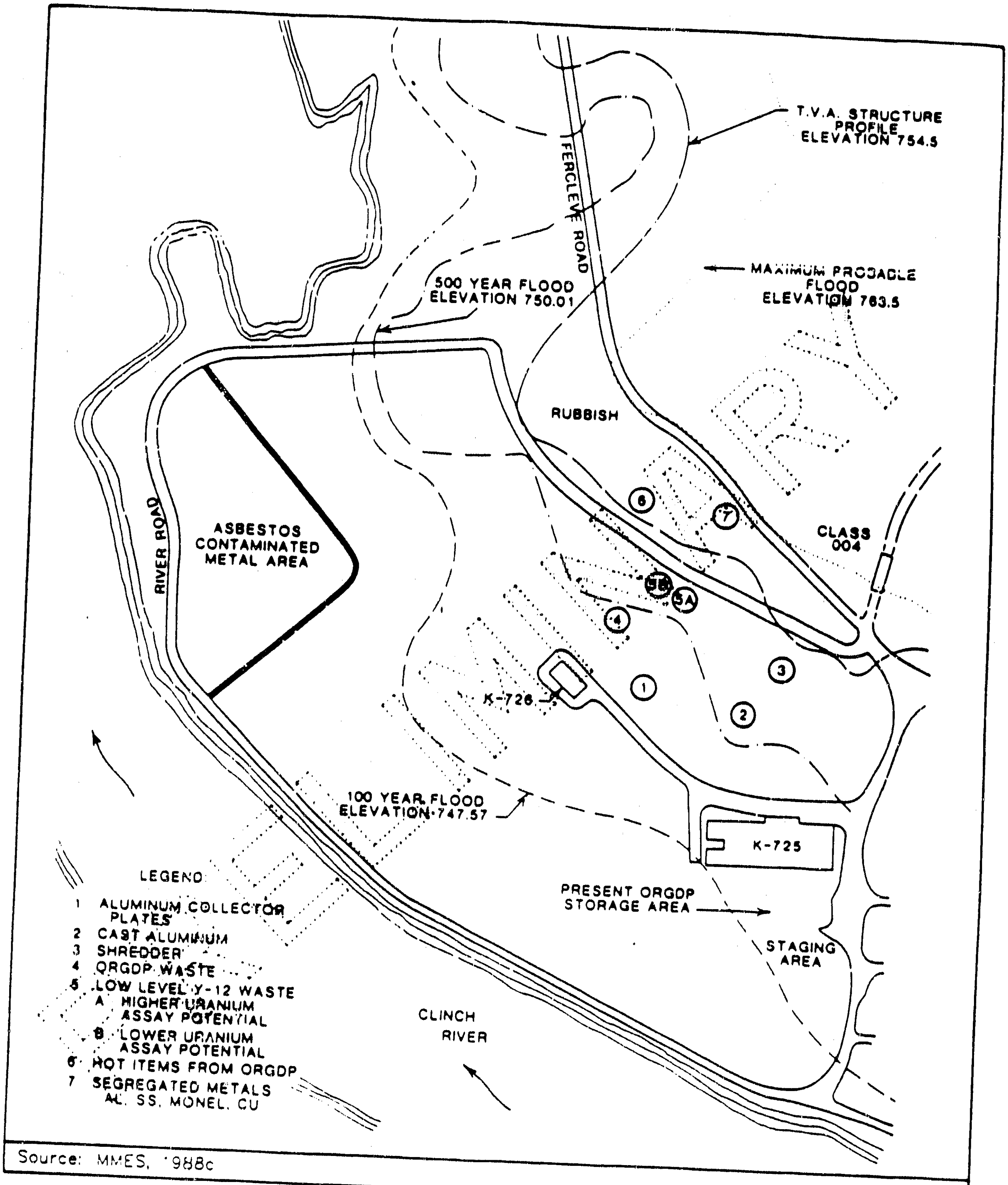
Operation and upgrading of the equipment for the production of enriched uranium resulted in the generation of large quantities of radioactive scrap. The K-770 Scrap Metal Yard at the old powerhouse area is used for the storage of radioactively contaminated scrap (Figure 4-4). Presently the K-770 Scrap Metal Yard receives wastes only from ORGDP. In the future, radioactive scrap generated at Y-12, and possibly from the past manufacturing of gas centrifuge equipment, will be sent to K-770.



Source: Ambrose, 1987

FIGURE 4–3

WASTE MANAGEMENT SCHEME FOR LLW OR MIXED WASTE AT THE ORGDP
ORGDP – OAK RIDGE, TN



Source: MMES, 1988c

FIGURE 4–4

K–770 SCRAP METAL YARD
AND CONTAMINATED DEBRIS SEGREGATED MATERIALS LOCATIONS
ORGDP – OAK RIDGE, TN

Until 1984, scrap metal was piled randomly throughout the yard, with much of the contaminated scrap being stored in the floodplain. There was no segregation by metal type, or by type and degree of contamination. The types of contaminants on the material handled, in addition to radionuclides, included PCBs, mercury, and prior to 1977, asbestos.

In 1984 Quadrex Corporation was hired by Martin Marietta Energy Systems (MMES) to move the scrap out of the floodplain, size-reduce the scrap, and segregate the scrap into piles of similar types. All scrap was removed from the floodplain and segregated into piles. Ten acres of soil where the scrap was stored remain that are contaminated with asbestos and radionuclides. Seven waste categories were established as follows (MMES, 1988c):

- Asbestos-Contaminated Metal - In an attempt to remove asbestos from smooth metal surfaces, a staging area was established and the metal was rinsed with high-pressure water. After rinsing, the material was stacked directly adjacent to the initial removal area. A fine, visible film of asbestos remains on the metal. Approximately 300 tons of material remain with present plans calling for disposal at the Y-12 low-level asbestos disposal ground (Scheib, 1986).

- Rubbish - Nonmetallic items in the rubbish pile include rags, paper, telephone poles, wooden pallets, and glass. Metallic items make up the majority of the pile and include galvanized steel, nonseparated mixed metal parts, instrument cabinets with tubing and wiring, motors, and insulated wiring. Sixteen thousand tons of rubbish remain, with final disposition not determined at the time of the Survey (Scheib, 1986).

- Cast Aluminum - Decontamination of porous cast aluminum is difficult. The material was size-reduced by shearing. Three hundred tons remain, with final disposition not determined at the time of the Survey (Scheib, 1986).

- Aluminum Blades - Approximately 3,000 drums of aluminum blades were redrummed by Quadrex due to the deterioration of the 208-liter (55-gallon) holding drums. The majority of the drums are stored in building K-704. Three hundred drums previously stored in the floodplain at the powerhouse were shipped to the K-25 Building for storage. These blades will remain in storage until final disposition is determined (Scheib, 1986).

- Items with Hot Spots Above Acceptable Limits - During segregation of metal types at the Contaminated Scrap Metal Yard, Quadrex was given upper limits [250,000 disintegrations per minute (dpm) or 100 millirads per square meter (mr/m^2)] on radiation contamination of metal that could be placed into long-term storage piles. Approximately 100 tons of this unacceptable material exists at the Contaminated Scrap Metal Yard. Options to be investigated include decontamination at K-1420 or inclusion of "hot spot" items with the scrap metal decontamination project. Final disposition was not determined at the time of the Survey (Scheib, 1986).

- Segregated Metal - During the metal segregation project, the metal throughout the scrap yard was placed in separate piles according to metal type. The five categories of long-term storage piles are ferrous, copper, stainless steel, aluminum, and special metals (monel, nickel, etc.). The ferrous category has undergone size-reduction by shearing. There are 1,350 tons of aluminum, 130 tons of stainless steel, 30 tons of special metals, 25 tons of copper, and 17,800 tons of ferrous materials. ORGDP has requested proposals for decontamination (Scheib, 1986).

- Class 004 - This category includes scrap metal items which were too large to process directly with the shear and items such as compressor nozzles which contain several metal types. One thousand tons of material are in this category (Scheib, 1986).

Currently there are no methods known to ORGDP to decontaminate the scrap to levels that would allow its release for unrestricted use. ORGDP has issued a Request for Proposal (RFP) for decontamination of the scrap. Assuming that technically feasible and economically practical decontamination procedures are made available, scrap decontamination would be conducted at ORGDP. The existing scrap inventory as well as scrap from DOE Oak Ridge-managed facilities would be handled.

DOE has not promulgated any <u>de minimis</u> levels for radioactivity in scrap at this time. These are levels of radioactivity, which, if not exceeded would allow the scrap to be released for unrestricted use. Such levels would be required if decontamination would reduce the radioactivity levels to low but still detectable concentrations and the scrap were to be released for unrestricted use.

Radioactive Container Labeling

Radioactive wastes are generated at various points within ORGDP and accumulated in drums near the point of generation. In some cases nonradioactive solid wastes are also generated in the same vicinity and are also accumulated in drums. ORGDP uses labels on the drums to indicate the types of wastes in each drum. However, the labels presently employed can lead to some confusion. Both low-level radioactive waste containers and nonradioactive, nonhazardous waste containers are green and have on the label in bold letters the word NON-HAZARDOUS. Containers holding radioactive wastes contain a tag; close inspection indicates that the waste is radioactively contaminated. This labeling practice could result in radioactively contaminated wastes being inadvertently handled as nonradioactive wastes (see Finding 4.1.2.4.3).

K-1421 Incinerator

The ORGDP formerly operated an incinerator for the burning of solid and combustible uranium-contaminated waste. It is a gas-fired furnace designed to operate on natural gas or propane. Ash was shipped to the FMPC (Fernald) for recovery of uranium. Currently three hundred 5-inch containers of ash are being stored in Vault 16-A. These containers cannot be shipped to Fernald until they are repacked into upgraded shipping containers to meet new U.S. Nuclear Regulatory Commission (NRC) standards as required by U.S. Department of Transportation (DOT) shipping regulations. Currently the K-1421 Incinerator is not in use. It was taken out of service due to its inability to meet state opacity regulations.

K-1070-C/D Classified Waste Disposal

Classified wastes are defined as any waste which reveals or may reveal restricted information because of its function (e.g., functional use in or association with a classified program), shape or configuration, or materials of construction, or because classified material to which it has been exposed has not been removed, or for any other reasons determined by an authorized classifier. Classified wastes can include radioactive and hazardous wastes.

Classified wastes are disposed of at the K-1070-C/D Classified Burial Ground. This 22-acre site has been used for disposal of classified low-level radioactive and nonradioactive waste materials and equipment since 1975. Materials are buried in trenches. All material is covered daily with dirt. ORGDP currently does not dispose of hazardous wastes or liquids into the Classified Burial Ground.

The trench operations have been used since the site was opened in 1975. Eight pits located on the southwest portion of the facility were used for the disposal of hazardous wastes including laboratory quantities of corrosives, oxidizers, reducing agents, and chemical and pesticide containers. One pit was used for the disposal of drum quantities of various solvents and organics. Materials buried in the trenches include packaged asbestos from classified operations (MMES, 1987b).

The K-1070-C/D Classified Burial Ground does not have any state permits. Groundwater monitoring wells have been installed around the disposal areas. ORGDP has prepared an RFI Plan for K-1070-C/D. See Sections 3.4.2, 3.4.4.3.1, and 4.5.2.3.1 for additional details.

4.1.1.3 Mixed Wastes

Mixed wastes are defined for RCRA purposes as hazardous wastes that also contain radioactive constituents. For purposes of this discussion, the term "mixed wastes" will also include PCB and asbestos wastes, which also contain radioactive constituents. Until May 1, 1987, DOE had maintained that RCRA regulations did not apply to those hazardous wastes containing radioactive constituents due to a statutory exemption for wastes subject to regulation under the Atomic Energy Act. DOE orders and guidelines did state that DOE facilities should adhere to the technical though not procedural requirements of RCRA regulation. On May 1, 1987, DOE and EPA jointly agreed that hazardous mixed wastes would be subject to RCRA regulations for hazardous constituents and DOE regulations for radioactive constituents. Thus hazardous mixed wastes would be subject to two sets of regulations.

The ORGDP has adhered to both the procedural and technical aspects of RCRA regulations even though adherence to procedural requirements was not required by DOE. TSD facilities managing hazardous mixed waste had obtained interim status, and had been included in the RCRA Part B permitting process. Thus DOE's policy change had no practical effect on the ORGDP.

The management of mixed wastes, including their treatment, incineration, and disposal, is complicated by the presence of radioactive constituents. Normal options for TSD of hazardous and PCB wastes cannot be used for mixed wastes. For example, commercial facilities will not handle mixed wastes. Thus until the K-1435 Incinerator works off the existing inventory, DOE cannot adhere to the requirements that certain PCB wastes be stored for no longer than 1 year prior to destruction, since no commercial facilities will accept PCB wastes with radioactive constituents. Sanitary landfills, which ordinarily accept double-bagged asbestos wastes, will not accept radioactively contaminated asbestos waste.

The ORGDP has a variety of mixed waste storage, treatment, and incineration facilities. (The facilities used for the management of mixed wastes have been listed and described previously in Section 4.1.1.1.) However, ORGDP does not have any on-site disposal facilities presently utilized for radioactive and/or mixed wastes. This results in need for long-term storage facilities until disposal options become available. The TSCA Incinerator will be used for incineration of incinerable mixed wastes, including all PCB wastes and some hazardous wastes. The operation of this incinerator will enable ORGDP and Oak Ridge-managed DOE operations (FMPC, RMI, PORTS, PGDP, Y-12, ORNL) to gradually reduce the amount of incinerable wastes in storage. However, this reduction will take place over several years and presumes that the incinerator fulfills permit conditions and achieves projected capacity, and that significant quantities of new wastes (e.g., from cleanups) are not generated.

The K-1435 Incinerator will not solve all the problems resulting from the lack of disposal sites for radioactive and mixed wastes. Among the larger-quantity wastes that will require the development of disposal options are the following:

- K-1435 Incinerator Ash - Successful delisting (see Section 4.1.1.1) would still result in the ash being a radioactive waste. (Approximately 35,000 cubic yards (76761 cubic meters) will be generated yearly.)

- K-1232 Inorganic hazardous radioactive sludge currently in storage.

- K-1407-B and K-1407-C Pond stabilized and non-stabilized sludges both containing radionuclides.

- Radioactive chemicals and sludges from the Cascade Improvement Program/Capital Upgrade Program (CIP/CUP) programs and production facility phaseouts.

Currently ORGDP plans to store stabilized K-1407-B and K-1407-C Pond sludges in containers aboveground at the K-1417 storage area. The process buildings are being utilized for the long-term storage of non-incinerable mixed wastes, K-1435 Incinerator ash, and radioactive wastes and equipment (see Section 4.1.1.1 for description of storage facilities). The storage facilities generally meet applicable regulatory requirements and good management practices. However, long-term storage even in adequate facilities does not eliminate the need for the development of disposal sites for radioactive and mixed wastes (see Finding 4.1.2.2.1).

4.1.1.4 Solid Wastes

Solid wastes are defined as those wastes which are not considered hazardous or PCB wastes and do not contain radioactive constituents. Solid wastes include sanitary waste (garbage), construction and demolition debris, oils and lubricants, nonhazardous sewage treatment plant sludges, and asbestos wastes. The disposal of classified wastes, which often are solid wastes, is discussed in Section 4.1.1.2.

Sanitary wastes are collected from throughout the site in dumpsters. The contents of the dumpsters are transported to Y-12 for disposal since ORGDP does not dispose of sanitary wastes on-site.

Sludge produced by the K-1203 sanitary sewage treatment plant, construction and demolition debris, and fly ash from ORGDP is disposed of at Y-12. None of the wastes disposed of either in the past or currently had hazardous or radioactive constituents. Section 4.5.1.1. discusses the Old Contractors Burial Ground (K-1070-F), and the New Contractors Burial Ground (K-1070-G) which are no longer used by ORGDP.

Various oils and lubricant wastes produced by ORGDP are being stored at the K-1425 storage facility for use as a fuel in the K-1435 Incinerator.

During the operation of the uranium enrichment process, hexavalent chromium-containing RCW blowdown was treated in an ANDCO reduction unit to reduce hexavalent chromium. The precipitated metal hydroxide sludge produced in the treatment process was discharged into the K-901-A pond. The sludge when tested proved to be nonhazardous. This waste is no longer produced, since the enrichment process facilities are no longer in operation.

Nonradioactive asbestos wastes are generated as the result of asbestos removal. Wastes are double-bagged and disposed of off-site at Y-12.

4.1.2 Findings and Observations

4.1.2.1 Category I

None

4.1.2.2 Category II

1. Treatment, storage, and disposal capacity. The long-term storage and accumulation of mixed wastes (hazardous and/or PCB and radioactive), on-site, due to the lack of treatment and/or disposal alternatives, increases the potential for the release of hazardous, PCB, or radioactive constituents into the environment. Examples of such waste include:

- TSCA Incinerator ash (even if delisted as a hazardous waste it will still be a low-level radioactive waste;
- K-1232 inorganic hazardous radioactive sludge currently stored in K-300-1;
- Stabilized and non-stabilized sludges and contaminated soils from the K-1407-B and K-1407-C ponds; and
- Radioactive and hazardous chemical wastes and chemicals from the CIP/CUP phaseout;
- Radioactive and mixed wastes resulting from phaseout of the production facilities.

The ORGDP process buildings have been designated to serve as the long-term storage areas for mixed and radioactive wastes from DOE/ORO facilities [ORGDP, Y-12, ORNL, PORTS, PGDP, RMI (DOE wastes only), FMPC]. Waste storage areas in the process buildings include the following:

- K-301-1 Vault 4 Hazardous Waste Storage Facility
- K-306-1 Vault 23A Hazardous Waste Storage Areas
- K-311-1 Radiogenic Lead Storage Vault
- K-305 Vault 19 and 19-B Hazardous Waste Storage Areas.

These storage areas presently meet RCRA and TSCA storage standards but will require continual maintenance and inspection to ensure that waste containers remain in sound condition. In respect to PCB wastes, it should be noted that although most PCB wastes will eventually be incinerated, most will be incinerated after the 1-year storage deadline applicable to certain PCB wastes (40 CFR 761.65) has passed.

Stabilized and non-stabilized K-1407-B Pond and 1407-C Pond sludge and contaminated soil will be stored aboveground in drums at the K-1417 Storage Area. These stabilized sludges are considered a mixed waste for which disposal options do not exist. In the event that ORGDP is successful in obtaining a delisting from EPA, the stabilized sludges could then be disposed of as a low-level radioactive waste, assuming disposal capacity for low-level radioactive wastes would be available.

The K-1435 Incinerator ash is also considered RCRA mixed waste. Currently ORGDP plans to store the ash in one of the RCRA permitted storage areas in the process buildings. It is ORGDP's intention to request delisting of the ash, preferably in a non-solidified form. Assuming the delisting petition is successful, the sludges, whether in a non-solidified or solidified form, would still require disposal in a low-level radioactive waste disposal site. If the delisting petition is unsuccessful (perhaps due to leachable metallics), there would be no presently existing mixed-waste disposal site available, and indefinite storage would be required.

Currently ORGDP intends to use the K-1419 fixation plant only for the solidification of the K-1407-C Pond sludges, and, if required, for the K-1407-B Pond sludges. A recent directive issued by EPA discussed a joint EPA and NRC approach for the aboveground disposal of solidified mixed wastes (EPA, 1987b). Thus if ORGDP is unsuccessful in obtaining a delisting for the K-1435 Incinerator ash, it is highly probable that indefinite operation of the K-1419 fixation facility would be required for solidification of the Incinerator ash.

All PCB-containing wastes (liquids, sludges, soils, etc.) and incinerable hazardous mixed wastes will be incinerated at the K-1435 Incinerator, according to current plans. It has been estimated that at least 5 to 7 years will be required to incinerate the present inventory of wastes, both in storage at ORGDP and at the various DOE/ORO facilities. Several assumptions are made: (1) significant increases in routinely generated incinerable wastes do not occur; (2) significant quantities of cleanup and spill wastes are not generated; (3) incinerator down-time is as anticipated; and (4) the incinerator complies with TSCA and RCRA permit conditions. In the event that any of these assumptions turns out to be wrong, long-term storage of these wastes will continue to be required and increased storage capacity will very likely be required.

Decontamination and decommissioning of the process buildings would also generate a large though presently non-determinable quantity of mixed and low-level radioactive wastes. These wastes are likely to be nonincinerable, since they would consist principally of process equipment and sludges from the K-1420 Decontamination Facility. The quantity of contaminated process equipment will be dependent on the development of scrap decontamination levels and promulgation of de minimis levels for radioactivity in scrap metal (see Section 4.1.1.2 discussion on K-770 scrap yard).

The development of scrap decontamination methods and promulgation of de minimis radioactivity levels in scrap will have an impact on the decommissioning of the process buildings. The costs of decommissioning will be affected by the availability and costs of scrap decontamination methods. This in turn will affect the need for mixed waste and low-level radioactive waste disposal facilities.

2. Storage container conditions. Leaking and/or deteriorating drums of wastes observed in certain areas resulted in actual or potential releases of wastes to the environment. The Survey team observed the following:

- K-792 switchyard: 60 to 70 drums of hazardous waste (TCE), waste oils and unknowns (potentially containing PCBs), and evidence of leakage and/or spillage. The ground was stained. As of March 23, 1988, the leaking drums were removed or overpacked and the leakage soaked up. Forty-four drums still remained as of March 24, 1988.

- K-1200: 60 drums, most containing waste organic fluid, were being stored. One drum was observed to be leaking and several were in poor condition. Leakage would be carried by stormwaters to a nearby storm drain.

- K-1004-T: Approximately 20 drums of unknowns were being stored. Several were severely corroded.

- K-770 Yard-Scrap Metal Shearer Building: Seven drums of waste oil and antifreeze, most in a deteriorated condition, were stored in the vicinity of the Shearer Building. Behind the Shearer Building adjacent to a loading dock, a pool of approximately 1,893 liters (500 gallons) of an oil/water mixture was observed. The source of the oil appeared to be a tank of hydraulic fluid and trench surrounding the process equipment, which leads to the pit. This building and area were used in the scrap metal segregation and size-reduction program by a contractor (see Section 4.1.1.2 discussion on K-770).

4.1.2.3 Category III

1. <u>Integrity testing of underground storage tanks</u>. The lack of integrity testing of underground regulated substance tanks could result in the undetected release of hazardous materials to the soil and/or groundwater. Various USTs at ORGDP contain regulated substances (gasoline, diesel fuel, chemicals, hexavalent chromium) and are subject to RCRA Section 280 requirements. These requirements presently include initial reporting of existing tanks to designated state agencies and requirements relating to release reporting and cleanup. In the future, EPA will promulgate technical requirements including monitoring, integrity testing, spill detection, and containment of spills.

   ORGDP has not tested most of the tanks containing regulated substances. Many of these tanks have a high potential to have leaked for reasons including their age, lack of corrosion protection, and the enhanced potential for corrosion of metallic tanks at ORGDP. The concrete cooling tower basins for RCW, which contain hexavalent chromium at a 6-8 parts-per-million (ppm) concentration, were used for periods ranging from 30 to 40 years. They were not integrity tested and monitoring wells have not been installed. Leakages of tens of thousands of gallons per day could have occurred and have been undetected in the water balance, due to the large daily throughput of the system (i.e., hundreds of millions of gallons per day) when it was in operation.

   Several steel tanks containing fuels do not have any corrosion protection. However, the underground steel piping conveying the hexavalent chromium-containing RCW did have cathodic protection, installed when it was discovered that the operation of gaseous diffusion plants resulted in stray ground currents which increased electrolytic corrosion of even coated underground steel tanks and pipelines. Thus the potential for leakage from ORGDP fuel tanks that did not have corrosion protection may have been increased.

   The need for integrity testing is increased since none of the USTs at ORGDP have leak detection devices. Thus, even in cases where corrosion protection has been installed (e.g., cathodic protection on RCW pipelines, and K-1414-1, K-1414-2, K-1414-3 fuel tanks), its effectiveness has not been evaluated. Cathodic protection devices must be properly installed and maintained to be effective.

4.1.2.4 Category IV

1. Waste accumulation areas. Releases of hazardous substances and/or wastes may occur from WAAs lacking secondary containment and/or impermeable surfaces. The Survey identified the following problems at WAAs, listed in Table 4-11.

The ORGDP generates wastes at a number of points. This results in the need for WAAs for the temporary accumulation of wastes including hazardous radioactive and mixed wastes. RCRA requirements applicable to WAAs include labeling and removal of wastes to permitted storage areas or treatment and/or disposal facilities within 90 days. The RCRA requirements for permitted storage areas of impermeable surfaces and secondary containment are not required for WAAs. However, since the types of wastes stored may include radioactive, mixed and PCB wastes in addition to hazardous wastes, good management practices would require adherence to these requirements for WAAs.

2. Incomplete UST inventory. The preparation and submission of an incomplete inventory of USTs containing regulated substances may result in the releases of hazardous substances to the soil and/or groundwater from USTs that are neglected or not properly closed. USTs containing regulated substances are subject to RCRA Section 280 reporting requirements. Regulated substances include chemicals listed in Section 101.14 of CERCLA, and petroleum and substances derived from petroleum (e.g., gasoline). In addition ORGDP is not in compliance with RCRA Section 280 reporting requirements which require facilities to report all existing USTs to designated state agencies by May 1986.

The notification made by ORGDP was incomplete. The Survey found tanks that are not on the ORGDP inventory. Table 4-8 describes tanks reported by ORGDP, and Table 4-9 describes tanks not reported but identified during the Survey. ORGDP stated that an updated report will be filed with the state. Finding 4.1.2.3.1 also discusses USTs.

3. Unloading station K-1420-A flammable waste storage tank. Inadequate secondary containment at the K-1420-A flammable waste tank drum unloading station may result in the release of flammable liquid wastes. Drums containing flammable liquid wastes are placed on a steel pan while contents are being pumped into the tank. The Survey team observed that the lip of the pan had been bent, negating its intended purpose (spill containment). The lip was fixed on 3/23/88.

TABLE 4-11

WASTE ACCUMULATION AREA OBSERVATIONS
ORGDP - OAK RIDGE, TN

Area	Material	Observations
K-1401	30 drums waste oil and coolant	No containment, permeable surface
K-1098-E	4 drums waste oil	No containment, permeable surface
K-770	5 drums antifreeze	No containment
Shearer Building K-770 Area	2 drums waste oil, pit containing 500 gallons is of oil/water mixture	No containment, permeable surface, stained soils
K-892-H	25 drums waste oil/sludge in three areas	No containment, permeable surface, stained soils
K-1004-T	20 drums unknowns	No containment, organic odor
K-1200	60 drums waste organic fluid	No containment, storm drain nearby
K-792 Switch-yard	60 to 70 drums waste oil, PCBs, hazardous waste and unknowns	No containment, semi-permeable surface, spills and stains, storm drain nearby as of 3/23/88, leaks and spills cleaned up; 44 drums remain as of 3/24/88
K-1004 Laboratory	Approximately 40 drums acids, bases, organics, and rad wastes	Leaky roof, drums in water; after rain, water can exceed capacity of WAA containment
K-1414	25 drums waste oil; 6 pallets lead batteries	No containment
K-633	400-gallon waste oil tank outside K-633	Tank dike half full of oil

Source: DOE Survey team

Note: The above list is not intended to be comprehensive.

4. Radioactive waste labeling. The lack of unique identification labels for low-level radioactive waste drums could result in mishandling such wastes. Low-level radioactive waste drums as well as nonradioactive waste drums are boldly labeled "NON-HAZARDOUS" on green labels. Only upon close inspection of the low-level radioactive waste drum labels is it possible to determine than the waste is radioactively contaminated.

4.2 Toxic and Chemical Materials

4.2.1 Toxic Substance Management

It is the stated policy of the ORGDP management to "effectively manage the procurement, transportation, storage, use, and disposal of all hazardous materials to adequately protect plant personnel, the public, and the environment from hazards associated with such materials" (MMES, 1987c). It is the Hazardous Materials Coordinator's (HMC's) responsibility to direct and coordinate this program. Some of the HMC's major functions include:

- Providing training, guidance, information, and assistance concerning management of hazardous substances.
- Conducting audits of the hazardous substance management program.
- Evaluating the hazardous properties of materials in use at the facility and maintaining the hazardous materials list.
- Developing and implementing a written hazard communication program that is available to all interested parties.
- Providing criteria and training for labeling and other types of warning in accordance with Federal regulations.
- Obtaining material safety data sheets (MSDSs) for all hazardous materials used at the plant, maintaining a file, and making these accessible to all employees.
- Reviewing purchase requisitions for all materials to assess hazards and quantities purchased.
- Coordinating the hazard rating process and providing the information to users.

The HMC has approximately 6,200 MSDSs on file and cooperates with the corresponding HMCs at the Oak Ridge X-10 and Y-12 facilities.

4.2.2 Toxic Chemical Use and Storage

Many toxic substances are in use at ORGDP. However, most of these substances are used in relatively small quantities (e.g., laboratory reagents) and this discussion will be concerned primarily with materials used in appreciable quantities.

4.2.2.1 Bulk Liquid Chemicals and Fuels Storage

Several hazardous materials are stored in large quantities in aboveground storage tanks at many locations throughout the plant. The major liquid substances in storage include fuel oil, lubricating oil, hydrochloric acid, nitric acid, sulfuric acid, PCBs, plating solution, potassium hydroxide solutions, sodium hydroxide solutions, trisodium phosphate solution, and 1,1,1-trichloroethane (see Table 4-12). The Survey team visually inspected most of these tanks for leaks, secondary containment, and appropriate labeling. The majority of these storage facilities were in compliance with the regulations and good industrial practice, but six sites were deficient due to leaks and/or inadequate secondary containment. The specific hazardous material tank and the problems observed are discussed in Finding 4.2.6.4.1.

4.2.2.2 Small-Quantity Liquid Chemical Storage Areas

Some hazardous materials are stored in moderate quantities at or near the sites in which they are used. Generally, these substances are stored in quantities of 55 gallons or less. The Survey identified three areas that contained 55-gallon drums of solvents that lacked adequate secondary containment, corroded drums, or leaking drums. The type of substance, the storage sites, and the problem observed are discussed in Finding 4.2.6.4.1.

4.2.3 Polychlorinated Biphenyls

There are many sources of PCBs and PCB-contaminated materials at ORGDP. Martin Marietta Energy Systems' policy is to remove from service all PCB items regulated by Federal and state laws by the end of 1988 (MMES, undatedd). Although strict adherence to this policy may not be possible at every facility, it is the corporation's goal to phase out PCBs to the maximum extent practicable as rapidly as possible.

Since a permanent shutdown of some ORGDP facilities has been announced, a plan to deal with the PCBs present in the operations area has been developed (McCullough et al., 1988). The elimination

TABLE 4-12

MAJOR ABOVEGROUND STORAGE TANKS
ORGDP - OAK RIDGE, TN

Hazardous Material*	Quantity (gallons)	Location
Sulfuric Acid	1,000 15,000 3,500 - 12,000	K-892 K-894 K-1407-A K-1419 K-1501
Hydrochloric Acid	10,000 32,300 10,000 - 1,450	K-892-Q K-1401 K-1404 K-1419 K-1420
Nitric Acid	1,450	K-1420
Sodium Hydroxide Solution	4,200 500	K-1401 K-1420
Trisodium Phosphate Solution	4,000	K-1401
Aluminum Sulfate Solution	6,000	K-1515
Nickel Sulfate Solution	500	K-1420
Plating Solution	5,300	K-1420
1,1,1-Trichloroethane	8,000 10,000	K-1401 K-1404
Fuel Oil	600,000 15,000	West of K-1501 West of K-1501
Lubricating Oil	Two 15,000	South of K-1407-B
OCB Tap Changer Oil	5 x 4,000	Switchyards
Hydraulic Fluid	500	K-770
Mineral Oil	2 x 4,000	K-731
Oil	500	K-633

Source: Adapted from SPCC Plan (MMES, 1988d)

* PCB Storage is not included.

Note: The above list is not intended to be comprehensive.

or reduction of the PCB hazard requires a detailed knowledge of the PCB concentration in each piece of equipment in the areas of the plant that will be permanently shut down. In addition, the uranium content must be known. Thus, a sampling and analysis plan has been designed to obtain the necessary data. The data base will also include an inventory of all electrical equipment with descriptions and locations. Table 4-13 and Figure 4-5 present the essential features of the sampling and analysis program. Table 4-13 lists the samples required at each location and Figure 4-5 presents a schematic diagram of the analytical approach and disposition of the PCB items.

The transformer coolant containing PCBs in the concentration range of 50 to 2,600 parts per million (ppm) will be treated by one of the commercial processes available that destroys the PCB molecule and allows the resultant fluid to be recycled back to the transformer (McCullough, 1988). A process that uses sodium metal to remove the chlorine atoms from the PCB molecule was demonstrated on the coolant from a PCB transformer at ORGDP. The treated fluid had a PCB concentration of 3 ppm and was returned to the transformer. The treatment process resulted in the production of a waste sludge, which was disposed of by the vendor at a hazardous waste facility. Field tests by the vendor have shown that this process is not economical at PCB concentrations greater than 2,600 ppm.

4.2.3.1 PCB Sources

The major sources of PCBs in use or in storage for potential use are presented in Table 4-14 (Haymore, 1987b). The largest source of PCBs at this facility is the coolant fluid in the 120 PCB transformers and the 9,656 capacitors. These items are located in the process and support buildings, as well as in the electrical switchyards. The specific locations are listed in Table 4-14.

Since the process buildings are not currently in operation, 80 of the PCB transformers and the capacitors have been placed on a standby status. The U.S. Environmental Protection Agency (EPA-Region IV) has advised the DOE/ORO that these PCB items are not considered to be in storage for disposal, but are on a standby status for reuse or resale until DOE decides on the future use of the facility (Dennison, 1987). Storage for disposal would trigger the maximum 1-year holding period specified in the TSCA regulations for PCB wastes.

In addition to the PCB sou·ces listed in Table 4-14, PCBs are contained in 158 PCB-contaminated transformers and in PCB-containing wastes (liquids and solids). The PCB-containing wastes are discussed in more detail in Sections 4.1.1.1 and 4.2.3.3.

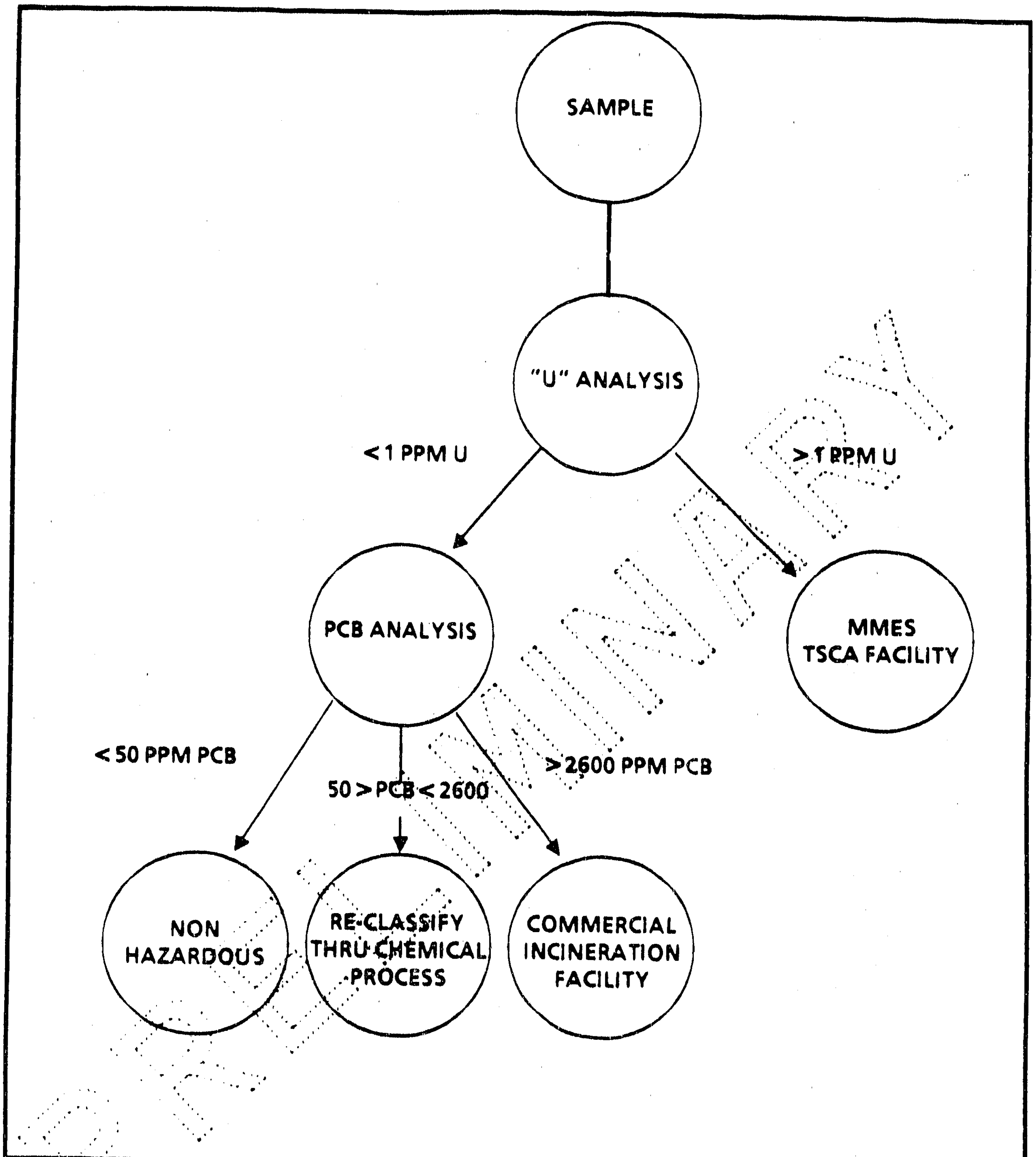
TABLE 4-13

PERMANENT SHUTDOWN
PCB SAMPLING AND ANALYSIS PROGRAM
ORGDP - OAK RIDGE, TN

Location/Electrical Equipment	Number of * Samples
K-33 Process Transformers	109
K-25 Cathodic Protection Transformers	32
K-709 Switchyard Spare Equipment	53
ORGDP Plant Distribution System Equipment	
K-633	8
K-702, 704, 707	10
K-801, 862, 892	32
K-1004-L	2
K-1037	23
K-1131	16
K-1301, 1303	7
K-1401, 1405, 1410	10
K-31 & K-33 Switchyards	135
K-27 Switchyard	16
TOTAL	453

Source: McCullough et al., 1988

* Includes 10% blanks



Source: McCullough et al., 1988

FIGURE 4-5

PERMANENT SHUTDOWN
PCB SAMPLING AND ANALYSIS PLAN
ORGDP - OAK RIDGE, TN

TABLE 4-14

MAJOR SOURCES OF PCBs
ORGDP - OAK RIDGE, TN

Source	Status	Location
30 PCB Transformers	In-Use	K-731, K-791, K-862, K-1037, K-1131, K-1301, K-1401, Y-12
19 PCB Transformers*	Spares	K-709, K-902-5, K-902-8
80 PCB Transformers	Standby	K-902-1, K-902-6, K-902-7, K-902-8
9,656 PCB Capacitors	In Service or in Standby	K-27, K-29, K-31, K-33
2 Storage Tanks (10,000 gal)	Storage	K-902-8

Source: Haymore, 1987b

* 9 of the spares are empty of coolant fluid.

4.2.3.2 Recordkeeping

The 1986 annual PCB Inventory (Haymore, 1987b) reports the total weight of PCBs in the PCB transformers, the capacitors, and fluid in storage for reuse as 1,088,877 kilograms (2,400,538 pounds). However, this weight is not correct as it was calculated by treating all coolant fluids present in the electrical equipment as consisting of PCBs, whereas the concentration of PCBs for the 30 PCB transformers still in use ranges from 503 to 2,460 ppm, which is a small fraction of the total fluid. The PCB annual report, a requirement of the TSCA regulations (40 CFR Part 761), specifically requires reporting "total number of PCB transformers and total weight in kilograms of any PCBs contained in the transformers" (see Finding 4.2.6.4.3).

Seven PCB transformers that were in outdoor storage at the Powerhouse Switchyard (K-709) are not listed in the annual inventory report. These transformers are identified in Table 4-15, and they appear to be intended for disposal (see Finding 4.2.6.2.2).

Quarterly inspection of PCB transformers is also required by the TSCA regulations. ORGDP conducts daily inspections of transformers in some areas, but these are not always documented. However, the mandated inspections have been reported as required by the regulations.

4.2.3.3 Storage of PCB Wastes

Large quantities of liquid and solid PCB wastes are stored at ORGDP. Most of these wastes will be disposed of by incineration utilizing the new TSCA Incinerator (K-1435). The major PCB waste storage areas include the following:

- K-306-1 PCB/Hazardous Waste Drum Storage Area - This facility is located in the west wing of the K-25 building and consists of a 3,200-square-foot area used to store radioactively contaminated PCB materials prior to disposal at the K-1435 TSCA Incinerator.

- K-306 23-A Hazardous Waste Storage - This facility is also in the K-25 building and is used for storage of hazardous wastes and PCB-contaminated soils and sludges. The permitted capacity is ~3,000 drums.

TABLE 4-15

PROBLEMS WITH PCB TRANSFORMERS
ORGDP - OAK RIDGE, TN

Transformer Identification	Observation	Location
Transformer B-700-A-38	Leaks; paper litter on floor	K-33
Transformer B-71PB	Leak	K-33
Transformer 314	Leak; gravel stained	K-792
Transformer K892-EN-13	Improper storage; not in PCB inventory	K-709
Transformer 226789	Improper storage; not in PCB inventory	K-709
Transformer 3411334	Improper storage; not in PCB inventory	K-709
Transformer 4929801	Improper storage; not in PCB inventory	K-709
Transformer 2668922	Improper storage; not in PCB inventory	K-709
Transformer 2668941	Improper storage; not in PCB inventory	K-709
Transformer (no number plate)	Improper storage; not in PCB inventory	K-709
Transformer 92PC	No PCB label (concentration 510 ppm)	K-27 Switchyard
Transformer 91PA	No PCB label (concentration 943 ppm)	K-27 Switchyard
Transformer 91PB	No PCB label (concentration 518 ppm)	K-27 Switchyard
Transformer A1	No PCB label (concentration 599 ppm)	K-862 Pumphouse
Transformer B2	No PCB label (concentration 621 ppm)	K-1037-B
Transformer D2	No PCB label (concentration 687 ppm)	K-1037-D
Transformer D3	No PCB label (concentration 524 ppm)	K-1037-D
Transformer D4	No PCB label (concentration 546 ppm)	K-1037-D
Transformer 7936848	No PCB label (concentration 618 ppm)	K-709 Powerhouse

Source: DOE Survey team

- K-1425 Waste Oil/Hazardous Wastes/PCB Storage Area - This facility is located on the east side of ORGDP and consists of a container storage building with a 2,000-square-foot storage area, a container staging area, and four 22,500-gallon storage tanks. These wastes will eventually be disposed of at the K-1435 TSCA Incinerator.

- K-726 PCB Waste Drum Storage Area - This building has a 35 by 75 foot storage area with a capacity of ~500 drums. At the time of the Survey, the 363 drums in storage contained PCB capacitors, light ballasts, PCB-contaminated soil, and kerosene.

- K-1435 TSCA Incinerator Tank Farm - Five of 17 storage tanks in this building were being used to store various PCB liquid wastes prior to incineration. There is also a PCB drum storage area in this building.

Storage of PCB wastes for disposal is mandated by the regulations to be in a designated area and must satisfy specific criteria to prevent or minimize a release of PCBs to the environment. Some problems were noted by the Survey team concerning the improper storage of PCB materials and deficiencies in a storage area. See Findings 4.2.6.4.1 and 4.2.6.4.4 for details. More information on the storage and management of PCB wastes is presented in Section 4.1.1.

4.2.3.4 Spills and Cleanups

The Environmental Management Department (EMD) has prepared the Oak Ridge Gaseous Diffusion Plant Spill Prevention Control and Countermeasure Plans for Oil, Hazardous Materials, and Hazardous Waste that includes procedures for PCB releases and cleanups (MMES, 1988d). This plan was updated in February 1988 and was prepared in accordance with the requirements of 40 CFR Part 112 using good engineering practices. The plan provides plant personnel with the information required in the event of a spill. For example, the locations, physical state, and quantities of PCB items are presented along with a step-wise procedure to follow in the event of a spill. In addition, the locations of spare drums and sorbent material to contain and clean up a spill are presented.

During an inspection of PCB- and PCB-contaminated transformers, the DOE Survey team observed some leaking transformers and evidence of past leaks (see Finding 4.2.6.2.1 for details).

4.2.4 Asbestos

4.2.4.1 Background

Asbestos has been extensively used at ORGDP in building construction materials (transite), for heat insulation (steam pipes, heating ducts, boilers, tanks, etc.), in some cooling towers (Munter's Fill), in the cascade process buildings, and for other miscellaneous applications. A list of ORGDP facilities that contain asbestos includes 264 buildings in the plant (ORGDP, undated). Some of the buildings were placed on this list because they have vinyl asbestos floor tile. Current plant policy controls inventory additions of asbestos and asbestos-containing material (ACM) by requiring written justification with Division Manager/Director approval. All ACM must be properly labeled when received from the vendor.

The stated philosophy of the plant's management is that exposure to airborne asbestos fibers be maintained at or reduced to the lowest practical level using conventional control techniques MMES, 1985c). The Industrial Hygiene Department (IHD) has the responsibility to interpret regulations and ensure compliance with applicable Federal, state, and corporate standards. The IHD performs inspections, conducts air monitoring of work areas, helps to identify the presence of friable asbestos, maintains appropriate records, compiles quarterly reports on the quantity of asbestos removed, and reports this information to the EMD. If more than 15 square meters of asbestos is removed, the EMD must notify the DOE/ORO.

4.2.4.2 Removal

Removal of asbestos and ACM is generally done by plant personnel. Employees approved to work with asbestos must have received training in the proper procedures for working with asbestos, must be designated as a respirator wearer, and must be a participant in a medical surveillance program. Fourteen employees have received the EPA training course and are qualified to work on asbestos removal projects. Also, the National Asbestos Council's 1-day course is presented annually, and videotapes are available to supplement the EPA course. The IHD maintains a list of persons qualified to work with asbestos.

Asbestos and ACM are significant problems in the permanent shutdown of some facilities at the ORGDP because friable asbestos is present in the process buildings and major tie-lines between facilities. The Survey team observed extensive areas in Building K-25 where asbestos and ACM were in an advanced state of deterioration. The gaseous diffusion process has been shut down for some time and many sections of this facility are closed and posted with warning signs. However, some areas of this complex are being used for storage of wastes and other materials. The friable condition of the asbestos in the facilities that have been shut down is largely due to the age of the buildings, extremes of heat and cold, humidity and water damage, and lack of maintenance (Crump et al., 1988).

The Survey team also found friable asbestos in the steam tie-lines between the K-25 and K-27 facilities (see Finding 4.2.6.4.2). Some of the asbestos had fallen to the ground in at least one area. The deterioration of asbestos in outdoor facilities is due to the action of constantly fluctuating temperatures, wind, ice, rain, and a lack of maintenance. For example, when the tie-lines were in service they were heated and were able to repel rain and ice. The sections of the tie-lines that have friable asbestos have been enclosed in plastic material until the asbestos can be removed. The removal project was scheduled to be started in May 1988 (Haymore, 1988).

The results of a feasibility study on the permanent shutdown of the diffusion facilities were reported in March 1988. This study has identified friable asbestos sites and the highest priority removal areas. The ORGDP staff plans to remove approximately 450,000 square feet of friable asbestos from inactive areas of the plant and encase 41,000 square feet of asbestos on the tie lines that will remain active. Table 4-16 lists these friable asbestos sites and the quantity to be removed at each location. The highest priority sites contain about 267,000 square feet of friable asbestos and are scheduled to be removed first. Table 4-17 lists these first priority sites and the quantities present at each location. Additional information is presented in Section 3.1.2.

4.2.4.3 Disposal

All asbestos-bearing wastes (e.g., scraps, debris, contaminated clothing, etc.) are placed in double plastic bags, labeled, and promptly removed from the work area. This waste is disposed of in a landfill at the Oak Ridge Y-12 facility. The Y-12 Centralized Sanitary Landfill II has been permitted by the Tennessee Department of Health and Environment (TDHE) for the disposal of nonradioactive asbestos.

TABLE 4-16

FRIABLE ASBESTOS SITES
ORGDP - OAK RIDGE, TN

Facility	Quantity (square feet)
K-25	115,000
K-27	14,000
K-29	6,000
K-31	41,000
K-33	27,000
Electrical Systems	19,000
Tie Lines	152,000
K-413	6,000
K-631	32,000
K-633	6,000
K-1131	10,000
K-1423	2,000
Other	20,000
TOTAL	450,000

Source: Adapted from Crump et al., 1988

Note: Does not include transite, shingles, or tower fill; includes 41,000 square feet on lines which will remain active.

TABLE 4-17

FIRST PRIORITY ASBESTOS REMOVAL AREAS
ORGDP - OAK RIDGE, TN

Facility		Quantity (square feet)
Tie Lines	K-25/K-27/K-631	36,000
K-25	Pipe gallery - Steam Red. Stat. (49)	5,000
K-27	Pipe gallery	3,000
K-633	Compressor testing building	6,000
K-27	Remainder of building	10,000
K-25	Remainder of building	88,000
K-701	Boiler house	2,000
Tie Lines	Remainder	117,000
TOTAL		267,000

Source: Adapted from Crump et al., 1988

Note: Lower priority areas = 138,000 square feet

4.2.5 Pesticides

4.2.5.1 Background

ORGDP uses a variety of herbicides, algicides, insecticides, and rodenticides to control and/or eliminate pests. The insect and rodent control program is managed by the Janitorial Department and is concerned with treating cafeterias, offices, and changehouses to control pests. An outside contractor is sometimes used for the application of insecticides in food handling areas. The control of vegetation around railroad tracks, switchyards, security fences, and gravel areas is managed by the Roads and Grounds (R&G) Department. The R&G Department is also responsible for treating the ponds throughout the facility for the control of algae.

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) requires that supervisors involved in the application of pesticides be certified by the State of Tennessee. ORGDP has two supervisors in the R&G Department and one in the Janitorial Department that have been certified. Also, the personnel involved in the application of pesticides receive training through a course taught at the University of Tennessee.

Necessary precautions are taken to ensure that all pesticides are applied in a safe and environmentally acceptable manner. For example, employees are required to wear safety equipment during application, herbicides are not applied during inappropriate weather conditions, and application of pesticides is generally conducted during the second shift when fewer workers are at the facility.

4.2.5.2 Pesticide Inventory and Storage Facilities

The pesticides currently used at the plant are shown on Table 4-18 (Tharpe, 1988). Pramitol is used in the largest quantity (4,650 pounds per year); it is a nonselective herbicide that controls most annual and many perennial broadleaf weeds and grasses, generally for a full season or longer. Roundup is also used in appreciable quantities to control grass and weeds, as well as many tree and woody brush species.

Pesticides are stored at two locations. Building K-1025-B contains the herbicides and those insecticides used to control soil and plant insects. The building was clean with the pesticides neatly arranged on separate pallets. The small building is diked to provide secondary containment, is properly labeled, and is kept locked with access only by authorized personnel from the R&G

TABLE 4-18

PESTICIDE INVENTORY
ORGDP - OAK RIDGE, TN

Insecticides and Rodenticides	Quantity on Hand (March 1988)	Estimated 4th Quarter Usage
Bolt Insect Spray	-0-	~3 gallons
Bolt Aerosol for Flying Bugs	23 cans	25 cans
Bolt Liquid Airborne	-0-	25 gallons
Bolt Liquid Crawling	-0-	30 quarts
Bolt Liquid - P550	25 gallons	1 quart
Bolt Liquid - R-3000	1 gallons	---
Bolt Liquid - P-3610	-0-	2 quarts
Bolt Liquid Water Based	25 gallons	5 gallons
Coldkill	47 cans	1 can
Crawlkill	5 cans	12 cans
Diazinon 4E	-0-	1 gallons
Malathion	-0-	3 gallons
Rodent Cake	45 pounds	13 pounds
ULD BP 300 Insecticide	31 quarts	2 quarts

Herbicides and Algicide	Quantity on Hand (March 1988)	Estimated 4th Quarter Usage
Round-up	32 gallon (16 - 2 gallon cont.)	43 gallons
Aquathol-K*	11 gallons	-0-
Hyvar*	40 gallon (2 - 20 gallon drums)	-0-
Pramitol*	1200 pounds (bagged - granular)	**

Source: Tharpe, 1988

* These materials have been on hand for several years and none have been ordered to add to quantities in the past couple of years. These factors explain why records reflect no P.O. or stores activity.

** 1987 annual usage was ~ 4,650 pounds.

Department. The Janitorial Department maintains a supply of insecticides and rodenticides in Building K-1407. These are kept in low-volume containers in four large cupboards, which were locked and appropriately labeled. Absorbent material is kept at both locations to rapidly clean up spills.

The R&G Department personnel use a site at the Classified Burial Ground as a pesticide mixing area. This is an uncovered soil area without any secondary containment. Spills in this area, if any, would be limited to approximately 2 gallons of a pesticide, since the herbicides are mixed directly in the tank of the sprayer equipment. A typical mixture was stated to be 2 gallons of pesticides to 150 gallons of water.

4.2.5.3 Disposal Practices

Empty plastic or glass containers are triple-rinsed and the rinsewater is added to the pesticide spraying solution. The rinsed containers are disposed of at the Y-12 Centralized Sanitary Landfill. Any pesticide residues are disposed of at an off-site hazardous waste facility.

4.2.6 Findings and Observations

4.2.6.1 Category I

None

4.2.6.2 Category II

1. Leaking PCB transformers. Three large PCB transformers were observed to be leaking by the Survey team. These transformers are identified in Table 4-15. Two transformers were in the K-33 Building and were dripping fluid from their valves onto the concrete floor. The leaks were stopped and the small amount of fluid was cleaned up by the plant's staff on the same day that the leaks were observed (3/21/88). The leak from transformer 314 in the K-792 Switchyard, also found by the Survey team, was more extensive. The transformer was cordoned off and drip pans were immediately placed at several locations by the plant's staff to catch the PCB fluid. The leak was due to a loose nut near the top of the transformer and the fluid split into several streams as it flowed down the side of the transformer to the gravel surface giving the appearance of multiple leaks. After the nut was tightened, the flow of fluid stopped. The surface of the transformer was cleaned and the plant's staff plans to remove the

contaminated gravel and soil (Haymore, 1988). Also, a large drip pan under the valve of this transformer contained a mixture of water and oil, indicating that the valve had leaked in the past; however, it was not leaking during the Survey.

In addition, some PCB transformers were noted that had apparently leaked small amounts of fluid which had spread over the surface of the valves. This oily surface then collected dirt and dust over a period of time to produce a black, fungus-like appearance. This covering would mask any future small leak, rendering it more difficult to detect at an early stage. This condition was noted on transformers 700-A-1, 700-A-3, and 700-A-10 located outside Building K-1401.

Leaks of PCB fluid can contaminate soil and persist for long periods of time. During heavy rains, water from the switchyard area enters navigable waters. However, in-line containment pits should protect these waters from oil discharges.

2. <u>Improper storage of PCB equipment and PCB waste</u>. Several PCB items were observed to be improperly stored at ORGDP. These include the following:

- Seven PCB transformers are stored outside at the Powerhouse Switchyard (K-709), apparently intended for disposal (Table 4-15). There is the potential for improper handling while stored at this location.

- Four 55-gallon drums of PCB debris (gloves, cloth, etc.) and a 30-gallon drum of waste Askarel were found in Building K-33. These items were not dated and appeared to have been stored there for several months. They were moved to a proper storage area on 3/15/88.

- Two 55-gallon drums of waste oil containing PCBs at concentrations higher than 50 ppm were found near Building K-794. These drums were not dated and appeared to have been stored for several months. The drums were moved to proper storage by the plant's staff.

Storage for disposal is mandated by the regulations to be in a designated area and must satisfy certain criteria to prevent or minimize a release of PCBs to the environment.

4.2.6.3 Category III

None

4.2.6.4 Category IV

1. Problems with hazardous materials storage areas. There is the potential for release of hazardous materials to the environment from product dispensing and bulk storage areas due to a lack of secondary containment and the poor condition of some product containers. Table 4-19 identifies the hazardous material in storage, the volume of liquid, and the deficiencies observed in the storage or dispensing areas.

   Five of the bulk storage areas did not have a secondary containment system to prevent a significant or catastrophic release of hazardous liquids to the environment. In addition, an oil tank in the basement of the K-633 Building was leaking, and there was evidence of past leaks of hydraulic fluid at the Shearer Building (K-770).

   Table 4-19 also shows that three product dispensing or storage areas lacked drip pans to contain leaks or spills, some of the containers were badly corroded, and one 55-gallon drum of kerosene was leaking.

   Releases from product storage and/or dispersing areas can result in the contamination of soil and surface waters.

2. Friable asbestos. There is the potential for windborne dispersion of exposed asbestos from the K-25/K-27 tie line. The Survey team observed asbestos insulation on the ground beneath the tie line. Plant personnel cleaned up this asbestos and wrapped part of the tie line in plastic as an interim measure to prevent dispersion of asbestos. ORGDP has contracted for removal of asbestos from this tie line in the Spring of 1988. In addition, the plant has developed plans to remove approximately 450,000 square feet of friable asbestos as part of the permanent shutdown of the gaseous diffusion facilities.

3. Errors in the Annual PCB Inventory Report. The PCB Inventory Report for 1986 is incomplete and contains some inaccurate data. The Survey team identified seven transformers that were improperly stored at the K-709 Powerhouse Switchyard and that were not included in the annual inventory. See Finding 4.2.6.2.2 and Table 4-15 for details. In addition, the report

TABLE 4-19

PROBLEMS WITH HAZARDOUS SUBSTANCE STORAGE AREAS
ORGDP - OAK RIDGE, TN

Area	Hazardous Material	Volume (gallons)	Observation
K-633	Oil	One AST, 500	Leaking; 3 inches of oil/water in basement
K-731	Mineral oil	Two ASTs, 4,000	No secondary containment
K-731	OCB tap changer oil	Two ASTs, 4,000	No secondary containment
K-761	OCB tap changer oil	One AST, 4,000	No secondary containment
K-792	OCB tap changer oil	Two tanks, 4,000	No secondary containment
K-770	Hydraulic fluid	One AST, 500	No secondary containment; floor stained; trench to outside pit contains oil; pit contains oil
K-792	Solvents on dispensing rack	Four drums, 55	No drip pans
K-1004-T	Solvents on dispensing rack	Six drums, 55	No drip pans; drums are corroding
K-1414	Kerosene	One drum, 55	Drum leaking; area stained; strong odor

Source: DOE Survey team

AST = Aboveground Storage Tank

Note: This list is not intended to be comprehensive.

overstates the amount of PCBs in the transformers because the total weight of oil is reported rather than the weight of the PCBs in the oil as required by the TSCA regulations. Inaccuracies in the report could lead to improper disposal of PCB items and result in the assessment of fines by the regulatory agency.

4. Deficiencies in a PCB storage area. Building K-726, a designated PCB-waste storage area, has some deficiencies that could result in the release of PCBs to the environment. The deficiencies observed by the Survey team include the following:

- Broken windows that could allow rainwater to enter the storage area (the windows were being replaced at the time the Survey was in progress).
- Cracks in the concrete floor of the storage area that can result in the release of PCBs to soil.
- The building site is below the 100-year floodplain.

These deficiencies are in violation of the TSCA regulations (Section 761.65).

5. Incorrectly labeled PCB transformers. Nine PCB transformers containing PCB concentrations in the range of 510 to 943 ppm did not have PCB labels (see Table 4-15 for identification and location). The lack of warning labels increases the potential for mishandling the PCB fluid and equipment resulting in the release of PCBs to the environment. The plant can also be assessed a fine by the regulatory agency for failure to compy with the TSCA regulations.

4.3 Radiation

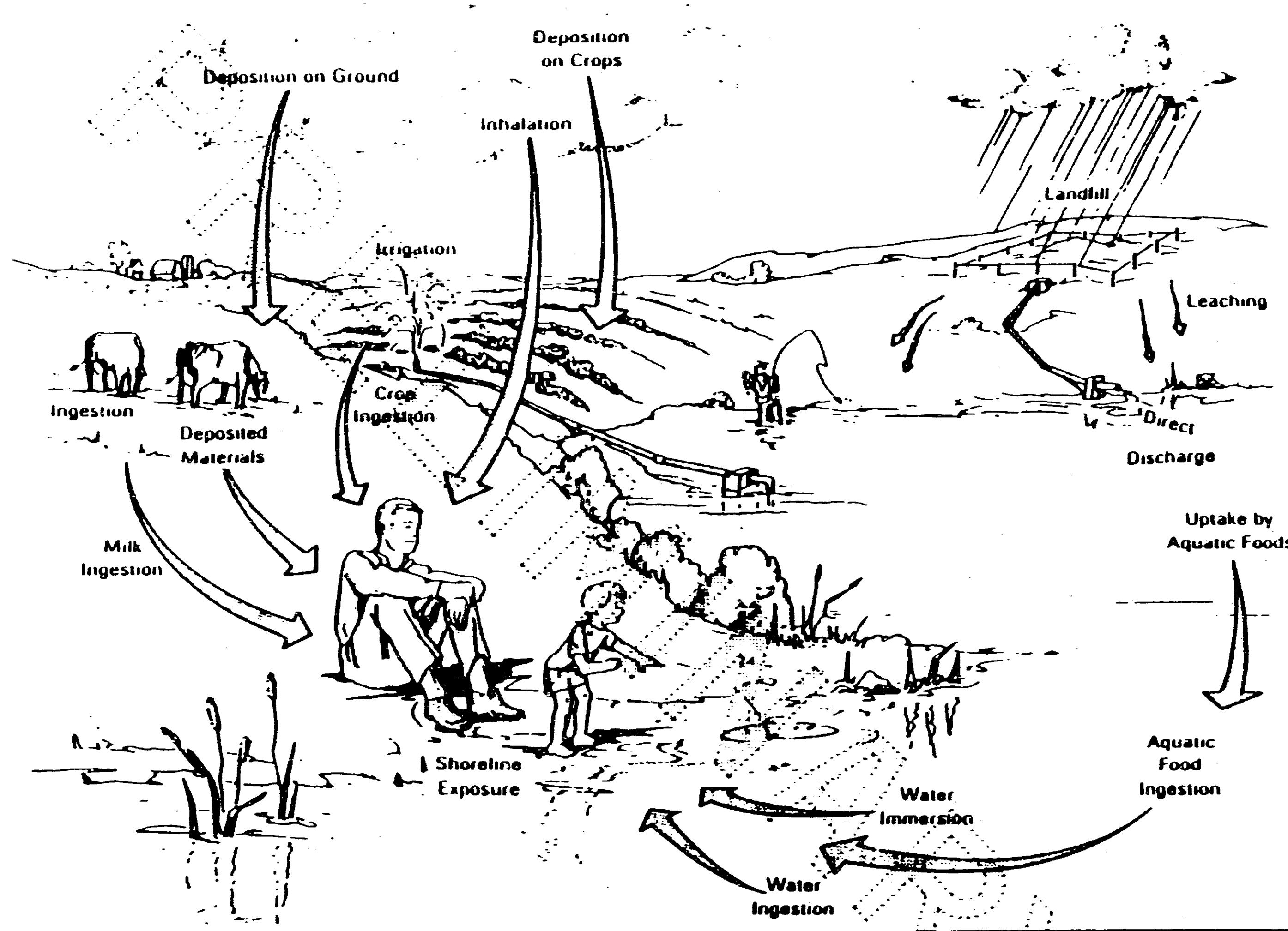
4.3.1 Background Environmental Information

The ORGDP radiation site setting can be described as a subset of each of the previous media settings (i.e., air, soils, surface water, and hydrogeology). Each of these primary pathways is responsible for radionuclide transport and potential contamination of ambient air, soils, drinking water, groundwater, vegetation, and food. Figure 4-6 depicts graphically some of these transport/exposure scenarios (MEPAS, 1987).

Background radiation in the vicinity of ORGDP is a consequence of both natural and man-made sources. These sources include cosmic radiation, natural radioactive materials in the soils and building materials, fallout from past atmospheric weapons detonations, releases of radioactive materials from nuclear power plants and other facilities handling radioactive materials worldwide, and the intake of radioactive materials in air, drinking water, and food. The most significant exposure is that to the lungs from background levels of radon. The annual average effective dose equivalent (EDE) for natural background in the United States is approximately 189 millirem per year (mrem/yr) (United Nations, 1982). This dose is detailed in Table 4-20. About one-half of the EDE is attributable to the inhalation of radon-222 and its decay products. Previously accepted estimates of background doses did not include the radon contribution and were estimated at about 100 mrem/yr.

The data in Table 4-20 were derived in accordance with the approach recommended by the International Commission for Radiological Protection (ICRP) in ICRP Reports 26 and 30. This approach allows direct comparison of the effective dose for different organs by reflecting the distribution of and organ sensitivity to various radionuclides. This is accomplished by applying "weighting factors" to the doses received by individual organs. The weighting factors are expressed as the fraction of the total risk for the entire body attributable to the organ. The sum of the dose equivalent for the individual organs provides an estimate of the total effect of the radiation on the whole body.

The EPA reports gamma radiation dose rates on a quarterly basis for select locations throughout the United States in <u>Environmental Radiation Data</u> (EPA, 1987c). During the reporting period of July-September 1986, measured dose rates equivalent to an annual dose of approximately 99.9 mrem ± 3.1 mrem were reported for the Knoxville, Tennessee, monitoring location, which is the closest one to ORGDP.



Source: MEPAS, 1987

FIGURE 4–6

TRANSPORT/EXPOSURE SCENARIOS
ORGDP – OAK RIDGE, TN

TABLE 4-20

AVERAGE ANNUAL EFFECTIVE DOSE EQUIVALENT TO HUMANS FROM NATURAL BACKGROUND RADIATION ORGDP - OAK RIDGE, TN

Organ	Annual Effective Dose Equivalent (mrem)
Gonads	24
Breast	14
Lung (Total)	100
Red Bone Marrow	13
Bone Surfaces	6
Thyroid	3
Other	29
TOTAL(1)	**189**

Source: United Nations, 1982

(1) Total represents the major product of the appropriate weighting factor times the annual dose equivalent for pulmonary, tracheal/bronchial, and mean doses.

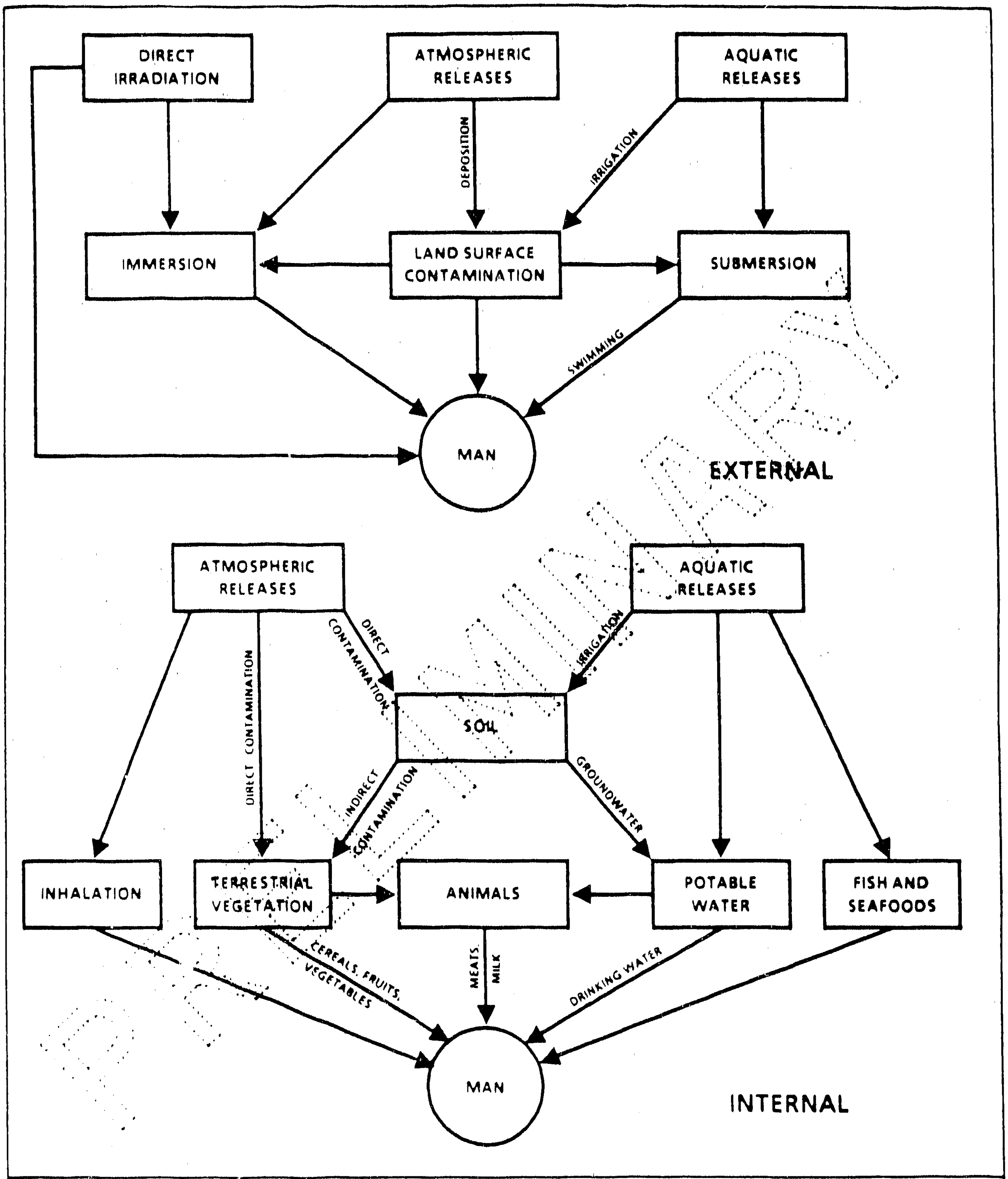
As required by DOE Order 5484.1, Chapter III, 4d2d1-3, ORGDP conducts an annual "assessment and reporting of potential dose to the public." In 1985 DOE adopted an interim radiation protection standard for environmental activities to be implemented in calendar year 1985 (Vaughan, 1985). It is DOE policy 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 recommendations 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 EPA published under the title "Control of Air Emissions of Radionuclides." In this document, the NCRP endorses the recommendation of the ICRP to limit the continuous exposure to any member of the public from other than medical sources and natural background to 100 mrem/yr whole-body dose-equivalent. The previously recommended limit of 500 mrem/yr is retained for noncontinuous exposures. This recommendation is now adopted as an interim standard for DOE environmental activities for the sum of all exposure pathways.

Radiation exposures are received from external sources and from radionuclides taken into the body by inhalation of air and ingestion of water and foodstuffs. 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. Principal pathways for exposure of humans from radionuclides released from ORGDP are shown in Figure 4-7. 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.

As described in Chapter 2.0, ORGDP is one of three DOE facilities operating on the Oak Ridge Reservation (ORR). As a result, background radiological measurements for one facility may be affected by the other two. Recognizing this, MMES has devised an ORR monitoring program in addition to each site's specific program and reports these data in an annual Environmental Surveillance report of the ORR and environs. Although the focus of this Survey report is ORGDP, frequent reference will be made to data collected from Y-12 and ORNL and its affect, if any, on ORGDP.

4.3.2 General Description of Pollution Sources and Controls

In that ORGDP is now in a "permanent shut-down" mode, major radioactive pollution sources are limited to the TSCA Incinerator, decontamination, and other support activities that do not release



Source: Adapted by DOE Survey team

FIGURE 4–7

PATHWAYS FOR EXPOSURE OF MAN FROM
ATMOSPHERIC AND AQUATIC RELEASES OF RADIOACTIVE EFFLUENTS
ORGDP – OAK RIDGE, TN

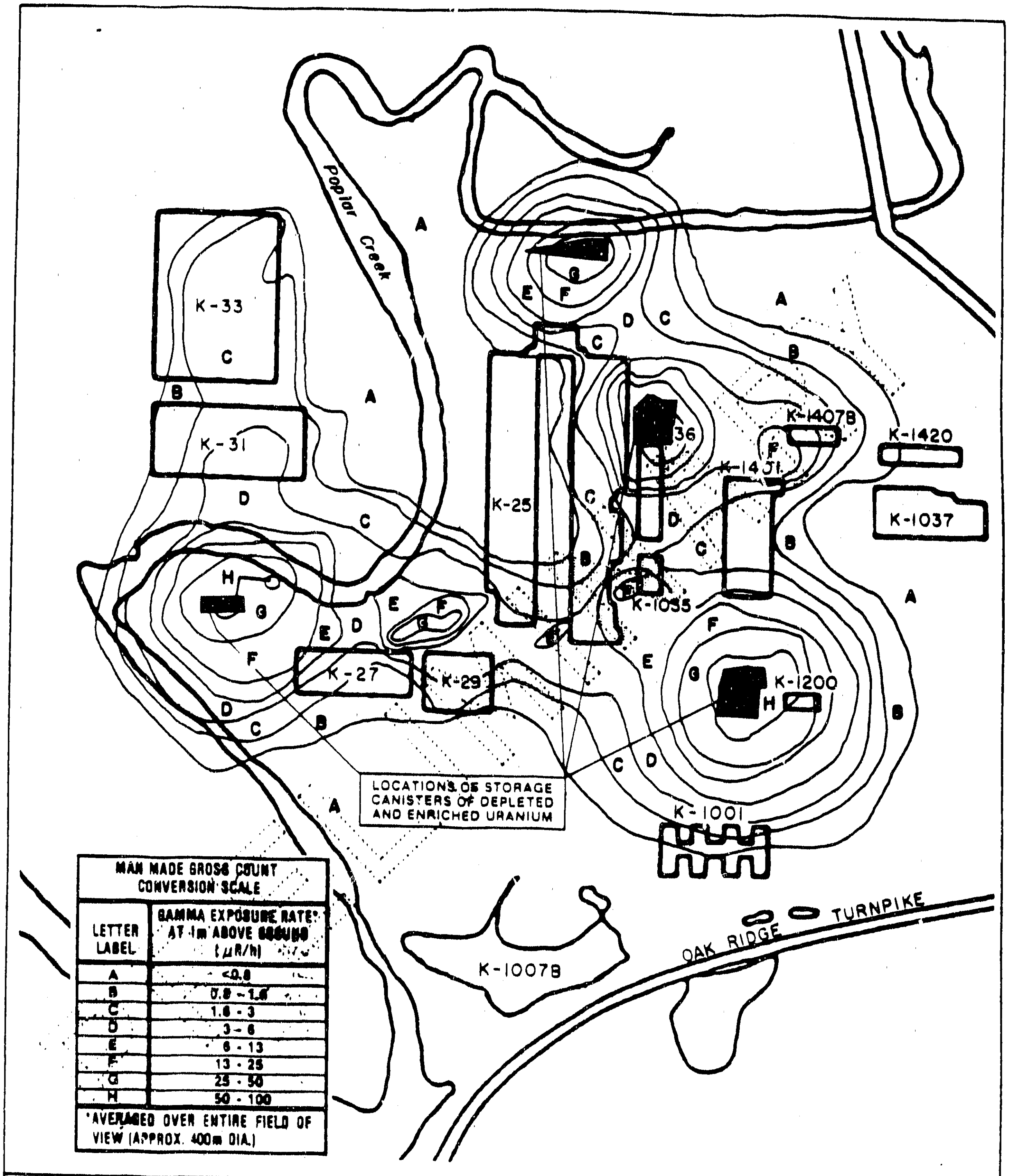
large quantities of radioactive emissions to the environment. By far, the largest source of radioactive materials will be that created as a result of D&D operations already discussed in Section 4.1. These D&D sources which do not present an immediate risk to the environment, are under study. Appropriate controls for D&D operations will need to be addressed on a case-by-case basis for each operation and are not considered to be within the scope of this Survey.

Aerial radiation surveys conducted by EG&G in 1974 (EG&G, 1977) show gamma exposure rates for man-made contaminants, primary sources of radiation, and total exposure rates for ORGDP (see Figure 4-8). As indicated in this aerial survey, ORGDP sources primarily consist of Tails Cylinder (depleted uranium) storage yards. Even though ORGDP is now in shut-down mode, tails cylinders still represent the major sources of direct radiation. These measurements are made in the vertical plane and do not necessarily represent ground plane or occupational exposure rates. While not anticipated to be in excess of DOE guidelines, the significance of these sources in contributing to site perimeter direct radiation unrestricted access dose cannot be evaluated because of the lack of a perimeter penetrating radiation monitoring program (see Finding 4.3.4.4.1).

Currently the major airborne radionuclide emission source operating at ORGDP is the K-1420 Decontamination Building. Various operations, such as cylinder washing, small and large parts decontamination, acid wash, and plating, are or were conducted in this facility with consequent radionuclide emissions. Although the site is no longer enriching uranium on a production basis, decontamination activities will continue to be an important part of ongoing operations.

As already discussed in Section 3.1, the K-1435 TSCA Incinerator is scheduled to begin operation some time in 1988. As required by the NESHAP, ORGDP has conducted dose modeling to determine effects of this new radionuclide source on the environs. Table 4-21 shows the comparison of doses with and without the K-1435 TSCA Incinerator. It should be noted that these estimates assume that control equipment would be 97 percent efficient; thus, resulting doses may be higher or lower than anticipated under normal operating conditions depending on actual efficiencies.

As stated in the permit (Smith, 1987), monthly release rates of total uranium, iodine-125 and 131, technetium-99, gross alpha, and gross beta will be reported on a quarterly basis. Additionally, Maximum Acceptable Quantities (MAQs) for each radionuclide to be incinerated in a given year will be established if the nearest resident is likely to experience a committed EDE or committed organ dose equivalent exceeding 1/100 of the applicable NESHAP standards.



Source: EG&G, 1977

FIGURE 4-8

1974 AERIAL GAMMA RADIATION SURVEY RESULTS AND SOURCES ORGDP - OAK RIDGE, TN

TABLE 4-21

ESTIMATED DOSE FROM K-1435 INCINERATOR
COMPARISONS OF DOSES FOR ORGDP AND THE TSCA INCINERATOR
ORGDP - OAK RIDGE, TN

Source	Receptor Location	Dose (mrem/yr) to Individual			
		Effective Total Body	Lungs	Kidneys	Thyroid
ORGDP Without TSCA Incinerator	Boundary Maximum Nearest Resident	6.7×10^{-7} 4.0×10^{-8}	6.6×10^{-7} 3.1×10^{-8}	7.3×10^{-6} 3.9×10^{-7}	Not Reported
ORGDP With TSCA Incinerator	Boundary Maximum Nearest Resident	5.5×10^{-1} 2.3×10^{-2}	6.4×10^{-1} 9.4×10^{-2}	1.6×10^{-2} 4.0×10^{-3}	4.1 5.0×10^{-2}

Source: Adapted from Ambrose, 1986

As shown in Table 4-21, ORGDP doses with the TSCA Incinerator operating will be increased substantially; however, they are projected to be well below EPA limits.

4.3.3 Environmental Monitoring Program

ORGDP conducts various levels of radiological monitoring of air, water, soil, sediment, groundwater, vegetation, and animal tissues. Direct radiation is also monitored through a cooperative program with ORNL. Discussion of radiological monitoring as it pertains to direct radiation and dose assessment issues is provided in this section.

ORGDP's environmental thermoluminescent dosimeter (TLD) program is incomplete for reasons specified in Finding 4.3.4.4.1. Of major concern is the lack of documentation, including identifying responsible personnel and procedures. As mentioned in a previous audit (Smith et al., 1985), ORGDP's TLD program lacks a focus that is documented and carried out by site personnel. The present system does not appear to be structured to measure the prominent direct radiation sources at ORGDP nor does it appear to measure "perimeter" exposure rates. Although the Survey team has no reason to suspect that ORGDP emits direct radiation in excess of guidelines for uncontrolled public access, defensible, documented perimeter data do not exist to support this assumption.

Radiological monitoring for the purpose of calculating public dose is performed on air and water effluent points. Effluent monitoring data from process stacks are used in the AIRDOS-EPA model for calculating dose. These data are used to calculate the maximally exposed individual and 80-kilometer (50-mile) doses, including air concentration, dry deposition, wet deposition, ground deposition, meat-milk-vegetation uptake, inhalation, ingestion, submersion in air, submersion in water, and surface exposure. These calculations are performed for ORGDP by ORNL personnel and are shown in Table 4-22. As can be seen in Table 4-23, doses from ORGDP airborne releases are well within applicable standards and guidelines.

Ingestion doses are calculated for drinking water and for consumption of fish and milk. Committed dose equivalents to persons drinking water from the Clinch River were calculated using measured, annual-average concentrations of radionuclides in water samples taken at locations listed in Table 4-24 released from ORR operations including ORGDP, ORNL, and Y-12.

The public water supply closest to the ORR is located about 26 kilometers (~16 miles) downstream, at Kingston. Based on measurements of radionuclides in river water samples taken at the Kingston filtration plant, the maximum doses from drinking water are <0.5 millirem effective and

TABLE 4-22

CALCULATED MAXIMALLY EXPOSED INDIVIDUAL 50-YEAR COMMITTED DOSE EQUIVALENTS FROM AIRBORNE RELEASES IN 1987
ORGDP - OAK RIDGE, TN

Release Location	Dose Equivalents (mrem/yr)				
	Whole Body	Effective	Lung	Endosteal Bone	Thyroid
ORNL[a]					
3039 stack	0.40	0.40	0.38	0.30	0.38
7911 stack	0.0093	0.0097	0.0081	0.013	0.013
Total ORNL	0.41	0.41	0.39	0.31	0.39
ORGDP[b]					
Building K-1420	0.0000018	0.000099	0.000038	0.0014	0.0000053
Y-12 Plant[c]					
Center	0.00030	2.4	19.0	1.1	0.0027
Entire ORR[d]					
All plants	0.41	2.4	19.0	1.1	0.39

Source: Adapted from Rogers et al., 1988a

a The maximally exposed individual is located 4,980 meters SW of the 3039 stack and 5,270 meters WSW of the 7911 stack.

b The maximally exposed individual is located 3,000 meters WSW of Building K-1420.

c The maximally exposed individual is located 570 meters NNW of the center of the Y-12 Plant.

d The location of the maximally exposed individual for the entire ORR depends on the organ or tissue of interest. For whole-body and thyroid exposures, it is the ORNL individual; for effective, lung, and endosteal bone, it is the Y-12 Plant individual.

TABLE 4-23

CALCULATED COLLECTIVE 50-YEAR COMMITTED EFFECTIVE DOSE EQUIVALENTS DUE TO AIRBORNE RELEASES IN 1987
ORGDP - OAK RIDGE, TN

Release Location	Effective Dose Equivalent (person-rem/yr)
ORNL[a]	
3039 stack	25.0
7911 stack	0.47
Total ORNL	25.0
ORGDP[b]	
Total ORGDP	0.0014
Y-12 Plant[c]	
Total Y-12	30
Entire ORR[d]	
All plants	55

Source: Adapted from Rogers et al., 1988a

a The collective 50-year committed dose equivalents to the 835,766 persons residing within 80 kilometers of the ORNL.

b The collective 50-year committed dose equivalents of the 837,129 persons residing within 80 kilometers of the ORGDP.

c The collective 50-year committed dose equivalents to the 863,264 persons residing within 80 kilometers of the Y-12 Plant.

d The collective 50-year committed dose equivalents for the entire ORR are the sums of the corresponding doses for each of the three plants.

TABLE 4-24

POTENTIAL 50-YEAR COMMITTED DOSE EQUIVALENTS FROM DRINKING WATER IN 1987[a] ORGDP - OAK RIDGE, TN

Location	Dose Equivalent (mrem)		
	Effective	Endosteal Bone	Stomach Wall
Melton Hill Dam	<0.38	2.4	0.05
White Oak Dam[b]	33.9	124.3	24.8
Gallaher process water	<0.53	2.8	0.19
ORNL tap water	<0.39	2.5	0.05
Kingston water plant	<0.50	2.6	0.26

Source: Adapted from Rogers et al., 1988a

a Assumes ingestion of 730 liters of water per year (2 liters per day), and includes radionuclides from all ORR operations.

b Water not consumed included as a worst case.

2.6 millirem to endosteal bone. The closest nonpublic water supply downstream is the ORGDP process water inlet shown as Gallaher process water on Table 4-24. Background doses (upstream) are calculated from samples collected at Melton Hill Dam. Doses calculated at White Oak Dam where water is not consumed are believed to be worst-case prior to dilution by the Clinch River. All drinking water doses are therefore well below applicable guidelines.

Although fish and milk doses are calculated for the ORR, the controlling radionuclide toxicities are not a result of ORGDP emissions.

A summary of estimated doses from all ORR pathways is shown in Table 4-25. As can be seen, the ORGDP-specific air doses are extremely low. ORGDP's contribution to the remaining pathways is included in drinking water and fish consumption pathways. As stated in Rogers et al. (1988a), although unlikely ". . . the nearest resident to the Y-12 Plant, who could receive an effective dose of 2.1 mrem from gaseous effluents, also drank milk from the sampled stations (0.26 mrem), ate fish from CRK 33 (0.3 mrem); drank Oak Ridge city water [which is the same as ORNL tap water (0.39 mrem)]; and fished the Clinch River between CRK 33 and 30 (5.6 mrem), he or she could receive a committed effective dose equivalent of about 9 mrem/year." This represents about 3 percent of the annual dose from background radiation and 9 percent of the DOE guideline of 100 millirem, excluding medical radiation doses, above 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

TABLE 4-25

SUMMARY OF ESTIMATED RADIATION DOSES TO AN ADULT DURING 1987
AT LOCATIONS OF MAXIMUM EXPOSURE
ORGDP - OAK RIDGE, TN

Pathway	Location	Effective (mrem)	Highest Organ (mrem)
Gaseous effluents	Nearest resident:		
Inhalation plus direct radiation from air, ground, and food chains	Y-12 Plant	2.1	17.0 (lung)
	ORNL	0.4	0.6 (LLI wall)
	ORGDP	0.0001	0.001 (endosteal bone)
Terrestrial food chain (milk)	Average of sampling stations	<0.26	2.0 (thyroid) 2.1 (endosteal bone)
Liquid effluents			
Drinking water	ORNL	<0.39	2.5 (endosteal bone)
	Kingston	<0.50	<2.6 (endosteal bone)
Eating fish	CRK 33 (ORNL discharge point)	0.30	0.60 (endosteal bone)
Direct radiation	Clinch River shoreline (33.3 to 30.0 CRK)	5.6 (250 hr/year)	

Source: Rogers et al., 1988a

4.3.4.4 Category IV

1. Perimeter penetrating radiation monitoring program. Off-site impacts including potential exposure to members of the public from penetrating radiation emissions, although not expected, cannot be fully characterized due to the lack of a perimeter penetrating radiation monitoring program. The existing monitoring is conducted for ORGDP by ORNL. It is not clear what the criteria for selection of monitoring locations were as determined by ORNL (for their needs). Additionally, there does not seem to be a clear purpose or central point of control at ORGDP for the monitoring being conducted.

4.4 Quality Assurance

4.4.1 Environmental Monitoring Program

4.4.1.1 Background

Historically, the Analytical Chemistry Department (ACD) provided services to production, research, and environmental control operations at ORGDP. After the DOE placed the gaseous diffusion plant on standby and closed the centrifuge separation program, the ACD's function was redirected to mainly provide environmental analyses in support of the ORGDP site, the Y-12 waste operations, DOE's ORO, and other Government agencies, including the cleanup of military sites. This change has resulted in an overall greater workload and an increased staff.

The ACD is part of the Quality and Technical Services Division and consists of five sections providing a variety of analytical services. The laboratories are located in four buildings -- the main laboratories are located in Building K-1004-D and an adjoining building (K-1004-C), with two satellite field laboratories located in Buildings K-1101 and K-1423. One of the satellite laboratories is outside the plant fence, since some of the analysts working there do not have a security clearance. The total floor space for analytical work is about 26,800 square feet, this including 219 linear feet of laboratory hoods and about 5,800 square feet of laboratory bench space.

The Department Director has complete responsibility for the entire laboratory operation and is assisted by four program managers and five section leaders to accomplish the overall laboratory management objectives (MMES, 1988e). The organization schematic is shown in Figure 4-9. The primary functions of this management group are briefly discussed below:

- Quality Assurance Manager - Has overall responsibility for all the QA/QC program activities and coordinates the activities of the statistician as they relate to the laboratory control programs.

- Program Managers - Coordinate all phases of the work. They are the principal contact between the customers and the laboratory. Their duties include ensuring that proper methodology is used and that appropriate analyses are requested; establishing reporting schedules; auditing laboratories; reviewing data from private laboratories performing military analyses; ensuring compliance of data with established criteria, etc.

DIRECTOR

PROGRAM MANAGERS

- Quality Assurance Manager
  - Control Programs
  - Statistical Evaluations
  - Laboratory Performance
- Manager, Waste Management
  - Waste Processing
  - Incinerator Analyses
- Manager, Environmental Analyses
  - NPDES Permits
  - Compliance Monitoring
  - DOE Site Survey
- Manager, Military Sites
  - Quality Assurance
  - Customer Relations
  - Auditing of Labs
  - Report Reviews

SECTION LEADERS

- Inorganic Analytical
  - Atomic Spectroscopy
  - Plasma Emission Spectroscopy
  - Radiochemistry
  - Isotopic Analysis
  - Sample Preparation
  - Method Development
- Process Support & Wet Chemistry
  - Wet Chemical Analysis
  - Field Laboratories
  - Wet Chemistry Development
  - Instrumental Chemistry
- Organic Analytical Chemistry
  - Organic Mass Spectrometry
  - Liquid & Gas Chromatography
  - Extraction of Organics
  - Analytical Development
- Instrumentation & Controls
  - Computer Systems
  - Instrument Repair Services
  - Instrument Applications
  - Instrument Development
- Sample Management
  - Field Sampling
  - Sample Custody
  - Sample Reporting
  - Standards Preparation
  - Submission of Controls

Source: MMES 1988e

FIGURE 4-9

ORGANIZATION OF THE ANALYTICAL CHEMISTRY DEPARTMENT
ORGDP - OAK RIDGE, TN

- Section Leaders - Have responsibility for the supervision of personnel and the work within their respective sections. This includes scheduling, QA/QC within the section, technical direction, etc.

The primary goal of the management group is to monitor the ACD's programs and ensure that all data generated are suitable for their intended use.

The ACD provides a comprehensive variety of services, including analysis of samples from environmental sources, waste management, and process activities; development of analytical methods and instruments; and computer systems development. To accomplish these objectives, the laboratories are equipped with state-of-the-art instruments, most of which are automated and computer-controlled. Some of the analytical instrumentation available includes 7 gas chromatograph/mass spectrometers, 10 gas chromatographs, 3 liquid chromatographs, 4 atomic absorption spectrometers, 2 inductively coupled plasma spectrometers, 1 X-ray fluorescence spectrometer, 1 laser-Raman spectrometer, emission spectrographs, Gas Chromatograph/Fourier Transform Infrared spectrometer, ultraviolet/visible spectrometer, Nuclear Magnetic Resonance spectrometer, etc. The laboratory is also equipped to perform most of the wet chemical sample preparation and analyses.

The ACD has an instrument service group to conduct preventive maintenance and perform minor repair services for the equipment. In addition, service contracts are maintained for all major instruments. The instrument shop also checks and certifies all analytical balances on a yearly basis and places certification stickers on them. During the Survey, the analytical balance in the Radiochemistry Laboratory had a certification sticker dated in calendar year (CY) 1986. However, this was the only balance observed that had not been certified within a 1-year period.

4.4.1.2 Sampling Quality Assurance Program

The ACD is responsible for the sampling operations associated with groundwater monitoring for ORGDP and other designated areas within the ORR. Starting in January 1988, the laboratory has had the responsibility for all environmental sampling associated with regulatory requirements. This includes NPDES permit requirements (discharge waters), soils, vegetation, and air samples. The laboratory has separate QC documents for groundwater and NPDES sampling.

The Sample Management Section is responsible for environmental sampling and receives specific instructions from the program managers. Sampling of monitoring wells, soils, waste, and surface water is based on EPA criteria and methods; that is, collection and preservation are generally based on SW-846, Federal Register (October 26, 1984, page 43260), and other EPA-approved methods. The Sample Management Section maintains logbook records that include field data, preservation procedure used, and other pertinent comments. The samplers also initiate the chain-of-custody (COC) process.

A sampling crew generally consists of two samplers. The lead sampler must have completed a sampling course (e.g., EPA sampling course). Some of the present samplers qualify as laboratory analysts according to their education and experience.

4.4.1.3 Sampling Chain of Custody

The ORGDP Technical Procedure No. 2055.RO describes the COC process and documentation necessary to ensure the adequate tracking of sample handling to maintain sample integrity from collection to analysis. Not all samples require the complete COC process. There are three categories of samples analyzed by the laboratory. These are as follows:

1. Nonregulatory - samples from waste treatment processes, development activities, process control, special studies, etc. The results are used "in-house" and are not public information. No COC is used since it is not required.

2. Regulatory-Nonlitigation - These include NPDES, well monitoring, air, etc. The results are reported to the regulatory agency and are for public availability. These have COC from the person obtaining the sample to the Sample Receiving Group but no COC is maintained within the laboratory.

3. Regulatory-Litigation - These are samples from the DOE Site Survey and from Resource Conservation and Recovery Act Facility Investigation (RFI) sites nationwide. These have COC from the person obtaining the sample to the Sample Receiving Group, and COC is maintained with each analyst handling or analyzing the sample.

Past audits by EPA and Techlaw for legal requirements have found this procedure to be in compliance with environmental regulations and legally defensible (Dill, 1988b).

The COC process is initiated by the sampler when he delivers the samples to the Sample Custodian in Building K-1004-A, Room 19. This room is equipped with security locks and a classified vault containing refrigerators. The Sample Custodian and relief supervisors are the only persons with keys to this room. Members of the Sampling Group of the ACD Sample Management Section (see Figure 4-9) use the ACD COC card containing the pertinent sample data and sign-off sections, to transfer the samples to the Sample Custodian. The COC card will accompany the COC samples to the specific laboratory. The COC card is filed for future reference and is retained for 2 years in the custodian's file, and for 5 years in the ORGDP vault.

4.4.2 Laboratory Analysis

4.4.2.1 Background

Most of the analyses are performed using procedures approved by EPA, DOE, the American Society for Testing and Materials (ASTM), or Standard Methods for the Examination of Water and Wastewater. These procedures are contained in a laboratory manual and copies of pertinent procedures are kept at the analyst's work station. The methods are also available from the VAX computer data base. Each laboratory is equipped with a computer terminal. The ACD processes approximately 200 samples a day, and ORGDP has contracted with IT Corporation (Oak Ridge, Tennessee) to analyze the overflow sample load. This arrangement and an increased staff have reduced the holding time of samples prior to analysis to less than the EPA requirements. A previous audit by NUS had reported that holding times were being exceeded for some samples (Smith et al., 1985).

The Survey team visited most of the individual laboratories and generally found them clean, well-organized, and well-equipped for their specific function. Interviews with ACD personnel indicated extensive knowledge, experience, and training for their respective roles in the department. As part of the computer based quality assurance-quality control program, the computer conducts a check to determine whether an individual entering data is listed as qualified before accepting any sample data. Personnel are qualified by learning the procedure from an experienced analyst and successfully analyzing a set of test samples. This qualification is good for a one-year period at which time the analyst must be requalified by his supervisor.

During the tour of the individual laboratories, the Survey team observed that many of the chemical reagent bottles in use did not contain the date they were received. The ACD policy is to date only those reagents that are used as standards or are known to have a short shelf life. Also, the plant has a scheduled annual cleanup week when all chemicals in stock are evaluated as to future need. Chemicals that are not needed or that have a vendor's listed and expired shelf life are transferred to the Environmental Group for disposal. However, it is good QC policy to date all chemicals when received. For example, it can be useful in determining the cause of a problem for any out-of-control analyses or unacceptable results received in a performance evaluation test program. In addition, for those situations when two bottles of the same reagent are in use, the oldest reagent can be used up first.

4.4.2.2 Quality Assurance Program

The ACD has established an extensive QA program to ensure that the data generated are scientifically valid, legally defensible, and of known precision and accuracy. The laboratory participates in both external and internal QC activities. The external QC program consists of participation in the following:

1. The EPA Contract Laboratory Program - The Agency supplies control samples to maintain certification for the analysis of "Superfund" site samples. QC samples are submitted on a quarterly basis.

2. The EPA Discharge Monitoring Requirements Program - A set of samples consisting of the parameters controlled by the NPDES permit is submitted annually. Participation is required by the laboratories analyzing NPDES samples.

3. DOE's Quality Assurance Program/Environmental Monitoring Laboratory (QAP/EML) Program - Control samples of air filters, soils, water, vegetation, and tissue containing low levels of radionuclides are supplied by the DOE Environmental Monitoring Laboratory in New York. Two sets of samples per year are received for analysis.

4. Laboratory Intercomparison Studies for Radionuclides Program - Samples of water and soils containing radionuclides are supplied by EPA's Environmental Monitoring Systems Laboratory (Las Vegas) upon request. One or more samples are provided monthly.

5. Water Supply Performance Program - A set of samples is received from EPA to maintain the Laboratory's qualification for the analysis of drinking water samples.

6. Water Performance Program - Water pollution samples are supplied by EPA to measure performance on controls associated with the DOE Site-Survey Program.

7. National Institute of Occupational Safety and Health (NIOSH) Proficiency Analytical Testing Program - Samples are received quarterly to retain certification for the analysis of industrial hygiene samples. Samples consist of (a) five filter disks containing lead, zinc, and cadmium; (b) one vial containing organic solvents; and (c) five charcoal filters with organic compounds.

8. PET Program - A commercial program of monthly QC samples, supplied by the Analytical Performance Group, Inc., designed to test the proficiency of analytical laboratories.

9. Martin Marietta Energy Systems Program - A six-plant QA program for supply water and NPDES samples with participation by ORNL, PGDP, Y-12, PORTS, Fernald, and ORGDP laboratories.

10. Duplicate Samples - Approximately 10 percent of all samples are duplicates that are submitted as separate samples by customers.

The internal QC program consists of

a. Laboratory control samples with each group of samples.
b. Addition of spikes to 10 percent of the routine samples.
c. Replicate analysis of prepared samples.
d. Method blank.
e. Appropriate instrument calibrations.
f. Field blank.

The laboratory uses a computer program, AnaLIS, developed by the ACD to manage QC activities. The system provides for the recording of internal control data on known standards, calculation of spike recoveries, comparison of duplicate measurements, surrogate recoveries, and ensuring that personnel have been certified.

The computer will report any out-of-control condition when the data are entered into the data base and request that action be taken by the supervisor. A problem analysis is made to determine the reason for the unacceptable result and appropriate corrective action is taken to return the analysis to a controlled status.

The quality of all data is evaluated by the Section Heads and/or Project Managers prior to reporting to the customers. This data validation procedure considers the accuracy of the data, the precision of the data, the completeness of the accuracy and precision data, representativeness of the data, and the comparability of the data.

Some recent results of the ACD's participation in the performance evaluation test programs were reviewed. In general, the laboratory's data were in the acceptable range for the parameters analyzed. The supervisor and QC Manager review all performance results to determine the cause of any nonconformance and take appropriate corrective action.

4.4.3 Findings and Observations

4.4.3.1 Category I

None

4.4.3.2 Category II

None

4.4.3.3 Category III

None

4.4.3.4 Category IV

None

4.5 Inactive Waste Sites and Releases

4.5.1 General Description of Pollution Sources and Controls

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) established (1) notification requirements, (2) liability standards, and (3) response authority for dealing with releases of hazardous substances to the environment. Also known as Superfund, CERCLA's scope is extensive. The EPA and state agencies can undertake or order study or cleanup when there is a release or the substantial threat of a release of a hazardous substance to the environment.

Superfund was substantially expanded by the Superfund Amendments and Reauthorization Act of 1986 (SARA). In addition to significantly increasing the size of the fund to finance cleanups, SARA creates a response authority for petroleum UST releases (technically an amendment to RCRA), and mandates community right-to-know and emergency preparedness programs (Title III). SARA also obligates Federal facilities to comply with the same regulations and policies as other entities. Hence, except for certain limited national security waivers, Federal facility cleanup plans for sites on the National Priorities List (NPL) must undergo EPA review and concurrence.

In addition to CERCLA/SARA, a second Federal cleanup authority was created in 1984 with the passage of the Hazardous and Solid Waste Amendments (HSWA). Included in these amendments to RCRA was a section (3004(u)) known as the "Continuing Release Provision", which required that facilities address ongoing releases from their existing and former SWMUs as a condition of granting a final operating permit. The implication of this provision is to establish a parallel RCRA-based cleanup program, whereby facilities desiring a permit for a new or ongoing operation must obtain approval for cleanup plans of their old waste units prior to getting a new permit.

This section introduces the sources of hazardous substance releases to the environment. Section 4.5.2 provides more detail on these sources.

Construction of ORGDP began in 1943, and its first diffusion stages became operational in 1945. The initial mission of ORGDP was enrichment of uranium in the U-235 isotope for military applications. In addition to Building K-25, for which the facility is known, four additional cascade buildings were added to provide a total of 5,100 stages of capacity to enrich uranium hexafluoride (UF_6) containing 0.711 percent uranium-235 to a highly enriched uranium containing 98 percent uranium-235. In 1964, the mission of ORGDP changed to supply uranium fuel containing 5 percent uranium-235 to civilian nuclear power reactors. The ORGDP has undergone two significant renovations, known as the CIP/CUP, in the late 1950s to early 1960s and again in the 1970s until 1981.

In addition to the gaseous diffusion operation, two large-scale pilot enrichment plants were constructed at ORGDP - the AVLIS process, and the GCEP. From 1952 to 1961, uranium hexafluoride was produced from uranium oxide and uranium tetrafluoride.

The investigation and cleanup of inactive waste sites at ORGDP is being performed primarily through the continuing release provision of HSWA [Section 3004(u)], rather than through CERCLA/SARA. The RCRA/HSWA process is being used because of a permit being sought by DOE for a facility at the Oak Ridge National Laboratory (X-10), and covers the entire Oak Ridge complex including Y-12 and ORGDP. A general RCRA facility assessment was prepared in March 1987 covering all of the SWMUs at ORGDP. Since then over 20 RFI Plans have been prepared by ORGDP covering virtually all of the major SWMUs at ORGDP. These RFI plans provide a brief background on the facility, standard sections on hydrogeology, and objectives and a plan for carrying out the RFI including sampling plans. Other elements of an investigation of inactive sites such as a comprehensive file search, interviews and a photography review have not yet been performed.

In most cases, the investigation has begun with the construction of a limited number of groundwater monitoring wells (see Section 3.4). Initiation of additional investigation activities is awaiting funding from DOE and approval by the TDHE of the ORGDP Quality Assurance plan for conducting the RFIs, according to ORGDP personnel. Table 4-26 lists the most significant known or suspected areas of contamination at ORGDP based on the judgment of the Survey team. Figure 4-10 shows the locations of these sites. Section 3.4 describes the groundwater monitoring system and the nature and extent of groundwater contamination for each of the significant sites. In cases where potential for soil contamination exists, the sites are discussed in Section 3.2. Some of the facilities are continuing to operate, and these are described in Section 4.1. See Section 4.1 for a discussion of the RCRA permitted tanks.

The ORGDP sites for which Hazard Ranking System (HRS) scores were determined are listed in Table 4-27. The modified HRS (mHRS) was used because it includes radionuclides as well as chemical scores. In each case, however, the mHRS score reflects the chemical portion of the score, and is therefore identical to the results that would be given by the HRS. Based on EPA criteria (47 <u>Fed</u>. <u>Reg</u>. 31180; July 16, 1982), a score of 28.5 on the HRS is sufficient to place a site on the NPL, which results in certain enforcement and remedial implications. The score used for making this determination is the "Weighted migration score (S_M)". None of the sites at ORGDP scored higher than 28.5 on the HRS.

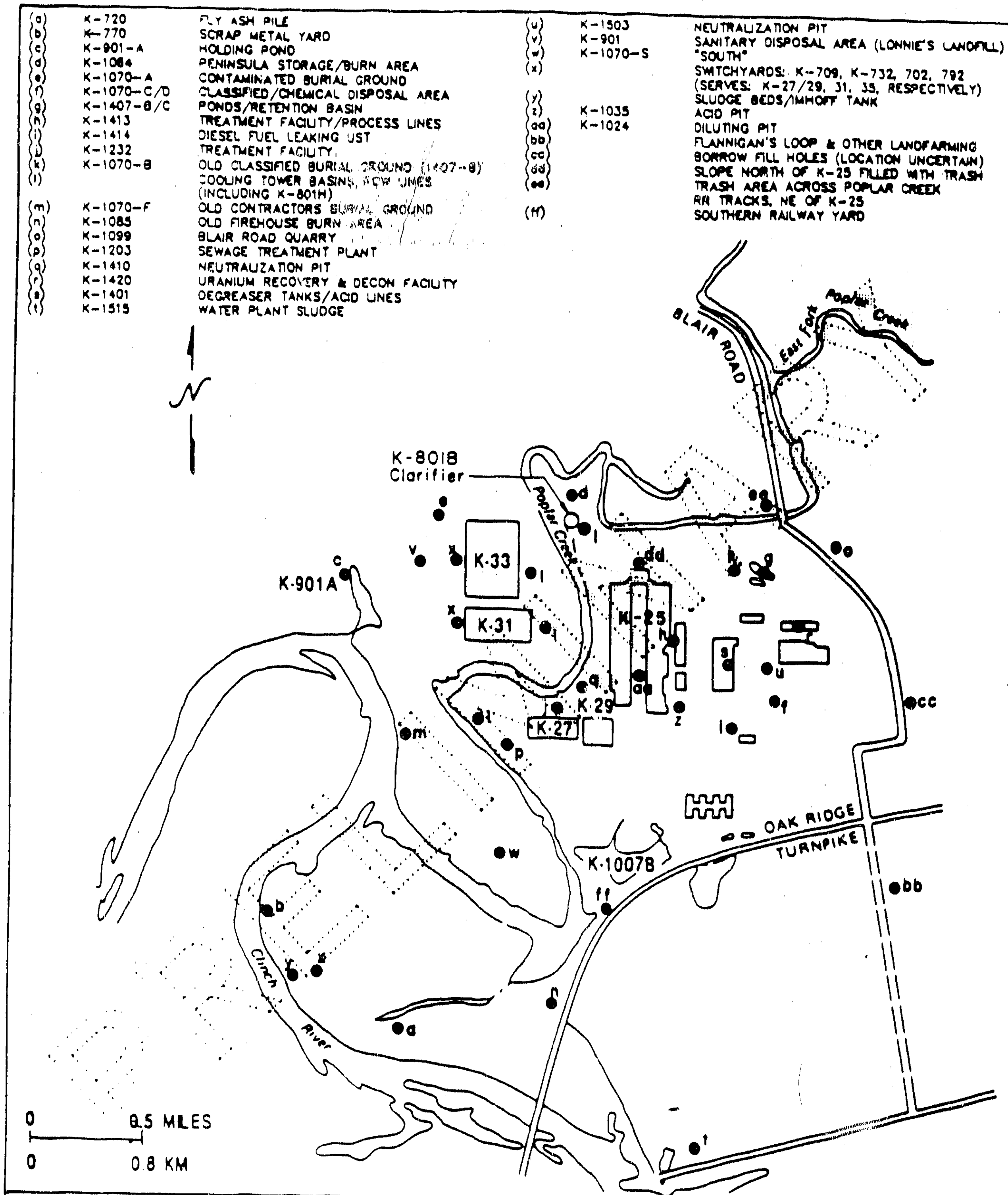
TABLE 4-26

MOST SIGNIFICANT KNOWN OR SUSPECTED AREAS OF CONTAMINATION ORGDP - OAK RIDGE, TN

Map ID	Building No.	Name
(a)	K-720	Fly Ash Pile
(b)	K-770	Scrap Metal Yard
(c)	K-901-A	Holding Pond
(d)	K-1064	Peninsula Storage/Burn Area
(e)	K-1070-A	Contaminated Burial Ground
(f)	K-1070-C/D	Classified/Chemical Disposal Area
(g)	K-1407-B/C	Ponds/Retention Basin
(h)	K-1413	Treatment Facility, Process Lines
(i)	K-1414	Diesel Fuel Leaking UST
(j)	K-1232	Treatment Facility
(k)	K-1070-B	Old Classified Burial Ground (1407-B)
(l)		Cooling Tower Basins/RCW Lines
(m)	K-1070-E	Old Contractors Burial Ground
(n)	K-1085	Old Firehouse Burn Area
(o)	K-1099	Blair Road Quarry
(p)	K-1203	Sewage Treatment Plant
(q)	K-1410	Neutralization Pit
(r)	K-1420	Uranium Recovery & Decon. Facility
(s)	K-1401	Degreaser Tanks/Acid Lines
(t)	K-1515	Water Plant Sludge
(u)	K-1503	Neutralization Pit

Source: DOE Survey team

Refer to Figure 4-10 for the locations of these sites



Source: DOE Survey team

FIGURE 4-10

ACTUAL OR POTENTIAL HAZARDOUS
SUBSTANCE RELEASE LOCATIONS
ORGDP – OAK RIDGE, TN

TABLE 4-27

SUMMARY OF mHRS RESULTS FOR POTENTIAL ORGDP CERCLA SITES
ORGDP - OAK RIDGE, TN

Site	Migration Mode			Weighted Migration Score, S_M	Direct Contact Mode, S_{DC}	Fire and Explosion Mode, S_{FE}
	Air Route, S_a	Surface-Water Route, S_{SW}	Ground-water Route, S_{gw}			
K-1070-A Old Contaminated Burial Ground	0	0	8.5	4.91	0	0
K-1070-B Old Classified Burial Ground	0	1.74	11.56	6.75	0	0
K-1070-C/D Classified Burial Ground	0	5.45	24.01	14.23	0	0
K-1070-F Old Contractors Burial Ground	0	0	0	0	0	0
K-106 4-G Burn Area	0	8.36	14.44	9.64	0	0
K-1099 Blair Road Quarry	0	0	0	0	0	0
K-1085 Firehouse	0	3.83	6.46	4.34	0	0
K-770 Scrap Metal Yard	23.07	13.28	6.56	15.84	0	0
K-1515 Land Treatment	0	0	0	0	0	0
K-1420 Oil Storage	0	5.84	20.28	12.19	0	0
K-1515 Lagoon	0	3.52	12.08	7.27	0.83	0
K-901-A Holding Pond	0	18.46	40.29	25.60	3.1	0
K-1700 Watershed	0	7.97	19.38	12.11	0	0
K-1007-B Holding Pond	0	7.44	20.87	12.80	0	0
K-25 Cooling Towers (6)	0	10.90	10.79	8.86	0	0
K-1410 Neutralization Pit	0	8.81	7.14	6.55	0	0
K-1064-G Drum Deheading	0	1.68	3.06	2.01	0	0
K-1414 Gas Tanks	*	*	*	*	*	*
K-1401 Acid Line	0	7.13	32.38	19.16	0	0

*Included with K-1070-C/D Classified Burial Ground

TABLE 4-27
SUMMARY OF mHRS RESULTS FOR POTENTIAL ORGDP CERCLA SITES
ORGDP - OAK RIDGE, TN
PAGE TWO

Site	Migration Mode			Weighted Migration Score, S_M	Direct Contact Mode, S_{DC}	Fire and Explosion Mode, S_{FE}
	Air Route, S_a	Surface-Water Route, S_{SW}	Ground-water Route, S_{gw}			
K-1004 Lab Drain	0	0	3.38	1.95	0	0
K-1420 Process Lines	0	7.97	7.88	6.47	0	0
K-725 Be Building	0	0	0	0	0	0
K-1410 Plating Facility	0	0	0	0	0	0
K-1420 Hg Recovery	0	0	0	0	0	0
K-1407-C Soil	0	5.84	12.39	7.91	12.50	0
K-1417 Soil	*	*	*	*	*	*
K-770 Garbage	**	**	**	**	**	**

Source: Bowers, 1986

*Included with K-1407-C Soil
**Included with K-770 Scrap Metal Yard

4.5.2 Findings and Observations

4.5.2.1 Category I

None

4.5.2.2 Category II

None

4.5.2.3 Category III

1. Actual and potential sources of soil, surface water, and groundwater contamination. There are numerous actual and potential sources of soil, surface, water and groundwater contamination at ORGDP. The majority of these actual and potential sources [Findings 4.5.2.3.1 (a through u)] were previously identified by ORGDP and are under investigation (see Table 4-26). In addition, the Survey team identified several previously undiscovered actual and potential sources [Findings 4.5.2.3.1 (v through ff)] through a review of files, photographs and interviews with ORGDP employees (see Table 4-28). The list in Table 4-29 shows all actual and potential areas of contamination including several relatively small potential sources such as tanks. These areas, listed in Table 4-28, provide neither a comprehensive compilation nor a focused list of known contaminant sources. The areas given in Table 4-28 are merely a list of potential hazardous substance release locations at ORGDP identified by the Survey team that may deserve more investigation. Because the Survey is not intended to supplant a comprehensive CERCLA investigation by the site, other sites at ORGDP may be identified by such an investigation (see Finding 4.5.2.3.3). In addition, file searches and field investigation of some of these potential contamination sites may indicate that no contamination exists at these additional sites. Because a complete CERCLA investigation is beyond the scope of the Survey, Finding 4.5.2.4.3 describes the need for a systematic and comprehensive CERCLA investigation of the sources considered during the Survey.

   a. K-720 Fly Ash Pile - The K-720 Fly Ash Pile is a potential source of soil, groundwater and surface-water contamination. Trace metal leachate runoff is a potential threat, and some data suggest the presence of a solvent.

TABLE 4-28

OTHER AREAS OF POTENTIAL CONTAMINATION IDENTIFIED BY SURVEY TEAM (MARCH 1988) ORGDP - OAK RIDGE, TN

Map ID	Building No.	Name
(v)	K-901	Sanitary Disposal Area (Lonnie's Landfill)
(w)	K-1070-S	"SOUTH"
(x)		Switchyards: K-709, K-732, 762, 792 (Serves: K-27/29, 31, 33, respectively)
(y)	K-710-B/C	Sludge Beds/Imhoff Tank
(z)	K-1035	Acid Pit
(aa)	K-1024	Diluting Pit
(bb)		Flannigan's Loop & Other Landfarming
(cc)		Borrow Fill Holes
(dd)		Slope North of K-25 Filled with Trash
(ee)		Trash Area Across Poplar Creek Along RR Tracks, NE of 25
(ff)		Southern Railway Yard

Source: DOE Survey team

Refer to Figure 4-10 for the locations of these sites

TABLE 4-29

DESCRIPTION OF INACTIVE WASTE SITES AND RELEASES AT ORGDP
ORGDP - OAK RIDGE, TN

Name	Dates of Use/ Occurrence	Size/Depth	Volume Received/ Spilled	Constituents Received/ Spilled	Additional Information
K-25 Cooling Towers					
K-802 H	1949- ?	430'x60'x13-15'	5.8 mill. gal.	18-22 ppm Cr VI	Used for 1101/1201 & K-25
K-892-G/H	1956-1985	950'x65'x28'	13.5 mill. gal.	1-2 ppm Zn	(G&M 1987)
K-892-E	1952-1985	385'x63'x16'	4.5 mill. gal.	0.8-1.6 ppm P	
K-892-J	1979-1985	320x40x3-4	0.2 mill. gal.		
(K-832-H)	1952-1985	350'x65'x13'	2.8 mill. gal.	18-22 ppm Cr VI	
K-802-B	1960s	340'x65'x13-15'	2.4 mill. gal.	H_2O stor. for Fire Fighting	(G&M 1987)
K-1004-N	30-40 yrs old -1979/80	21'x21'x3'			
K-27 & 29 RCW Lines	Early 1950s-1985	2,900 L.F. 3-10' deep 16-54" Dia.			(G&M 1987) Connected to K-832 cooling tower basin.
K-31 RCW Lines	?-1985	10,000 L.F. 3-7' deep 24-48" Dia.			Connected to K-862-E cooling tower.
K-33 RCW Lines	Early 1950s-1985	12,500 L.F. 3-8' deep 12-60" Dia.		Known to have leaked (p. 3-18)	Connected to K-892 G/H.
K-33 ANDCO Tmt. Unit					Inside K-33. (G&M 1987) Exempt
K-306-1 PCB Storage	1984-present	25'x150' inside K-25	Unknown	PCB wastes	(G&M 1985) Exempt
HW Drum Storage	1977-present	160'x20' 40'x300'	864 55-gal. drums	PCB wastes	
Vault 23A	1984-present	290'x45'	3,000 drums	Sludges, carbon filter media, corrosives	

TABLE 4-29
DESCRIPTION OF INACTIVE WASTE SITES AND RELEASES AT ORGDP
ORGDP - OAK RIDGE, TN
PAGE TWO

Name	Dates of Use/ Occurrence	Size/Depth	Volume Received/ Spilled	Constituents Received/ Spilled	Additional Information
K-311-1 Radiogenic Lead Storage	1960s-present	40'x50' 2,500 ft^2	51 tons stored	Radiogenic lead	(G&M 1985) Exempt
K-720 Fly Ash Pile	1940s-1950s	10-15 acres (~20 acres)			(G&M 1987) 3004(u) monitor. Fly ash pile at Y-12 found to contain hazardous constituents.
K-725 Beryllium Building	Late 1940s-early 1950s			Be, U, Mg, solvents	Used for development of fuel elements for nuclear-powered aircraft.
K-726 PCB Storage Facility	1978-present	75'x50'	Five hundred 55-gal. drums	PCB liquids PCB solids: capacitors, kerosene, soil, ballasts	
K-731 Switch House (K-27& 29)					
K-732 Switch Yard (K27 & 29)					
733-A Transfer Oil Storage Tank		16,000 gal.			
Oil Storage Tank		19,140 gal.			
K-761 Switch House					

TABLE 4-29
DESCRIPTION OF INACTIVE WASTE SITES AND RELEASES AT ORGDP
ORGDP - OAK RIDGE, TN
PAGE THREE

Name	Dates of Use/ Occurrence	Size/Depth	Volume Received/ Spilled	Constituents Received/ Spilled	Additional Information
K-762 Switch Yard (K-31)					
K-763-B Tr. Oil Storage Tank		15,000 gal.			
K-763-C Tr. Oil Storage Tank		15,000 gal.			
Scrap metal	Since 1960s	22 acres total 30 acres (G&M 1985)	40,000 tons 2,215 lb 20,000 ft^3	LLW metal U in soil Asbestos Hg, PCB < 1977 liquid waste leaked (G&M 1985)	Alpha, beta or gamma on surface or if orig. from process building. (G&M 1985) C-Monitor
K-770 Garbage			Approximately 5 Ci	Wood, plastic, insulated wire U-contaminated	Generated during segregation of K-770 waste piles.
K-791 Switch House					
K-791-NA Static Capacitor Station					
K-792 Switch Yard (K-33)					

TABLE 4-29
DESCRIPTION OF INACTIVE WASTE SITES AND RELEASES AT ORGDP
ORGDP - OAK RIDGE, TN
PAGE FOUR

Name	Dates of Use/ Occurrence	Size/Depth	Volume Received/ Spilled	Constituents Received/ Spilled	Additional Information
K-793-A Tr. Oil Storage Tank		7,056 gal.			
K-793-B		7,056 gal.			
K-793-C		11,760 gal.			
K-793-D		15,845 gal.			
K-900 Bottle Smasher	1980-October 1984	3'x5'x2' deep		Methyl ethyl ketone peroxide, anhydrous ether, isopropyl ether, 1,4-Dioxane, dinitrophenyl-hydrazine	(G&M 1985) Exempt Located at 1070 F center spoilyard.
K-901-A Holding Pond	Late 1950s-1985 1974-ANDCO chromium treatment testing began; 1979-full-scale (600 gpm) chromium treatment began Early 1970s-1985 (G&M, 1987) 1985 Discharges ceased	5 acres	9 ppm Chromium 3,500 ppm solids (Note change in 1979)	Chromium VI prior to 1975; Cr III since 1975 Chromium hydroxide, Pb, Ni, Cu, U 1070-A Leachate may enter 901-A	Received RCW, runoff, groundwater prior to construction of dam/overflow weir in mid-1960s. (G&M 1987) 3004 (u) monitor NPDES 901 (007) collected since 1974 >0.05 mg/l occasionally.

TABLE 4-29
DESCRIPTION OF INACTIVE WASTE SITES AND RELEASES AT ORGDP
ORGDP - OAK RIDGE, TN
PAGE FIVE

Name	Dates of Use/ Occurrence	Size/Depth	Volume Received/ Spilled	Constituents Received/ Spilled	Additional Information
K-901-A Continued			533 400-lb cylinders of UF_6, HF, Br, Cl	Contents of ~200 cylinders shot out of cylinders with high-powered rifles Cr > 3,000 mg/kg	RFI August 1987 K/HS-136
K-1001-B Waste Accumulation Area	March 1987-present	5'x5'	30 gal.	Temporary storage of photographic waste solutions	
K-1001-C,D Waste Accumulation Area	March 1987	5'x5'	30 gal.	Temporary storage of photographic waste solutions	
K-1003 Waste Accumulation Area	March 1987-present	5'x5'	30 gal.	Photographic waste solutions	
K-1004-B Waste Accumulation Area	1986-present	40'x40'	25 drums	Flammables, solvents, acids, bases, sludges	
K-1004 Area Lab Drain Also see K-1004-N Cooling Tower (K-25)	1940s-present	24" drain, ~0.25 mile long	2,000 gal/yr (G&M 1987)	Laboratory chemical wastes: solvents, acids, bases	Discharges to K-1007-B Holding Pond. (G&M 1987) 3004(u) monitor Waste disposal prior to 1974 NPDES permit.

TABLE 4-29
DESCRIPTION OF INACTIVE WASTE SITES AND RELEASES AT ORGDP
ORGDP - OAK RIDGE, TN
PAGE SIX

Name	Dates of Use/ Occurrence	Size/Depth	Volume Received/ Spilled	Constituents Received/ Spilled	Additional Information
K-1004-L Vault	1950s-1960s	≈ 25'x25'		Concrete casts for storage of reactor return samples	(G&M 1987) 3004(u) monitor located under South end of 1004-J bldg.
K-1004-L RCW Lines	?-1979/80	550 L.F. 2-5' deep 4-12" Dia.			(G&M 1987) C-Monitor connected to 1004-N
K-1007 Waste Accumulation Area	March 1987-present	5'x5'	30 gal.	Photographic waste solutions	
K-1007-UST	?-1986 (removed)		250 gal.	Gasoline	(G&M 1987) C-Monitor
K-1007-B Holding Pond		15 acres	2,200 gal/yr. reagent grade chemicals (from K-1004)	3-12 ppm PCB in pond (source?) PCBs in sediment; elevated COD	NPDES permit in Feb 1984 required BMP ceased lab chemical discharges. Drains 1004 Area labs. K-31, 27 & 29 storm drains. Exempt (G&M 87)
K-1025-C Storage Bldg.	1979-present	40'x25' 6" dike 500 ft^3 cap. 3,740 gal. cap. (80 55-gal. drum cap.)		Wastes or off-spec chemicals for off-site shipping Various P&V materials and D001-D011 wastes	(G&M 1985) Exempt

TABLE 4-29
DESCRIPTION OF INACTIVE WASTE SITES AND RELEASES AT ORGDP
ORGDP - OAK RIDGE, TN
PAGE SEVEN

Name	Dates of Use/ Occurrence	Size/Depth	Volume Received/ Spilled	Constituents Received/ Spilled	Additional Information
K-1031 Waste Accumulation Area	1960s-1985	50'x50'		Paint wastes	
K-1035-A Satellite Drum Storage	1980-present	6'x18'	16 55-gal. drums	Wastes from circuit board cleaning facility D002 & D004 through D011	(G&M 1985) Upgraded October 1985.
K-1064-G Drum Deheading Facility	Early 1970s-1979	UST-1,000 gal. 75'x50'		Solvents, misc. organics	Drum residual pumped into UST.
K-1064 Burn Area/ Peninsula Storage	Disposal/ burning: 1950s-1960s Storage: Late 1960s-early 1970s	3 acres 5 acres (G&M 1985)	1,838 drums found during "closure" (1979)	Solvents, organics, rad-contamin. waste oil, PCB waste liquids, paint wastes	(G&M 1985) C-Monitor ["G"-area]
K-1070-A Contaminated Burial Ground	Late 1940s-March 1976 Closed < 1975 (G&M 1985)	2.6 acres total 0.2 acre burial/auger Trenches: 11'x3'x108' augered holes: 12'x3'	35,575 ft^3 2,430 ft^3 as of 7/75(RFI) Total radioactivity = 14.1 Ci	U-contaminated material UF_6 cylinders, Be chips, boron, NaF, oil	Leach alumina from Uranium Decon Fac. (1420). (G&M 1985) C-monitor RFI March 1987 K/HS-133

TABLE 4-29
DESCRIPTION OF INACTIVE WASTE SITES AND RELEASES AT ORGDP
ORGDP - OAK RIDGE, TN
PAGE EIGHT

Name	Dates of Use/ Occurrence	Size/Depth	Volume Received/ Spilled	Constituents Received/ Spilled	Additional Information
K-1070-B Old Classified Burial Ground	1950s-early 1970s Closed < 1970 (G&M 1985)	3.7 acres 30' depth	Total radioactivity = 0.15 Ci	Rad-contamin. classified materials (U & TRU) May include: LLW, solvents, organics	Haz. chemical disposal suspected. (G&M 1985) C-Monitor
K-1070-C/D Classified Burial Ground	1975-present Pits: 1977-1979	22 acres Haz. chem. pits. Ten: 20'x20' x20'	 9,129 gal 1,600 lb	Rad-contaminated classified materials (LLW) Solvents/ organics, waste chemicals	(G&M 1985) RCRA monitor ["D"-Area] (G&M 1985) C-Monitor ["C"-Area]
K-1070-D1, D2, D3, Storage Dikes	Diked storage area: 1979-May 1985 Nov. 1980-April 1985		912 drums	Hazardous waste liquids	Closed 2' cover (G&M 1985)
K-1070-F Old Contractors Burial Ground	early 1970s-1978 1940s-1979	10 acres		Construction rubble Soil, masonry, metal, fly ash, hard asphalt. Possibly hazardous or radioactive wastes	Complete records not available. (G&M 1985)
K-1070-G Burial Ground	NA	100'x100'	NA	Primarily construction rubble	

TABLE 4-29
DESCRIPTION OF INACTIVE WASTE SITES AND RELEASES AT ORGDP
ORGDP - OAK RIDGE, TN
PAGE NINE

Name	Dates of Use/ Occurrence	Size/Depth	Volume Received/ Spilled	Constituents Received/ Spilled	Additional Information
K-1085 Old Firehouse Burn Area	1950s-1960s ?	0.1 acre pit 25'x25'x12' deep		Waste solvents, organics Oil, paints, solvents (G&M 1985)	Open burning. (G&M 1985) C-Monitor
K-1095 Waste Accumulation Area	March 1987	20'x20'	500 gal.	Temporary drum storage of paint waste solutions	
K-1099 Blair Road Quarry	NA Closed < 1970 (G&M 1985)		NA	Rad-contamin. combustible waste	Originally used for rock source in 1940s. (G&M 1985) C-Monitor
K-1203 Sewage Treatment Plant, sludge drying beds	1945(?)-present		Capacity: 600,000 gpd 400,000 gpd used	Unknown; potentially PCBs, solvents, uranium	See Section 4.5.2.3.

Source: DOE Survey team

G&M 1987: Motley, 1987
G&M 1985: Geraghty and Miller, Inc., 1985
K/HS-136: MMES, 1987d
K/HS-133: MMES, 1987f

The K-720 Fly Ash Pile is approximately 1 mile southwest of the main ORGDP. The ash pile is approximately 1,000 feet east of the K-700 Power House, just south of an elongated discharge flume. The K-720 Ash Pile consists of fly ash and boiler slag generated in the K-700 Power House from the combustion of pulverized coal.

Construction of the K-700 Power House area began in June 1943 and initial operation to supply power to the nearby ORGDP started in April 1944. The K-700 Power Complex was composed of the buildings and systems needed to receive power from the Tennessee Valley Authority (TVA) grid, generate power from the local steam electric generating facilities, and distribute power to ORGDP. The "power house" contained three 750,000-pounds-per-hour (lb/hr) steam boilers to drive 14 turbine generators, for a total electrical output of approximately 270 megawatts (MW). Power generation at K-700 was discontinued in 1962 after the U.S. Atomic Energy Commission (AEC) decided to use power only from TVA.

Fly ash, bottom ash, and boiler slag are by-products of the combustion process at power stations that burn fossil fuels. Fly ash, the very fine residue fraction, is carried off in the stack gases from the boiler units except in more recent cases where stack gases are filtered in bag houses or electrostatic precipitators. Bottom ash and boiler slag are the heavier ash particles collected at the bottom of the boiler. Ash can be removed from the bottom of the furnace in a molten state and quenched in water or in a solid granular form. If the ash leaves the furnace in a molten state, as at the K-700 Power House, the boiler is referred to as a wet-bottom boiler and the residue is called boiler slag. If the ash is removed in a solid, granular form, the boiler is called a dry-bottom removal system, and the percentage of ash produced is approximately 50 percent fly ash and 50 percent boiler slag.

At K-700 the fly ash was mechanically collected into a hopper, dumped in with the boiler slag, and all the residue was then discharged to a sluice trench. Ash sluice-water pumps supplied high-pressure water to transfer the residue to the ash disposal field where the ash and slag were spread out with a bulldozer. The discharge cooling water from the slag quenching was discharged to the long discharge flume north of the ash disposal field, which empties into Poplar Creek.

Sediment samples (26 and 27) of the discharge flume taken by ORGDP in 1985 revealed no elevated radionuclide concentrations [less than 30 picocuries per gram (pCi/g) for beryllium-7 and cesium-137; no cobalt-60 or uranium-238 or 235 was found] (Ashwood et al., 1986). No results for organics or metals in sediments were reported and do not appear to have been analyzed. The metals concentration may be a significant environmental concern associated with the flume. Failure to analyze for metals may result in undetected releases of metals into groundwater or the Clinch River.

An RFI Plan for the K-720 Fly Ash Pile was completed in March 1988 (MMES, 1988f). No ash or leachate analyses have yet been performed, but a review of data from EPA by ORGDP indicated that "...general characteristics of coal combustion by-products presented in this section indicate that the K-720 ash pile may contain hazardous constituents" (MMES, 1988f). The RFI plan showed surface-water sampling results for two storm drains (SD-994 and SD- 992) on the south side of the discharge flume draining the north side of the main ash pile. These results indicated no elevated contaminant concentrations except for 990 milligrams per liter (mg/l) butyl carbitol (trade name for diethylene glycol monobutyl ether) in SD-994.

The source of this glycolether contamination is not known, but additional analyses would be needed to confirm its presence and concentration using a statistically significant sample size. ORGDP personnel believe that butyl carbitol is a laboratory artifact resulting from a residue of cleaning agent. If this belief were correct, no butyl carbitol would exist in the ash pile or its runoff. Butyl carbitol has also been found in storm drain analyses at other locations not associated with the ash pile (e.g., SD-170, 180 and 190 discharging to Mitchell's branch and SD-100 draining the southern front of the plant).

b. K-770 Scrap Metal Yard/Former Powerhouse Area - The K-770 Scrap Metal Yard/Former Powerhouse Area is a source of soil contamination and a potential source of surface-water and groundwater contamination (see also Section 4.1.1.2). Uranium is the most widespread known contaminant, although there is also a potential for PCB and fuel oil contamination. In addition, oil leaks from the old tank farm, and PCB leaks from transformers around the powerhouse and the beryllium building may have resulted in contamination. A RCRA Facility Investigation (RFI) plan for the K-770 area was completed in March 1988 (MMES, 1988c).

The K-770 Scrap Metal Yard is a storage unit southwest of the ORGDP adjacent to the Clinch River. The unit consists of a 25-30 acre tract of land used since the 1960s for the storage of low-level radioactively contaminated scrap metal. ORGDP estimated that the K-770 area contains 40,000 tons of low-level radioactively contaminated scrap metal (Advanced Science, Inc., 1987). Unclassified scrap metal is taken to this unit if it is found to contain alpha or beta/gamma activity on the surface or if the scrap metal originated from a process building (see Section 4.1.1.2).

In 1984-1986, ORGDP retained a contractor to segregate the scrap by separating it according to metal type and then reduce it in volume by shearing. The scrap metal is also being considered for smelting at a future date. The scrap was segregated into piles according to composition. Items with hotspots above ORGDP acceptable limits accounted for 100 tons of the material (MMES, 1988c).

Soil samples collected from the unit indicate that some of the uranium has washed or leached from the metal into the underlying soil. ORGDP estimated that 2,215 pounds of uranium are in the soil at the K-770 Scrap Metal Yard.

The unit also contains, in one section, approximately 20,000 cubic feet of asbestos-contaminated metal consisting primarily of metal pipe. In addition to the radioactive contamination, known or suspected chemical contaminants include PCBs, mercury, and asbestos. ORGDP personnel believe that these contaminants were associated with the scrap-metal operations prior to the waste tracking system in 1977.

ORGDP is evaluating the area for the uranium, transuranics, and asbestos located at the unit because these is no evidence that the area was used for a chemical storage or disposal area. There is also no complete records system that would indicate that hazardous chemicals were not disposed of or stored at K-770 along with the other wastes.

From 1944 to 1962, 13 fuel oil storage tanks were in use at the powerplant where scrap is now stored between Fercleve and River Roads. No records were available on the chemical characteristics of this oil. No information is available on whether spills or leaks occurred from these tanks or associated line and pumps. The sampling planned during the RFI should help characterize this potential fuel oil contamination.

PCB contamination of soil may have occurred in the powerhouse area as a result of spills and leaks from transformers used there from 1943 to 1962. No information is available on this potential contamination source, except for ORGDP records of transformer failures retained by ORGDP (Newton, 1977). Potential contamination from transformers is discussed separately in Section 4.5.2.3.2.c on switchyards. A transformer containing 15,000 gallons of oil in the K-25 switchyard near the powerhouse is known to have exploded and burned on July 2, 1950.

The K-725 Beryllium Building is located at the K-770 Scrap Metal Yard south of the ORGDP. The unit was operated from the late 1940s until the early 1950s. The unit was used for a Fuel Element Development Facility and operated originally by Fairchild Aircraft Engine Corporation and later operated by General Electric. The primary purpose of the development facility was to develop fuel elements to be used in nuclear-powered aircraft. The development test performed at the unit included high-temperature material testing and high-temperature coating testing. X-ray facilities, metallographic equipment, oxidation testing, and machine shops were also located at this unit (Advanced Science, Inc., 1987).

Hazardous materials used at the facility included beryllium, uranium, and mercury, but quantities of materials used are unknown. ORGDP personnel are attempting to determine the extent of the surface and equipment contamination.

The K-770 garbage waste pile is located at the K-770 Scrap Metal Yard. The pile was generated during the segregation of the scrap metal at K-770 (Advanced Science, Inc., 1987). Materials stored in the pile include wood, plastic, insulated wire, and other materials that could not be segregated into distinct categories. The waste pile is grouped with the K-770 Scrap Metal Yard because the material was originally mixed with the scrap metal and the primary constituent of concern is uranium.

c. K-901-A Holding Pond - The K-901-A Holding Pond is a potential source of surface-water and groundwater contamination. Chromium is the most significant known contaminant, although other contaminants are known to be present.

There are two sources of contamination within the K-901-A Holding Pond. First, hexavalent chromium sludge was discharged to the pond for approximately 15-20 years

- from the late 1950s until 1975, when a chromium treatment unit was placed on-line. Second, at least several hundred cylinders of miscellaneous waste chemicals were disposed of or vented in the pond during the late 1970s.

The K-901-A Holding Pond is located approximately one-fourth mile west of the K-33 Building. ORGDP initially began discharging chromate sludges to K-901-A in the early 1950s, according to ORGDP. No information is available on where the sludge was discharged from 1945 to the early 1950s. In the mid-1960s, ORGDP constructed a dam to create a holding pond at K-901-A.

The unit consists of a 5-acre surface impoundment used primarily for settling chromium hydroxide precipitates. These precipitates were generated from the RCW system used in cooling for the enrichment process. The water used in the RCW system was treated with chromium to provide corrosion protection for process equipment. During the recycling process, a blowdown is generated that contains water-soluble hexavalent chromium. In order to meet the NPDES effluent standards for total chromium at the K-901-A effluent, a process was installed to convert the hexavalent chromium to insoluble trivalent chromium. The electrochemical treatment (ANDCO) was installed in 1975 and provides the valence reduction with the K-901-A unit being used as a settling basin for the precipitates.

ORGDP personnel sampled the sludge from the ANDCO unit and found that it was not chemically hazardous according to RCRA (40 CFR 261). The K-901-A pond was initially used without the ANDCO treatment unit. The water discharged to the pond prior to treatment would be considered chemically hazardous since the total chromium concentrations were greater than 5.0 mg/l (Advanced Science, Inc., 1987). The amount of water discharged through the unit prior to the installation of the ANDCO unit is unknown. ORGDP is also investigating the pond based on sediment data that indicate that hazardous constituents are contained in the sludge.

The marsh-like K-901-A area received surface runoff, groundwater discharge, and gaseous diffusion process cooling water effluents prior to the construction of the dam/overflow weir in the mid-1960s. An RFI plan for K-901-A was completed in August 1987 (MMES, 1987d).

The average water intake from the Clinch River for the RCW system at ORGDP, prior to the gaseous diffusion process being placed in standby mode, was 11.0 million gallons per day (mgd) with 10.3 mgd lost to the atmosphere as evaporation or mist drift. The design of the ORGDP RCW system recirculating rate was 300,000 gallons per minute (gpm), which required treatment of 12,000 gpm makeup water.

RCW was discharged from the system as blowdown to the K-901-A Holding Pond and replaced with fresh makeup water to avoid exceeding the calcium and sulfate product solubility limit and forming scale in the cascade heat exchangers. The chromium level in the RCW was maintained at 9 parts per million (ppm) (18-20 ppm chromate). Because the NPDES permit at ORGDP limits discharge from the K-901-A Holding Pond into the Clinch River to 0.05 ppm total chromium, disposal of the blowdown was of major concern. This led to the installation of the electrochemical metal reduction unit and the use of the Betz 1100 anionic polymer.

The average and maximum chromium concentrations found in the K-901-A pond sediments were 1,600 and 3,300 milligrams per kilogram (mg/kg), respectively (Ashwood et al., 1986).

The second source of contamination in K-901-A, cylinder venting and disposal, resulted in an unknown amount of hazardous substances mixed with the chromium sludge in the pond. Various sizes and types of steel cylinders were used in laboratory work and research and development projects connected with uranium hexafluoride production and gaseous diffusion plant operations at ORGDP. Cylinder contents included uranium hexafluoride, hydrogen fluoride, combinations of halides (bromine, fluorine, chlorine) and various fluorinated/chlorinated hydrocarbons. Cylinder sizes included the 400-pound UF_6, 12-inch-diameter MD-type, as well as various sample containers.

The cylinders were suspended over the pond water, and after being shot with a high-powered rifle (fired from a distance), the cylinder was dropped into the water. The method of discharge at the onset of the disposal operation was simply swinging the cylinders out on a rope and shooting the cylinders to empty their contents. A cylinder chute was later built for better control of the cylinder. ORGDP personnel indicated that cylinders were initially dropped into the pond after being shot, but that the procedure eventually changed so that the cylinders were retrieved from the pond after the contents had been vented through the bullet hole and reacted in the water. A metal basket was constructed to facilitate cylinder retrieval, according to ORGDP personnel interviewed by the Survey team.

The RFI plan developed by ORGDP for K-901-A indicated in a table of "historical events" that the "gas cylinder discharge operation at the K-901-A Holding Pond occurred from the "mid-1960s-1975" (MMES, 1987d). Discharge of cylinders into K-901-A appears to have actually continued until at least 1979. A disposal request form dated October 1979 described a phosgene cylinder discharged at K-901-A *(Perry, 1979)*. There are no complete records of the number of cylinders discharged into the K-901-A lagoon, with the exception of one operation carried out to dispose of over 500 cylinders that had been abandoned in the four K-1025 storage buildings located north of K-25.

Five hundred and thirty-three cylinders were removed from the K-1025 storage buildings along with cylinders from other locations requiring disposal. The inability to dispose of the contents of these cylinders due to inoperable valves led to a shooting operation followed by immersion in the K-901-A Holding Pond. ORGDP estimated that the contents of approximately 200 of the 533 cylinders stored at K-1025 were discharged into the K-901-A pond.

d. K-1064 Burn Area/Peninsula Storage Area - The K-1064 Burn Area/Peninsula Storage Area is a source of groundwater contamination (see Section 3.4) and potential surface-water contamination. Miscellaneous solvents and radionuclides are the principal contaminants of concern.

The K-1064 Burn Area/Peninsula Storage Area is located on the peninsula north of the K-25 Building. The unit consists of approximately 3 acres of land that was used to store and dispose of waste solvents, organics, and radioactively contaminated waste oil. ORGDP personnel believe that disposal operations occurred during the 1950s and 1960s and consisted of the open burning of solvents. According to ORGDP personnel interviewed during the Survey, initially solvents were poured out and burned in a shallow unlined pit. A metal pan was used in later years. No records are available pertaining to the quantities of material disposed of by this operation. ORGDP completed an RFI plan for the K-1064 Burn Area/Peninsula Storage in July 1987 (MMES, 1987e).

In the late 1960s and early 1970s, the area was used to store drums of solvents, organics including PCBs, and radioactively contaminated waste oil. In 1979, ORGDP stopped using K-1064 for hazardous waste disposal and removed 1,834 drums (90,000 gallons) of waste stored there (Advanced Science, Inc., 1987). No information was available on where those drums were taken.

Also located in the Peninsula Area is the K-1064-G Drum Deheading Facility. The facility was built in the early 1970s and was taken out of operation in 1979. The unit consists of a small building and an underground 1,000-gallon tank (Advanced Science, Inc., 1987). The operation consisted of removing the tops from empty 55-gallon drums so the drums could be reused for various purposes. Drums containing residual quantities of liquid material were emptied into the underground tank. The material stored in the tank consisted primarily of solvents and various other organic materials. The tank was emptied and the liquid removed from the facility when operations were discontinued. During the Survey, the tank was on the ground next to the old drum crusher. No evidence of a tank leak or corrosion was visible.

e. K-1070-A Contaminated Burial Ground - The K-1070-A Contaminated Burial Ground is a source of groundwater contamination. A variety of solvents, radionuclides, caustics and acids were disposed of at K-1070-A.

The K-1070-A landfill is northwest of Building K-33. ORGDP buried hazardous and unclassified low-level radioactive waste there for approximately 30 years from the late 1940s until March 1976.

Although the total area committed for disposal at K-1070-A is approximately 2.6 acres, the area actually occupied by the buried materials is less than 0.2 acre. As of July 1, 1975, this area contained about 35,575 cubic feet of materials contaminated with uranium and 2,430 cubic feet of materials contaminated with thorium. The bulk of the material is leached alumina containing small quantities of uranium that were generated as a waste stream from the Uranium Decontamination Facility. Other wastes include uranium and thorium compounds, contaminated UF_6 cylinders, beryllium chips, boron, radioactively contaminated NaF, oil, plutonium, and arsenic. According to ORGDP, the total radioactivity of these materials is predicted to be approximately 14.1 curies (Advanced Science, Inc., 1987). Wastes were emptied into auger holes and trenches or buried in drums.

Records of the materials in this burial ground were maintained by marking each grave with a numbered stake and recording the contents corresponding to the stake. The area contains 62 "graves" (the term used by ORGDP personnel) of various sizes, ranging from trenches 11 feet deep by 3 feet wide by 108 feet long to augered holes 12 feet deep by 3 feet in diameter.

The unit does not contain adequate run-on diversion or a leachate collection system. The unit has, however, been covered and seeded to minimize the potential for surface runoff contamination. An RFI plan for K-1070-A was completed in March 1987 (MMES, 1987f).

f. K-1070-C/D Classified Burial Ground - The K-1070-C/D Classified Burial Ground is a source of soil, surface-water, and groundwater contamination. A wide variety of solvents, metals, and radionuclides were disposed of at K-1070-C/D.

The K-1070-C/D Classified Burial Ground is a 22-acre tract of land on the east side of ORGDP. Three separate operations have occurred at K-1070-C/D:

- trench burial of radioactive wastes - trenches A, B, and C (still operating);
- liquid chemical disposal in pits A-H; and
- storage of chemical waste drums in three diked areas (1, 2, and 3).

A general description of waste material buried in K-1070-C/D is given in Table 4-30. An RFI plan was completed for the K-1070-C/D burial ground in December 1987 (MMES, 1987b).

In 1975, ORGDP began disposal of classified low-level radioactive wastes (LLW) and non-radioactive wastes. This operation is still occurring and involves digging a trench approximately 300 feet long by 100 feet wide and 40 feet deep. Materials are placed into the trench and covered at the end of each day with soil. The total uranium activity for the classified trenches is estimated to be 0.15 curie. The area is currently (as of March 1988) being used for burial of classified LLW. Two trenches (A and B) have been filled. Trench C is currently in use. ORGDP has no records of the material buried in these trenches. Because the trenches were used during a period before strict controls on

TABLE 4-30

DESCRIPTION OF WASTE MATERIAL IN K-1070-C/D
CLASSIFIED BURIAL GROUND
ORGDP - OAK RIDGE, TN

Area	Waste Description	RCRA Hazardous	Quantity
Trenches (A - C)	Miscellaneous: Paper Wood Roofing Process Materials	No	Tons
	Asbestos	No	
	Classified Materials and Equipment	No	
Small Pits (A - H)	Inorganic Chemicals: Bromine Titanium Tetrachloride Phosphorous Pentoxide Decanoic Acid Potassium Stannate Ammonia Persulfate	Yes	950 pounds
	Pesticides and Pesticide Containers	Yes	600 pounds
	Nickel sulfamate	Yes	5 gallons
	Spent Solvents and Organic Waste: Trichloroethane Isopropyl Alcohol Xylene Carbon tetrachloride p-Dichlorobenzene Oil Varsol Freon Acetone Paint Waste Glycol Tergitol Toluene Methylene Chloride Methyl Ethyl Ketone	Yes	9,100 gallons
Small Glass Pits	Crushed Mercury, Sodium, and Tungsten Vapor Light Bulbs	Yes	55 gallons

Source: MMES, 1987b

hazardous waste disposal, it is possible that hazardous substances were disposed of in these trenches.

Several pits (A-H) constructed in 1977 were used until 1979 for the disposal of various hazardous wastes including laboratory quantities of corrosives, oxidizers, reducing agents, and chemical containers. These pits were approximately 20 feet by 20 feet by 20 feet deep. One of the pits was used for the disposal of drum quantities of various solvents and organics including methylene chloride, Freon, and trichloroethylene. The lower portion of each pit was backfilled with sand and the liquid wastes were poured into the sand. Immediately adjacent to this area are three additional pits used for the disposal of plastic materials and waste glass (e.g., empty glass containers, crushed fluorescent bulbs, etc.). Records maintained for the disposal activities at the pits indicate that 9,129 gallons of solvents/organics and 1,600 pounds of waste chemicals were disposed of at these units (Advanced Science, Inc., 1987). A list of chemicals disposed of in these pits is given in Table 4-30. In addition to these chemicals, approximately 1,000 gallons of classified and unidentified chemicals were disposed of in the pits at K-1070-C/D (Perry, 1984). This list appears to have been derived by ORGDP from a 1984 internal memorandum to file (Perry, 1984). This memo compiled a list of chemicals disposed of in K-1070-C/D trenches from a review of disposal request forms from 1977, 1978, and 1979. According to this memo, the C area received chemicals before 1977, but there are no records prior to 1977. Because the K-1070-A burial ground was closed in March 1976 (see Section 4.5.2.3.1.e), it is unclear where solvents and miscellaneous hazardous waste would have been disposed of between March 1976 and 1977.

The three earthen dikes were constructed in 1979 and used until May 1935 for the drum storage of various hazardous organics including waste oils, solvents, and solvent-contaminated waste oil. The three earthen dike storage areas were approximately 0.15, 0.26, and 0.21 acre, respectively. Drums from the K-1064 Burn Area/Peninsula Storage site containing greater than 5 ppm PCBs and/or 1 percent solvents were stored at these dikes.

The diked areas were backfilled with soil and seeded in 1987 according to a closure plan (IT Corporation, 1985) approved by the TDHE in November 1986 (Tiesler, 1986). No decontamination or capping was deemed necessary because ORGDP found no "RCRA hazardous waste constituents" in the soils within the diked areas (MMES, 1987b). The soil at the three diked areas was sampled using a random plot design in 1-foot intervals up to 4 feet deep. The soil was analyzed for a variety of organic and inorganic contaminants. The results of these analyses indicated that no contamination was significantly above background for that soil type using a control point approximately 20 feet away. The concentrations of metals found were also within the range of normal background levels found across the United States (California Department of Health Services, 1986).

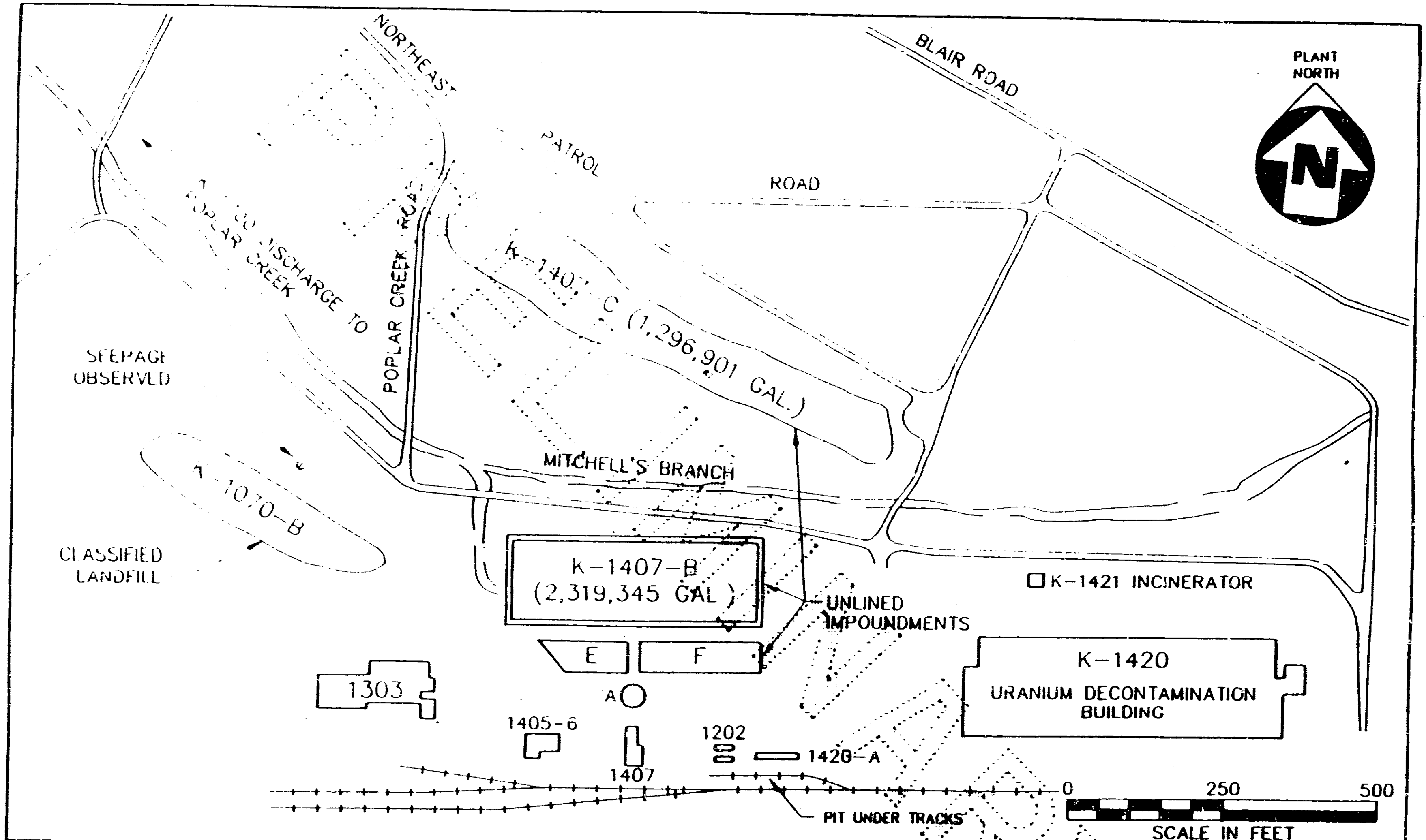
The Survey team observed a spring with a strong solvent odor seeping out of the soil bank at the bottom of the K-1070-C/D hillside. This seepage flowed into a ditch along the east side of Avenue D. According to historical topographic maps of the site prior to the construction of K-1070-C/D, a small intermittent stream previously ran along a course through the current K-1070-C/D area. This spring may be the vestigial remnant of that stream.

g. K-1407-B/C Holding Pond/Retention Basin Area - There are several sources of groundwater contamination and potential soil and surface-water contamination in the K-1407-B/C Holding Pond/Retention Basin area (see Figure 4-11). The K-1407-B Holding Pond is the central, and most significant, environmental problem in this area. In addition to this unlined hazardous waste lagoon, the area includes:

- K-1407-C Retention Pond;
- K-1407-C Soil Waste Piles;
- K-1417 Soil Waste Piles;
- K-1407-E/F Surface Impoundments; and
- K-1700 Watershed.

In addition, the 1070-B Old Classified Burial Ground is located near this area, and may be considered part of the waste group, but is described separately here in Section 4.5.2.3.1.k because of the relatively unique waste streams and the discrete type of operations that occurred there.

The K-1407-B Holding Pond consists of a 1.3-acre impoundment with a storage volume of approximately 1 million gallons. This impoundment was used from the 1940s until the early 1980s primarily for settling the metal hydroxide precipitates generated during the neutralization and precipitation of metal-laden solutions treated in the K-1407-A



Source: Adapted from Kuhlmeier et al., 1986b

FIGURE 4-11

K-1407 B/C AREA
ORGDP – OAK RIDGE, TN

Neutralization Unit. In addition to this primary source, K-1407-B received wastes from the K-1420 Metals and Decontamination Facility and the K-1501 Steam Plant. The K-1407-B Holding Pond discharges through an NPDES discharge point.

The waste streams discharging to K-1407-B were diverse as indicated by the summary provided in Table 4-31 and the following brief description of these waste streams:

K-1402 HCl Stripping Bath Effluent -- The K-1420 stripping bath effluent containing 18 to 24 percent HCl with dissolved nickel chloride, ferrous chloride, cadmium, chromium, and lead. A nitric acid bath effluent was also part of this waste stream.

K-1420 HCl Cleaning Bath Effluent -- The K-1420 HCl cleaning bath effluent contained 18 to 24 percent HCl with dissolved ferrous chloride, chromium, and lead.

K-1420 Metals Finishing Rinse Effluent -- The K-1420 plating rinse effluent contained HCl, water, cadmium, and chromium.

K-1401 Metals Cleaning Solution -- The K-1401 metals cleaning solution contained HCl, 95 percent sodium hydroxide, and 95 percent sodium bisulfate.

K-1407-A -- Extraction Procedure (EP) toxic metal-laden acids, bases, and rinsewaters entered K-1407-A for treatment. Cadmium-, chromium-, and lead-contaminated neutralized effluent and precipitated metal hydroxide sludges were discharged to the K-1407-B Holding Pond.

K-1501 Steam Plant Water Softener -- The K-1501 water softener reagent consists of calcium and magnesium chloride and sulfuric acid solutions. The pH of this stream ranges from 1 to 4.

K-1501 Coal Pile Runoff -- K-1501 coal pile runoff consists of leachate from the coal pile storage areas at the K-1501 steam plant. The pH of this stream ranges from 3 to 4.

The sludge in the K-1407-B Pond contained, among other contaminants, up to 250 micrograms per gram (μg/g) (ppm) arsenic, 3,200 μg/g chromium, and 9,700 μg/g nickel. In addition, 82 parts per billion (ppb) tetrachloroethylene and 69 ppb trichloroethylene were found in the sludge. The pH was relatively neutral at a range of 6.7 to 7.4.

TABLE 4-31

SUMMARY OF WASTE STREAMS DISCHARGED TO K-1407-B
ORGDP - OAK RIDGE, TN

Hazardous Waste	Hazard	Basis
K-1407-A Treatment Tank precipitates	EP toxic	Listed waste F006 Cd > 1.0 mg/l (D006) Cr > 5.0 mg/l (D007) Pb > 5.0 mg/l (D008) Miscellaneous waste[a]
K-1501 Steam Plant Water Softener	Corrosive	pH < 2.0 (D002)
K-1501 Coal Pile Runoff	Corrosive	pH < 2.0 (D002)
K-1420 Acid Stripping Bath Effluent	EP toxic	Cd > 1.0 mg/l (D006) Cr > 5.0 mg/l (D007) Pb > 5.0 mg/l (D008)
K-1420 HCl Cleaning Bath Effluent	EP toxic	Cr > 5.0 mg/l (D007) Pb > 5.0 mg/l (D008)
K-1420 Metals Finishing	EP toxic	Cd > 1.0 mg/l (D006) Cr > 5.0 mg/l (D007)
K-1401 Metals Cleaning Solution	Corrosive	pH < 2.0 (D002) Cd > 1.0 mg/l (D006) Cr > 5.0 mg/l (D007) Pb > 5.0 mg/l (D008)

Source: IT Corporation, 1987

[a]These process wastes consist of a wide variety of wastes that may be classified as EP toxic, corrosive, or toxic. Only small quantities of these wastes are generated.

According to ORGDP personnel, the K-1407-B effluent was very acidic (pH approximately 2) in previous years, prior to regulation of the discharge. Aerial photographs taken of the K-1407-B area in 1945 (photographs numbers 88610 and 88612) illustrated that an area north of the K-1407-B Pond, near the current K-1407-C Basin, was used for burning and disposal of miscellaneous garbage at that time.

The K-1407-C Retention Basin has a storage volume of 2.5 million gallons. This impoundment was used primarily for settling potassium hydroxide scrubber sludge, which was considered a hazardous waste because its pH was greater than 12.5 (hence it would have been a D002 waste according to 40 CFR 261.22). Metal hydroxide sludges removed from the K-1407-B settling pond were also disposed of in K-1407-C. These wastes were also considered hazardous on the basis of EP toxicity and because they contained a listed waste (F006). Discharge of K-1407-B wastes to K-1407-C ended in 1973 according to ORGDP personnel. Sludges in K-1407-C also contained low-level radioactive constituents, and may therefore be a mixed waste.

The sludge in the K-1407-C Basin contained, among other contaminants, up to 97 µg/g (ppm) arsenic, 2,400 µg/g chromium, and 21,000 µg/g nickel. Information on groundwater monitoring in the K-1407-C Basin is presented in the Hydrogeology Section (3.4). The pH was an average of 10 and a maximum of 11.

The K-1407-C and K-1417 soil waste piles are located on the northeast corner of the ORGDP. The K-1407-C pile is approximately 100 feet north of the K-1407-C Pond and the K-1417 pile is located approximately 200 feet east of the K-1417 concrete block casting and storage area. The two piles contain a total of 1,535 cubic meters of low-level radioactively contaminated soil. The soil was discovered to be contaminated with radioactivity during radiation surveys performed prior to the construction of K-1419. Normally, the soil would have been taken to a spoil area where fill was needed. Because the soil was radioactively contaminated, however, it is being stored on-site until an appropriate disposal alternative has been determined. Based on the analytical results obtained from the soil, ORGDP estimated that there is approximately 4.228×10^{-2} curie of uranium in the soil (Advanced Science, Inc., 1987).

The K-1700 Watershed consists primarily of the small stream, approximately 0.75 mile long, which flows from the K-1407-B Holding Pond to the K-1700 NPDES discharge location. The stream is a natural stream that receives the effluent from the K-1407-B

Holding Pond. The unit is being evaluated as a potential CERCLA unit due to the results found in the "Sediment Contamination In Streams Surrounding the Oak Ridge Gaseous Diffusion Plant" report (Ashwood et al., 1986). In the Survey, it was found that the stream sediments contained detectable levels of heavy metals and uranium. ORGDP suspects that the source of these metals is the K-1407-B Holding Pond, which is used as a settling basin for the sedimentation of metal hydroxides and which discharges into the small stream (Advanced Science, Inc., 1987).

h. K-1413 Treatment Facility - The K-1413 Treatment Facility is an apparent source of groundwater contamination from solvents, radionuclides, and acid wastes. ORGDP has detected groundwater contamination around K-1413 (see Section 3.4.x). An RFI plan for K-1413 was completed in February 1988 (MMES, 1988g). Because the K-1413 facility includes several elements, the RFI plan was written for the entire Waste Area Group (WAG).

The K-1413 WAG is due east of the K-25 Building. The WAG includes the K-1413-C Neutralization Pit south of Building K-1413, two smaller pits to the north and east of Building K-1413, the lines from the pits to the K-1401 Acid Line via a pumping station, the process lines within the K-1413 Building, and the storm drain lines in the vicinity of the K-1413 Building.

The south pit is open and has a capacity of approximately 21,000 gallons. This pit is equipped with an agitator and a sump pump and has a bin on top for the addition of lime. The two smaller pits are 4 feet by 4 feet by 4 feet in size and hold approximately 2,500 gallons each. They are connected to the K-1413 Building and the pumping station by process drains. The north pit is equipped with a pump that allows circulation from the north pit to the south pit when a valve between the north pit and the pumping station is closed.

The K-1413 site was built and put into operation as a research and development facility in the early 1950s. Originally the K-1413 site consisted of only the K-1413 Building and the east pit. In the late 1960s, an annex was added to the K-1413 Building and the north pit was constructed. In 1974-1975 the south pit was constructed to isolate the treatment and disposal of classified waste. A pumping station, just north of the K-1413 Building, was also built at this time, and process drains connected this station to the north pit, the east pit, and to the K-1407-A/B neutralization and holding pond facility.

The south pit was not connected to the K-1413 Building; however, a process drain allowed the transfer of waste streams from the north pit to the south pit when a valve between the north pit and the pumping station was closed. This transfer was driven by a pump located at the north pit. The wastes were then pumped from the south pit into a tanker truck and transported to the K-1407-C Disposal Pond. Prior to 1974-1975 the waste streams from the north and east pits discharged by gravity flow into the storm sewer systems located on the east and west sides of the K-1413 Building.

The north pit pump was deactivated in 1982, and the process drain between the north pit and the south pit was cut and capped. The south pit is, therefore, a closed system with waste solutions brought in by tanker trucks. The east pit remains in use. No information on leak tests of these pits was available.

A variety of activities have been carried out in the K-1413 Building since the facility was put into operation in the 1950s. An early K-1413 development project involved the fluorination of uranium metal chips to UF_6. The chips were immersed in perchloroethylene and shipped to the K-1413 facility in 55-gallon drums. Interviews revealed that spills of perchloroethylene occurred at the facility and UF_6 was accidentally lost to the stack in at least one incident. Due to the dispersion of UF_6 away from the building and the rapid conversion of UF_6 to UO_2F_2, ORGDP believes that any uranium released during the incident would not have remained at significant levels.

The chemicals utilized in the various activities discussed in the RFI plan are summarized below. Because records of all the chemicals used in this facility are not available, this is a partial list of possible contaminants. Records of the quantities and concentrations of the chemicals listed below are also not available.

- Uranium tetrafluoride
- Uranium oxide
- Antimony
- Titanium
- Fluorine
- NH_4OH
- Nickel
- Diethylene glycol
- Sulfuric, hydrochloric, nitric, and organic acids
- Nitric and organic acids

- Tungsten, rhenium, uranium, sodium, calcium, and hydroxides
- Mercury
- Uranium hexafluoride
- Perchloroethylene
- Tantalum
- Zirconium
- Uranyl nitrate
- Anisole
- Ruthenium
- Dibutyl ether
- Nickel, copper, chromium, hydrogen and sodium fluorides
- Hydrogen chloride
- Tungsten and thenium potassium hexafluorides

i. K-1414 Gasoline Tanks - At least one former diesel fuel tank (removed 1987) at the K-1414 garage is a source of groundwater contamination resulting in detectable benzene, xylene, and toluene in the soil and groundwater.

The K-1414 garage has maintained USTs since 1949, and storage for automotive fuels has been on-going since that time. EPA UST notification records for ORGDP listed three USTs for the K-1414 facility. Two of the tanks are reported to be approximately 6 years old while the third was listed as 37 years old. It is not clear whether the two 6-year old tanks are replacements for tanks that were removed, or whether they were added at K-1414. All the USTs are fabricated of steel and have sacrificial anode cathodic external corrosion protection. Associated piping material of the younger tanks is fiberglass reinforced plastic; the piping of the older tank is made of steel. At present one 5,500-gallon-capacity tank contains unleaded gasoline, the second tank contains methanol (2,000-gallon capacity), and the third and oldest tank was removed from the ground but previously contained diesel fuel before it was found to be leaking.

Inventory discrepancies of diesel fuel suggested that the tank containing diesel fuel was leaking; consequently a Petrotite test was performed on the diesel tank on February 25, 1987. The results of the test indicated that the tank and/or associated piping was leaking at a rate of approximately .08 gallon per hour (gal/hr). The tank was removed on March 3, 1987. Following removal, the diesel tank was retested and no leak was detected. The unleaded gasoline tank was tightness-tested on March 13, 1987, and the results indicated that it was tight.

From direct measurements, ORGDP estimated that approximately 500-600 gallons of No. 2 grade diesel fuel had been released from the tank. However, the leakage rate determined by the Petrotite test was suggested to be about 2 gallons per day (gpd) for an unknown time. Hence, if the tank leaked at 2 gpd for only half its 37-year life, then almost 14,000 gallons of diesel fuel could have leaked into the ground.

ORGDP recovered free product at the time of the removal of the diesel tank. A mixture of diesel fuel and water was pumped from the tank hole into a trailer-mounted 250-gallon tank. The mixture was decanted and the water portion bled from the tank. Approximately 300-400 gallons of diesel fuel was recovered within a few days. The decanted water was discharged into a storm drain at the site. The water then passed through an inverted weir and several oil absorbent booms. The storm drain ultimately drains into Mitchell Branch (K-1700 watershed). A total of six booms were installed along Mitchell Branch to contain free product which might have been inadvertently discharged to the storm drain.

Information on groundwater monitoring at the K-1414 facility is given in Section 3.4. Actively used tanks are discussed in Section 4.1. ORGDP completed an RFI plan for the K-1414 UST leak in February 1988 (MMES 1988b).

j. K-1232 Treatment Facility - The K-1232 Treatment Facility is a potential source of groundwater contamination from radionuclide wastes.

According to ORGDP personnel, the K-1232 facility was initially used from 1972 until 1980 for processing classified materials. Waste treatment at K-1232 occurred from March 1984 until September 1987 when the operation was moved to Y-12. No information was available on the operations prior to 1980.

The K-1232 Treatment Facility is southwest of the K-25 Building north of K-27 approximately 150 feet south of Poplar Creek, on a small bluff 50 feet above the creek. There are several aboveground treatment tanks located inside K-1232 as well as in-ground outdoor tanks located west of K-1232 between K-1232 and K-131. There are four large in-ground concrete tanks at K-1232:

- K-1232-B-1 - Settling Tank - 75,000 gallons
- K-1232-B-2 - Settling Tank - 75,000 gallons
- K-1232-A - Equalization Tank - 22,000 gallons
- K-1232-C - Neutralization Tank - 1,600 gallons

There are also two concrete sumps (B-3 and B-4), one on each end of the Settling Tanks. The two Settling Tanks are adjacent to each other, sharing a center wall, and are 75 feet by 25 feet. The equalization and neutralization tanks are located approximately 25 to 30 feet east of the settling tanks and are 30 feet by 15 feet and 16 feet by 7 feet, respectively. In addition there are underground lines connecting K-1232 and K-1231 with the settling tanks. Finally, there are seven floor drains inside K-1232. The K-1232-A Equalization Tank and the B-1 and 2 Settling Tanks were originally sealed with a black mosaic coating. This coating had peeled off in large patches. The concrete walls were eroded in many area in these tanks and in tank K-1232-C and the B-3 and B-4 sumps, and some sections had been patched with concrete. No information was available on when this damage had occurred or whether wastes had leaked out of the tanks.

A leak test of the underground piping (Goldsmith, 1988) indicated that the underground pipes between K-1232 and the B-1/B-2 Settling Tanks leaked at a rate of 1 to 1-1/2 gal/hr. The floor drain system from K-1232 leaked at a rate of 1 gal/hr. ORGDP completed an RFI plan for the K-1232 Treatment Facility in January 1988 (MMES, 1988h).

k. K-1070-B Old Classified Burial Ground - The K-1070-B Old Classified Burial Ground is a potential source of groundwater and surface-water contamination from radioactive wastes. The K-1070-B Old Classified Burial Ground is approximately 400 feet north of Building K-1401 and about 400 feet west of the K-1407-B Holding Pond. The unit covers approximately 3.7 acres and has an average depth of approximately 30 feet (roughly 180,000 cubic yards). Records were not maintained and the types and quantities of waste material disposed of at the unit are not known. The types of materials expected to be in the unit include radioactive and nonradioactive classified materials. The radioactive materials would include uranium and trace quantities of transuranics. ORGDP also suspects that hazardous chemicals may have been disposed of at the unit.

ORGDP believes that K-1070-B was operated from the 1950s through the early 1970s when it was closed by covering and seeding. No run-on diversion or leachate collection systems exist at the unit.

During the Survey, a wet area was observed on the hillside of the K-1070-B Burial Ground on an otherwise dry hillside. Groundwater appeared to be seeping out of the ground on the lower part of the K-1070-B slope. This seepage then flowed to the K-1700 stream. Hence, contaminants from the K-1070-B Burial Ground may be a surface-water threat as well as a groundwater threat. The Survey team's limited review of old aerial photographs at ORGDP revealed that a small stream ran through the middle of the K-1070-B Burial Ground in 1954 (photo #88611). Hence, the K-1070-B Burial Ground resulted from filling in a stream ravine. The location of this former stream appears to correspond to the current seepage at K-1070-B.

Because of its proximity to the K-1407-B Holding Pond and the K-1407-C Retention Basin, ORGDP is investigating the groundwater at the K-1070-B Burial Ground together with K-1407-B/C. Information on groundwater monitoring is given in this report in Section 3.4.

I. Cooling Tower Basins/RCW Lines - The RCW towers, basin, and lines are a potential source of groundwater contamination from chromate-contaminated waters and other organic wastes. ORGDP is planning to evaluate the cooling towers that used chromium-treated water as a corrosion inhibitor. This evaluation will include K-892-G/H, K-862-E, K-892-J, K-832-H, K-802, and K-1004-N. The cooling towers are considered USTs because more than 10 percent of the basins and associated piping are underground.

Pipe breaks, basin leaks, and cooling tower air emission plumes have discharged chromium into and on adjacent areas. All three sources are potentially significant contributors to groundwater and soil contamination. In addition, an unidentified organic waste was stored in at least one of the basins (K-801-B) for several years. The RCW system processed very large quantities of water through a system of basins, towers, and underground lines. The RCW system withdrew an average of 11.0 mgd of water from the Clinch River and lost approximately 10.3 mgd through evaporation and mist drift. The RCW system was designed to recirculate 300,000 gpm, which required treatment of 12,000 gpm of makeup water.

The underground lines connecting the cooling tower basins to the process buildings were known to have leaked at various times. These lines are over 24 inches in diameter. The main line feeding the process buildings was 48 inches in diameter. In some cases the leaks were large and obvious, such as the failure that occurred in the 1960s on the east side of K-25 that caused the ground to collapse, according to ORGDP personnel interviewed by the Survey team. In other cases, the leakage was slower and more subtle. These leaks may have resulted in more losses, however, because they could go undetected for long periods of time. Widespread corrosion and leakage from the RCW system has been a concern at ORGDP for almost 30 years. According to ORGDP personnel, (MMES, 1988a) "In 1958 ... an investigation of the underground RCW piping revealed serious corrosion problems from galvanic currents that had penetrated the protective coating on the pipes".

The basins under the cooling towers may be another source of slow leakage to the ground. The basins were constructed of concrete in the 1940s and 1950s, and have not been tested for leakage.

Finally, wind-borne mist from the operation of the cooling towers may have caused soil (see Section 3.2) and groundwater contamination (see Section 3.4). Because hexavalent chromium is extremely water soluble, this contaminant has probably been leached into the ground. If 10.3 mgd of RCW were lost through evaporation and mist drift, then as much as 6,200 tons of hexavalent chromium may have been deposited in the environment from cooling tower mists at ORGDP (see Table 4-32). This estimate is probably conservative (i.e., overestimates the amount of chromium discharged to air) for several reasons. First, not all of the loss had a chromium concentration of 10 ppm. Second, to the extent that some of the loss was truly evaporative, this waste would have not contained significant chromium. Much of the 10.3 mgd lost, however, did not change phases to a vapor, but merely drifted as droplets in the wind, and would have contained chromium. Also, some of this loss estimated to have gone into the air may have actually been lost through seepage of the basins. Finally, the cooling towers did not operate at full capacity for the entire 40 years. Some of the towers were not built until the late 1950s, and repairs sometimes required temporary shutdowns. Actually, the K-801-H tower was placed in service in 1944. The K-802-H and K-832-H towers began operation in 1945. In 1951, the K-8614 tower was put in service and in 1955, the K-892-G and K-892-H towers were placed in service. The K-802 RCW system was

TABLE 4-32

CALCULATED ESTIMATE OF COOLING TOWER CHROMIUM LOSS
ORGDP - OAK RIDGE, TN

10.3 million gallons/day lost* x 3.785 liters/gallon =	39 million liters/day lost
39 million liters/day lost x 10 ppm hexavalent chromium mg/l) =	390 million mg/day chromium lost
390 million mg/day =	390,000 grams/day chromium lost
390,000 g/day ÷ 453.6 g/lb =	860 lb/day
860 lb/day x 365.25 days/year =	314,000 lb/year
314,000 lb/year x 40 years =	12,569,500 lb
12,569,500 lb ÷ 2,000 lb/ton =	6,200 tons

Source: DOE Survey derivation of ORGDP estimates

*Estimate of evaporative and wind drift losses of ASI, 1987 converted from chromate to a non-chromate phosphate system in 1977, and was demolished in 1979.

From 1974 to 1981, ORGDP stored an organic chemical waste in the K-801 clarifier. This waste was discharged initially to the K-1007-B pond, but because this discharge resulted in a large fishkill, the waste was stored in the K-801 clarifier, while the K-801-H cooling tower basin was repaired for additional storage capacity (Goodpasture, 1988b). The waste had a chemical oxygen demand (COD) of 5,000 mg/l, which is higher than would be expected for a conventional sewage waste. On March 14, 1975, approximately 400,000 gallons of this high-COD chemical waste was released systematically to Poplar Creek beginning at about 3:00 pm, through the night until about 7:00 AM the next morning. ORGDP indicated that no foaming or fishkills were observed during this discharge, and that the COD levels in Poplar Creek were kept below a background of 20 mg/l through dilution (Mitchell, 1975). The K-801-H cooling tower basin was subsequently repaired to provide the extra storage capacity needed to avoid this type of discharge.

The K-801 clarifier and the K-801-H cooling tower basin are in-ground concrete tanks. The K-801-H basin, which was also later used for storage of this waste stream, was found to leak water inward after a small amount of waste had been pumped into it. Because of a concern that this inleakage could result in outleakage during times of low water table, ORGDP pumped out the waste and planned to repair the vertical expansion joints through which the water was leaking. No records are available to indicate whether that planned repair was completed. ORGDP personnel did not believe that the K-801 clarifier or the K-801-H basin leaked their stored waste into the ground, but no leak testing data were available. Failure to investigate these basins for leaks and historical releases could result in undetected groundwater contamination.

m. K-1070-F Old Contractors Burial Ground - The K-1070-F Old Contractors Burial Ground is a source of groundwater contamination from solvents and radionuclides. The K-1070-F Old Contractors Burial Ground is approximately 1 mile west of the K-33 Building on the Poplar Creek Peninsula and consists of approximately 10 acres of land. The unit began operation in the early 1970s and was closed in 1978. It was used primarily for the burial of construction and renovation rubble including soil, concrete, asphalt, wood, and roofing materials. No records are available for materials disposed of at the unit during its first few years of operation (Advanced Science, Inc., 1987). Evidence of groundwater contamination was revealed by recent monitoring well data (see Section 3.4).

The K-900 Bottle Smasher is also located on the peninsula of Poplar Creek immediately south of the K-1070-F Burial Ground. Because of the proximity of these two units, it may be difficult to distinguish which unit, if not both, is responsible for the groundwater contamination. Also located on the Poplar Creek peninsula is another potential burial area that was unidentified prior to the DOE Survey. This area is considerably further south on the peninsula (1/4 mile) and would not affect the wells near the K-1070-F Burial Ground and K-900 Bottle Smasher because groundwater generally flows off of the peninsula toward the rivers in this area rather than along the length of the peninsula (see Section 3.4.1.2).

n. K-1085 Old Firehouse Burn Area - The burn area at the old K-1085 Firehouse is a potential source of groundwater contamination from hydrocarbon contaminants (benzene, xylene, and toluene). The K-1085 Old Firehouse Burn Area is south of the ORGDP near the intersection of Highway 95 and Bear Creek Road. The unit is assumed by ORGDP personnel to have been in operation during the 1940s, 1950s and 1960s and was used for the open burning of various waste solvents and organics. Records were not maintained, hence the period during which the unit operated or the quantity of material disposed of at the unit is not known (Advanced Science, Inc., 1987).

During the Survey, three former ORGDP firemen returned to the site for a day to tour the old firehouse area and help identify the location of the old burn pit. These former firemen all indicated that the burn pit had been located behind the firehouse to the east of where the monitoring wells are located between east Gallaher Road and the Oak Ridge Turnpike. Monitoring wells UNW-33, UNW-34, UNW-35, and UNP-6 are located on the north side of Bear Creek Road, while the old burn pit, was located on the south side. If the firemen are correct about the location of the old burn pit then the monitoring wells are not located near this potential source of contamination. This error could result in groundwater contamination, if present, going undetected. The failure of ORGDP to accurately locate the monitoring wells near the source was a result of the inadequate CERCLA investigation (see Section 4.5.2.3.3), which should include extensive file searches, aerial photograph review and analysis, and interviews with former and veteran employees.

According to the former ORGDP firemen interviewed during the Survey, a 12-foot-deep pit was dug approximately 25 feet by 25 feet. At the end of the day, according to the firemen, at approximately 5 PM, the firemen would ignite approximately 1,000 gallons of waste oil and solvents in the pit. Another fireman recalled that the pit would only have approximately 3 feet of freeboard when it was filled. Assuming a pit 20 feet by 20 feet by 20 feet deep and this freeboard, approximately 26,931 gallons of oil would have been in the pit. Although these recollections are extremely divergent, a significant amount of oil and solvents appears to have been poured into the pit.

o. K-1099 Blair Road Quarry - The K-1099 Blair Road Quarry is a potential source of groundwater contamination.

The K-1099 Blair Road Quarry is northeast of the ORGDP just south of the single-lane bridge across Poplar Creek on Blair Road. The quarry was initially used as the source of rock used in the construction of the ORGDP during the 1940s (Advanced Science, Inc., 1987). The unit was used later as an area for the open burning of radioactively contaminated combustible waste such as paper and wood. No records are available on the operational timeframe nor the quantity of material burned at the unit. There is no record indicating whether hazardous chemicals were or were not disposed of at the unit.

During the pre-Survey site visit in February 1988, the Survey team observed four drums in the quarry area along the entrance road to the quarry. ORGDP personnel indicated later that these drums were subsequently removed for commercial disposal. No records were available on the contents of these drums. The name "Stouffer" was painted on the label of at least one of these drums. All four drums appeared rusty and surrounded by weeds approximately 20 yards off the entrance road to the quarry.

According to interviews with long-time ORGDP employees by the Survey team, the K-1099 quarry previously was a water-filled pit. The pit was filled in by bulldozing the charred debris of the waste after it had been burned.

In the single monitoring well located in the quarry, ORGDP found that groundwater at the K-1099 Quarry was contaminated with radioactivity above the 15 picocurie-per-liter (pCi/l) drinking water standard for alpha activity. The presence of elevated alpha concentrations suggests that uranium is probably in the groundwater (see Section 3.4).

p. K-1203 Sewage Treatment Plant - The K-1203 Sewage Treatment Plant and two adjacent sludge beds are a potential source of groundwater and soil contamination from radionuclides, metals, and PCBs.

The original sewage treatment plant built in the 1940s probably received hazardous substances in the past, prior to the implementation of environmental controls in the 1970s. This assumption is based, in part, on information available from similar production and sewage systems at the Portsmouth and Paducah Gaseous Diffusion Plants.

According to one former ORGDP employee interviewed by the Survey team, the Imhoff tank had cracked concrete walls that allowed groundwater to leak in when the tank was emptied for repairs. These cracks would have also been a likely route for contamination to seep out into the groundwater.

In addition to the Imhoff tank and other treatment plant facilities, the adjacent sludge piles and underground sewer system may be a source of groundwater contamination. The sanitary sewer system consists of the treatment plant, nine lift stations, 4,400 linear feet of force mains, and 51,000 linear feet of gravity mains. The existing sewage treatment plant was built in 1975 and has a capacity of 600,000 gpd (MMES, 1984). Part of this system is inactive in ORGDP buildings no longer in use.

At least two sludge drying beds have been used at the Sewage Treatment Plant (east and west - K-1203-5 and 6, respectively). No analytical data are available for this sludge. At the two other gaseous diffusion plants, the Survey team found that the sewage treatment plant sludge was contaminated with uranium and PCBs.

q. K-1410 Neutralization Pit - The K-1410 Neutralization Pit is a potential source of groundwater contamination from radionuclides, acids and metals.

The K-1410 Neutralization Pit is across Poplar Road from the K-1410 Plating Facility, approximately 600 feet west of the K-25 Building and adjacent to Poplar Creek. The limestone pit is outside a security fence that surrounds ORGDP. The K-1410 Neutralization Pit area consists of five separate components:

- the pipe leading from the K-1410 Building to the concrete pit;
- the pipe leading from the concrete pit to the limestone pit;
- concrete neutralization pit;
- limestone pit; and
- the weir from the limestone pit to the creek.

In 1945, the K-1410 Building was used for the storage of clean trapping material (alumina, carbon, sodium fluoride). An area of the K-1410 Building was also used for dumping spent traps and refilling them with clean trapping material. Most of the spent material containing low-level radioactive uranium was stored in the K-25 Building vaults for subsequent recovery. A uranium decontamination and cleaning facility was operated in the K-1410 Building from the late 1940s until the K-1420 Chemical Operations Facility was built and placed into operation in the mid-1950s. The decontamination and cleaning solutions from Building K-1410 were transported to K-131 for recovery if economic recovery criteria were met; otherwise, the solutions were discharged into Poplar Creek. During this time, the discharge pipe ran underground until it exited from the bank of the creek; the discharge pipe then emptied into the creek or onto the bank near the water's edge. Discharge pipes were elevated above the ground or water surface with the effluent spilling into the stream or onto the bank. An interim period existed from the time the K-1420 Building was completed (1953-1954), and the K-1410 Building began plating operations in 1963. During this interim period, the K-1410 facility continued servicing cascade chemical tanks and vacuum pumps and cleaning and decontaminating equipment parts.

In 1963, the K-1410 Plating Facility and Neutralization Pit were in operation. The K-1410 facility was modified as an electroplating facility. The modifications included excavating a pit on the bank of Poplar Creek and filling it with limestone. This pit was built to handle neutralization of the discharges from the plating operations. An underground pipeline from the K-1410 facility, at the side of the bank above the pit, was installed to discharge the plating effluents. Rip-rap lined the bank from the pit to Poplar Creek. Effluents overflowed from the pit down the rip-rap into Poplar Creek.

In order to meet EPA requirements, a new neutralization facility was constructed and placed in operation in 1975. The facility consisted of a 15,800-gallon concrete pit with feed and mechanical mixing equipment and monitoring instruments. The concrete pit was upgradient of the original limestone pit with the effluent from the concrete pit discharging into the original pipeline and exiting at the limestone pit. The neutralized discharge into Poplar Creek was permitted under the NPDES regulations.

In 1979, the needs of the ORGDP improvement and upgrading program (CIP/CUP) had been met, and the K-1410 Plating Facility and Neutralization Pit were shut down. The K-1410 Building, the neutralization pit, and the original limestone pit are now abandoned.

Both pits at K-1410 received many of the same waste streams. The original limestone pit and the K-1410 Concrete Neutralization Pit were built in series a decade apart (1963 and 1975, respectively). Chemicals used in the plating operations included alkaline cleaners (various trade names; no specific chemical names are available).

ORGDP conducted degreasing operations in the K-1410 Building from 1946-1963 using a commercial degreasing unit that included a recovery still. The degreaser was required to clean pumps that used a heavy oil, referred to as "MFL" oil, as a lubricant. Initially, carbon tetrachloride may have been used as the degreasing agent, but trichloroethylene was later used. There is no evidence that the degreasing agents were discharged into the neutralization pit after use. The bulk of the degreasing operations with organic degreasers was handled in K-1401 after K-1410 became an electroplating facility. From 1963 until 1979, degreasing was conducted in the K-1410 Building using inorganic degreasing agents such as detergents and specially formulated alkali and acid dips that contained trace amounts of organic degreasers.

ORGDP completed an RFI plan for the K-1410 Neutralization Pit in September 1987 (MMES, 1987g).

r. K-1420 Uranium Recovery and Decontamination Facility - The K-1420 Building and associated facilities are potential sources of soil and groundwater contamination from radionuclides, metals, acids and solvents. The K-1420 WAG is located within the ORGDP between the Northeast Patrol Road and 15th Street. The K-1420 WAG consists of three components:

- K-1420 Process Lines - north and south process drains (outside Building K-1420 down to the K-1407-B Holding Pond)
- K-1420 Oil Storage Yard

- K-1421 Incinerator.

The K-1420 Chemical Operations Building was constructed and began operation during 1953-54. The building initially contained the following facilities:

- Furnace stand for converter conditioning and recovery;
- Mercury recovery;
- MFL oil reclaiming;
- Classified parts disassembly and cleaning;
- Cascade and feed plant equipment cleaning and decontamination (includes compressors, converter parts, valves, piping, UF_6 cylinders);
- Uranium recovery;
- Aluminum leaching (removal of uranium from the trapping media); and
- Laboratory.

Plating facilities were installed in the mid-1960s. Both electroplating and electroless plating processes were used. Neither process employed cyanide; however, cyanide may have been used in development work performed in the laboratory. The operations in the K-1420 Building are also discussed in Section 4.1.

A converter bundle cleaning and barrier removal facility was installed in the early 1970s to handle the converters being replaced in the CIP. This facility was shut down with the completion of the CIP in 1981.

An oil reclamation project was started in early 1983. Uranium-contaminated waste oil was treated with quinoline and was centrifuged. The resulting uranium-bearing sludge was incinerated at the K-1421 Incinerator until the incinerator was shut down; the sludge is now stored. The oil concentrate supernatant from the centrifuge separation process, with less than 200 ppm uranium, is currently sent to K-1435 for storage before incineration. The K-1420 annex was added to the east end of Building K-1420 in the early 1970s. The annex was used by maintenance personnel to disassemble classified converter parts being removed from the cascade in the CIP.

The K-1421 Incinerator was used from the beginning of K-1420 operations. The incinerator consisted of a brick pit and stack used to burn contaminated paper gloves, shoes, oil sludges, etc. The original incinerator was then modified in the late 1960s with a secondary burner and a higher stack. Operation continued until 1982 when the incinerator was modified in order to meet EPA standards. It was shut down in 1986 due to emissions exceeding uranium emission standards.

The K-1420 Mercury Recovery Room is located on the ground floor of Building K-1420, on the northeast side of the ORGDP within the security perimeter fence. During the 1960s and 1970s, operations in the K-1420 Mercury Recovery Room included cleaning used mercury and recovering mercury from mercury-bearing wastes with a distillation process.

A triple distillation process consisting of three stills in series was used for the purification of elemental mercury. In each of the distillation units, the mercury was vaporized and condensed. In the third unit, the mercury was condensed into a recovery bottle and water decanted so that only ultrapure mercury (99.9+ percent) remained in the recovery bottle. At the onset of the operation, glass recovery bottles able to hold 8 pounds of mercury were used. The glass bottles were later replaced with plastic bottles holding 6 to 8 pounds of mercury. These bottles were packaged in special crates and shipped to various government agencies.

Since mercury recovery was the principal objective, measures were taken to prevent spills. Mercury-contaminated wastes and used mercury were washed with nitric acid in a 2.5 - 5.0-gallon container in the sink. The sink contained a standpipe that prevented materials from entering the drain at the sink level. Washed solutions were then transferred to the distillation units. Spills associated with the distillation units were contained in a curbed area beneath these stills. A floor drain in the center of the mercury recovery room was raised from the floor level, preventing most spills from entering the drain line.

A change in the allowable concentration limits for airborne mercury under the National Emission Standards for Hazardous Air Pollutants (NESHAP) required upgrading of the mercury recovery room's ventilation system. The ORGDP management decided not to renovate the exhaust system, and the mercury recovery operation was shut down in the early 1980s. The room still contains the ventilation hoods, distillation equipment, and other equipment associated with the recovery process. Presently, mercury-bearing wastes and used mercury are sent to the mercury recovery room to be packaged in appropriate containers (see Section 4.1.1.2).

The effluent from the room's drain lines discharged into the K-1407-B Holding Pond. Leak testing in 1987 revealed extensive leakage from the south and north side process drain (Goldsmith et al., 1988) of K-1420. Several other underground drainage lines leading from K-1420 to the K-1407-B Holding Pond may also be leaking, or have leaked.

Despite measures to contain mercury inside the room, mercury was found in the center floor drain when the line was accidentally punctured. To immobilize the mercury, the line was grouted and capped where the line exits the K-1420 Building and the floor drain in the mercury recovery room was sealed.

During operations at the mercury recovery room, the concrete floor (except for the curbed area beneath the distillation units) was painted with an oil base paint. However, the painting was primarily for aesthetic reasons and not for the purpose of providing a seal to prevent movement of mercury through the floor to the ground surface underneath the building.

s. K-1401 Degreaser Tanks/Acid Lines. - The K-1401 tanks and lines are a potential source of groundwater contamination from acids and radionuclides.

The K-1401 Acid Line is located within the ORGDP on the east side of Building K-1401 between Avenue D and Avenue F. The 10-inch acid line, constructed of vitrified clay pipe, is approximately 1,500 feet in length, and runs from the southeast end of the building toward the K-1407-B Holding Pond. There are three components related to the appurtenances at the K-1401 Building:

- acid, alkali, and degreaser tanks with respective process drain lines inside Building K-1401;

- A process drain line beginning at the southeast end of Building K-1401 (another line ties this line to the northeast corner) and extending to the K-1407-B Holding Pond; and

- a process drain line running from Building K-1301 to its intersection with the K-1401 Acid Line.

The process drain lines connecting K-1401 to the K-1407-B Pond are connected to two sumps at the northeast and southeast corners of K-1401 which drain a floor trench that runs the perimeter of K-1401. Depleted cleaning solutions and rinsewater were 'dumped' on the floor of K-1401 and allowed to flow into this floor trench leading to the process drain lines. Spills from the drum and tank storage of acid and trichloroethane at K-1404 form another effluent to these drain lines (Goldsmith et al., 1988).

The K-1401 Maintenance Facility has been used for various cleaning operations. The cleaning solutions discharged through the acid line and flowed to the neutralization pit at the K-1407-B Holding Pond. The process drain line was used primarily to transfer organic and inorganic degreasing liquids to the K-1407-A Neutralization Pit or K-1407-B Holding Pond. The acid line leaked and was partially replaced in 1975. The bell joints in the process line were packed with lead, rope, and tar and sealed over with concrete. The pipe ran through a limestone-filled trench with diatomaceous earth packed around the pipe. Subsequent leaks occurred due to the acid seeping out the joints and corroding the limestone. The K-1401 drain line, which ranges from 4 to 15 feet below grade, was slip-lined in 1982 with a 10-inch polyethylene sleeve from the K-1401 Building to the manhole west of the K-1407-A Neutralization Pit. In 1988 EPA required the acid line to be shut down and double-contained or replaced prior to reuse. Degreasing operations in Building K-1401 may remain shut down and the acid line abandoned.

Prior to 1977, K-1301 housed a nitrogen production facility that discharged spent caustic solutions directly to the K-1407-B Holding Pond. In 1977, the process drain lines were repiped to flow to the K-1407-A Neutralization Pit. All the other nonprocess drain lines in K-1301 were tied to either the sanitary or storm sewers. In 1978 or 1979 the K-1301 facility was shut down.

ORGDP completed an RFI plan for the K-1401 Degreaser Tanks/Acid Line in November 1987 (MMES, 1987h).

t. K-1515 Land Treatment - The K-1515 Water Treatment Plant sludge beds may be a potential source of groundwater or soil contamination. The K-1515 Land Treatment Unit is south of the ORGDP adjacent to Bear Creek Road between Highway 95 and the K-1513 Sanitary Water Treatment Facility. The facility consists of a storage unit for approximately 25,000 cubic feet of sediment that was removed from the K-1515 Lagoon during the early 1970s. The sediments were generated from the K-1513 Treatment Plant and consist primarily of aluminum sulfate. ORGDP believes that trace quantities of radioactive materials may also be present in the sludge. The trace amounts of radioactivity in the untreated water from the Clinch River are concentrated in the sludge in the bottom of the K-1515 Lagoon. Neither the quantity nor concentration of radioactive material has been determined. In addition, because of the historical discharge of effluents from the X-10 ORNL into White Oak Creek, which leads to the Clinch River (DOE, 1988), contaminants such as heavy metals and radionuclides discharged into the Clinch River from ORNL may have been pumped into the water supply for ORGDP at K-1513 and settled out in the sludge and deposited in the K-1515 land treatment area. It is unlikely that mercury contamination from the Y-12 plant discharges into the East Fork of Poplar Creek (Case, 1977) were pumped into the K-1520 water plant for ORGDP and concentrated into the K-1515 sludge, because the intake point is located on the Clinch River upstream of its confluence with Poplar Creek.

The lagoon is approximately 2 acres and is used for settling aluminum sulfate particulates generated during the sanitary water treatment process. The aluminum sulfate is used as a coagulant to remove suspended solids from the treated water. The sludge in the bottom of the lagoon is not hazardous but is being evaluated because of the trace amounts of hazardous chemicals and radioactivity that are in the raw water from the Clinch River. Samples collected from the sludge indicate detectable quantities of alpha and beta/gamma-emitting materials in the sludge. The trace quantities of radioactivity in the raw water are removed during the treatment process and are concentrated in the lagoon sludge (Advanced Science, Inc., 1987).

u. K-1503 Neutralization Pit - The K-1503 Neutralization Pit and associated facilities are potential sources of groundwater and surface-water contamination. The K-1503 Neutralization Pit is located south of the K-1501 Steam Plant across the road near the south coal yard. The K-1503 site includes:

- the K-1503 Neutralization Pit,
- the trench inside the K-1501 Building, and
- the underground line that connects the pit and trench.

ORGDP completed an RFI plan for the K-1503 Neutralization Pit in December 1987 (MMES, 1987i).

In the mid-1940s, a pit was excavated (15 feet by 18 feet by 8 feet with an estimated capacity of 16,000 gallons) south of the K-1501 Steam Plant to receive sludge generated from the chemical water softening process carried out in the steam plant. In 1973, a synthetic zeolite water softening process was installed in the K-1501 Steam Plant; the pit was upgraded, lined, and put into operation as a neutralization pit. Hence, the pit was unlined for almost 30 years, from approximately 1945 to 1973. The hydrogen zeolite softening process results in the formation of carbonic, sulfuric, nitric, and hydrochloric acids.

Both brine and acidic regeneration solutions were discharged from the K-1501 Steam Plant into a concrete-lined floor trench and from there were sent via an underground line to be neutralized in the K-1503 pit. After neutralization, the solutions were discharged to a nearby catch basin that drained to the K-1407-B Pond (see Section 4.5.2.3.1.g). The pipe from the pit to the storm drain is now capped at its exit from the pit. In 1979 the unit was modified so that the solutions were routed from the K-1503 pit via an aboveground pipe to the K-1407-A Neutralization Facility. No neutralization has occurred at the K-1503 pit since this modification. In 1987, the K-1503 unit began routing K-1501 discharge solutions to the Central Neutralization Facility.

In 1987, ORGDP performed leak tests on the components of the K-1503 site. These tests indicated extensive leakage from the trench inside the Steam Plant and the line between the trench and the neutralization pit. The damaged floor around the trench was stabilized by backfilling with concrete. In order to bypass the leaking underground line, an aboveground line was installed to route the solution from the steam plant to the K-1503 pit.

The waste stream contains calcium and magnesium chloride and sulfuric acid solutions with a pH of 1 to 4 and is considered to be a hazardous waste due to corrosivity (D002, 40 CFR 261.22) (Goldsmith et al., 1988). The current operation of the K-1503 facility is discussed in Section 4.1. According to the RFI plan for K-1503 (MMES, 1987i), the untreated effluents from K-1501 contained trace levels of metals (maximum 14 ppb chromium and 23 ppb nickel), but an extremely low pH (0.8). No organics were believed to be discharged from K-1501.

Discharges from the K-1503 Pit now go to the K-1407-A Pit and are routed to the K-1407-E and F ponds. These ponds are located between the K-1407-A Pit and the K-1407-B Pond. The additional hydraulic head from the K-1407-E and F ponds may help accelerate the movement of contaminants from the K-1407-B area.

The threat to surface water from K-1503 is indirect. According to general hydrogeological studies (Kuhlmeier et al., 1986a), the groundwater table slopes to the northwest and discharges to the K-1700 stream (Mitchell Branch). Contaminants from K-1503 could leach through the soil and enter K-1700. Because K-1503 is located upgradient of the K-1407-B Pond, acidic leachate could reach the contaminated K-1407-B area and mobilize metals and other contaminants that might otherwise form an insoluble species in the soil.

v. The K-901 Sanitary Disposal Area - The K-901 "Sanitary Disposal Area" (Lonnie's Landfill) may be a source of groundwater contamination. No information is available on the type of contaminants that may be in the landfill.

The Survey team identified the K-901 landfill as a result of reviewing ORGDP records, including the standard "Request for Disposal of Waste Materials and Equipment" form (UNC-12463) used by ORGDP since May 1978. This form included checkoff boxes for 12 specific disposal areas including the K-901 landfill and the K-901-A Lagoon (hence, these areas could not be mistaken for each other). In addition, the K-901 landfill was labeled on a soil sampling map from November 12, 1974 (Drawing No. S-KT-K100; M38083 1 1, E-74).

Based on a cursory review of aerial photographs by the Survey team, the K-901 landfill began use between 1968 and 1974. A 1968 photograph (PH-68 1647) does not appear to show any evidence of clearing in the area at the time. A 1974 photograph (PH-74 1358), however, clearly illustrates some landfilling in the area.

According to interviews with ORGDP personnel, the K-901 Landfill was used primarily for disposal of demolition debris and construction rubble. But, because K-901 was used during a period before the imposition of environmental controls on solid waste disposal, it is possible that hazardous substances may also have been disposed of in the landfill. During the Survey, only concrete blocks, rebar, and lumber were found protruding from the bank of the landfill.

A small stream runs alongside the landfill, leading to the K-901-A lagoon. This stream was lined with sand-like material that apparently resulted from the discharge of cooling tower blowdown, based on a comparison with the sandy sludge in the K-901-A lagoon and on Survey team interviews with ORGDP personnel.

w. K-1070-S (South of K-1070-F) - The K-1070-S area south of the K-1070-F Old Contractors Burial Ground (see Section 4.5.2.3.1.m) may be a source of groundwater contamination.

Little information is available on this K-1070-S area except from aerial photographs and interviews with ORGDP employees. A photograph from 1944 (K/PH-77-4570) shows an area of approximately 16 acres cleared of vegetation, with two dirt mounds on the eastern side running north-south. The dirt mounds may be the result of an adjacent trench, and are approximately 350 feet long end-to-end. It is unclear from the photographs whether or not there is a trench next to the dirt piles. In the northwest corner of this cleared area is a small oval-shaped road with three roads running across it. A pond is located on the western edge of the clearing across from the dirt piles and south of the oval road. This water appears to be more permanent than a large ephemeral puddle of standing water because the roads have been built around it. South of the pond separated from the western edge of trees only by a dirt road was a disturbed area that appears to be a rubble pile or a small landfill. The entire cleared area is south of the cable crossing connecting the original K-25 process building with the powerhouse, whereas the K-1070-F Old Contractors Burial Ground is located significantly north of this road crossing. Another aerial photograph taken in 1967 shows the K-1070-S area completely overgrown with trees and vegetation. The use of the area in the years between 1945 and 1967, when use of the K-1070-S area ceased, is not clear without a more thorough analysis of aerial photographs.

According to ORGDP personnel, there is no clear information on what the K-1070-S area was used for, and what, if anything, was buried there. Some ORGDP personnel recalled that the J.A. Jones Construction Company used the area for staging and storing equipment, but other ORGDP personnel believed that the J.A. Jones area was elsewhere. During construction of K-25 in the 1940s, a small bridge crossed Poplar Creek where the supply cables were placed. This bridge may have provided access for construction vehicles to the job site from K-1070-S. The road, located on the other side of Poplar Creek from the cleared area and abutting the creek where the bridge was located at the cable crossing, is named "Contractors Road."

x The K-732, K-762, K-792, and K-709 Switchyards - The K-732, K-762, K-792, and K-709 Switchyards may be sources of groundwater or soil contamination from PCBs and mineral oil.

The K-732, K-762, and K-792 Switchyards are located near and served the K-27/29, K-31 and K-33 process buildings, respectively. The K-709 switchyard, containing approximately 700 transformers, was located northeast of the powerhouse and began operation in 1944/5 (Newton, 1977). It was shut down and disassembled in 1964, after operating for almost 20 years. Most of the recent documentation and, hence, this subsection focuses on K-732, K-762, and K-792. The K-732 switchyards began operation in the late-1940s, while the K-762 and K-792 Switchyards began operation in the early 1950s. All the switchyards have operated for more than 20 years during a period when PCBs were in widespread use and no regulatory controls were imposed on spills and leaks of PCBs.

During the Survey, oil-stained gravel, soil, concrete, and transformers were observed in all the switchyards (except K-709, which was disassembled and overgrown), suggesting the occurrence of historical spills and leaks. ORGDP sampled nine (three in each switchyard) soil locations in the switchyards and found no evidence of PCB contamination. A Survey team review of the sampling locations revealed that the soil samples were taken at the periphery of the switchyards away from the PCB-filled equipment where contamination, if present, would be expected.

According to ORGDP personnel (Dalton, 1988), leaks of 50 gallons or more were common in the switchyards prior to the imposition of environmental regulations. Leaks would often be tolerated unless there was a threat of equipment failure and consequent interruption of the production process. During the period between 1964 and 1972, referred to as the "austerity period" by ORGDP, leaks were particularly common because funding was unavailable to replace leaky transformers.

The switchyards are underlain by a drainage system that leads to an oil skimmer. In the event of a significant leak, oil would be pooled into a skimmer sump where it could be safely recovered. This system was constructed in the early 1980s, hence, spills occurring between 1940-1970 would not have been collected. A layer of rock 2 feet thick was laid down in each switchyard. The rock may have retained a significant amount of the contaminated oil before it reached the soil below. Following a transformer (No. 103) failure in the K-732 (K-27) switchyard in September 1982, a film of oil was observed on Poplar Creek. ORGDP personnel traced this release to a valve vault sump pump that discharges to a storm drain on the west side of the switch house which does not flow into the K-897-K skimmer pit. ORGDP planned to construct another oil sump to remedy this release route (Dalton, 1982).

A review of ORGDP files by the Survey team revealed numerous documented instances of transformer leaks and spills in the switchyards. A complete cataloging of these leaks was beyond the scope of the Survey, but the following sample of incident summaries suggests that failure to investigate these records could result in undetected releases of contaminated material and a failure to fully account for the inventory of released contaminants.

- A transformer containing 15,000 gallons of oil in the K-709 (K-25) switchyard near the powerhouse exploded and burned on July 2, 1950 (Newton, 1977).

- On August 5, 1951, a transformer in the K-31 Switchyard exploded twice and burned (Union Carbide Corporation, Nuclear Division, 1951; Anthony, 1957). The transformer (No. 205) contained approximately 93,300 pounds of oil (approximately 14,000 gallons). Because combustion of the oil in the ensuing fire was probably incomplete, and the fire department was called immediately, a significant amount of the oil probably soaked into the ground. No information was available on whether the oil contained PCBs. PCBs were in general use in 1951 when the fire occurred. The fact that the oil was able to burn does not necessarily indicate an absence of PCBs.

- On June 5, 1961, transformer 302 "tripped out of service" cracking a bushing and allowing oil to leak (Haynes, 1961).

- On September 10, 1982, transformer 103 in the K-732 switchyard (K-27) failed, resulting in the loss of approximately 2,900 gallons of mineral oil. According to the investigation report, "the sides were found bulged and an eight-inch weld near the top of the transformer tank had ruptured and was allowing mineral oil to spray out of the transformer. . no effort was made to recover the PCB-contaminated oil" (Dalton, 1982). Several days after the failure, an oil film was observed on Poplar Creek. This release was traced to a storm drain. ORGDP personnel performed two sets of analyses of the oil. The first test indicated 70 ppm PCB, but the second test indicated 31 and 34 ppm PCB. A later "Unusual Occurrence Report" (Thomas, 1982) indicated that the oil contained 35 ppm. A similar failure was reported in 1954 for a transformer in K-731.

In addition to leaks and spills from transformers, the oil pumphouses in the switchyards are apparent sources of soil contamination and potential sources of groundwater contamination. During the Survey, extensive oil contamination in and around the K-794 pumphouse in the K-792 (K-33) switchyard was observed. The gravel, dirt, and concrete outside K-792 were soaked with oil. Approximately 60 rusty drums of waste mineral oil, two unidentified salvage drums, four drums marked "trichloroethane", 14 unmarked rusty full drums and 8 lead-acid batteries were on the ground on the south side of K-792. Several of the drums were leaking. Inside K-794, a floor pit on the north and east sides of the building was filled with a layer of oil approximately 4 inches thick floating on water. On the west side of K-794 was a manhole containing oil and water.

y. K-710-B/C Former Treatment Plant Sludge Bed/Imhoff Tank - The K-710-B Sludge Bed and the K-710-C Imhoff Tank at the former sewage treatment plant at the old K-710 Sewage Treatment Plant is a potential source of groundwater contamination from radionuclides, metals, and PCBs.

No specific information is available on the type of contamination at the old K-710 Sewage Treatment Plant. The K-710 plant was used for almost 20 years from 1944 until 1964 when the powerhouse area was deactivated. The K-710 plant is located along the Clinch River southwest of the powerplant. Because of the widespread use of PCB-contaminated transformer oils at the powerhouse (see Section 4.5.2.3.1.x), PCBs may be a contaminant in the sludge. Other radioactive and hazardous chemicals are not likely contaminants because most ORGDP industrial operations discharged to another sewage plant.

According to a 1968 NPDES permit application (Long, 1968), the K-710 plant was designed for 20,000 gpd and operated at approximately 15,000 gpd to accommodate roughly 50 people working at the powerhouse area. Although the permit indicated that only domestic sewage would be discharged to K-710, the 15,000 gpd is higher than would be expected for only 50 people and suggests that other discharges such as cooling water were being sent to K-710. The K-710 plant is now processing only about 5 gpm for approximately 5 guards who use the facilities at the powerhouse area. A simple filter with chlorination is used and the K-710-B Sludge Bed and K-710-C Imhoff tank are not used now or expected to be used in the future.

z. K-1035 Acid Pit - The K-1035 Acid Pit is a potential source of groundwater contamination from radionuclides, metals, and acids.

The K-1035 Acid Pit was apparently used for a sump in the sewer discharge leading from K-1035 where various plating acid dips and machine operations have occurred since the 1960s. The pit is not used now but previous leaks may have entered the surrounding soil and groundwater. According to ORGDP Drawing No. 18413 (dated November 18, 1981), the K-1035 sump discharges to the outfalls on the southern side of ORGDP.

aa. K-1024 Diluting Pit - The K-1024 Diluting Pit may be a source of groundwater contamination. No information is available on the exact nature of the potential contaminants, but solvents and acids were presumably used in the operation.

The K-1024 Building was the instrument shop until it was moved to the K-1035 Building in 1964. The K-1024 Building is located in the center of the "U" of the K-25 Building complex. A 4-inch Dysipon line leads from the west side of the K-1024 Building into the diluting pit which leads to an 8-inch vitrified clay line discharging north out of the K-25 "U" (ORGDP Drawing No. CE-18407). There is no information on the exact nature and extent of contaminants discharged to this pit, or whether it leaks. But interviews with old-time ORGDP personnel indicate that solvents were routinely used to clean instruments including "transmitters," which had been connected on-line in the process buildings and were therefore contaminated with uranium and other radionuclides.

bb. Flannigan's Loop and Other Landfarming - Road oiling on Flannigan's Loop and other roads in and around the ORGDP complex may be a source of soil and groundwater contamination from PCBs, metals, and radionuclides.

Used oil was applied for dust control at ORGDP from the 1940s until the 1980s. No information is available on exactly where or how much of what type of oil was applied, but ORGDP personnel indicated to the Survey team that virtually all dirt roads associated with the site were oiled depending on the traffic along the road and the weather. The Classified Burial Ground and Flannigan's Loop were the only areas identified specifically in documents available to the Survey team (Christy, 1982). Flannigan's Loop road is located across the Oak Ridge Turnpike from the south site entrance, connecting the turnpike to Bear Creek Road over a low ridge near the pistol range. Oil disposal on Flannigan's Loop began in 1982 and continued until the mid-1980s (Mitchell, 1982a). In 1988, soil samples along Flannigan's Loop by ORGDP indicated no elevated concentrations of contaminants. A wide variety of volatile and extractable organics, PCBs, metals, and radionuclides were analyzed, but no information was available about where the samples were taken (e.g., soil sample location map). In June 1982, the waste oil that was to be disposed of on Flannigan's Loop was analyzed for PCBs, chlorinated solvents, and total uranium, which were found to be below 5 ppm, 1 percent (10,000 ppm) and 10 ppm, respectively (Mitchell, 1982b).

ORGDP arranged in August 1978 to have a 600-gallon tank of noncontaminated crankcase oil emptied by a commercial contractor (Henderson, 1978). Approximately 4,200 gallons/year of oil were expected to be removed in this manner. But, in October 1978, "recent analysis of ORGDP waste oil accumulated at the vehicles garage indicated the presence of enriched uranium" (Mitchell, 1978), and hence the sale of the oil did not occur. In early 1979 a "Filter Waste Spreader" was purchased for land farming waste fuller's earth resulting from lubricating oil reclamation (Bard, 1979; Stief, 1979). It is not clear where this land farming operation of fuller's earth occurred.

Although there is no clear information about the exact volume of used oil disposed of at ORGDP, the amount appears to be under 50,000 gallons/year. According to a 1979 inventory, approximately 85 gpd of "oil contaminated with small quantities of uranium" and fuller's earth containing oil were being generated (Mitchell, 1979). An additional 54,000 gallons of used oil were already in storage. Presumably the generation rate was significantly higher in the 1950s and 1960s when the activity at the plant was greater.

cc. Borrow Fill Holes - Borrow fill holes around the ORGDP vicinity may be a source of groundwater contamination. No information is available on the exact types of potential contaminants. According to interviews of long-time ORGDP employees by the Survey team, borrow pits from which fill material was obtained for ORGDP were used for waste burial. No exact information was available on the nature of the wastes buried in these pits, but because of the lack of controls over waste disposal prior to the 1980s, it is possible that some hazardous substances may have been disposed of in the pits. Some ORGDP personnel believe that most of the waste was construction rubble, demolition debris, and old equipment (Dykstra, 1988).

dd. Landfill on Slope North of K-25 - An area used for landfilling north of the K-25 Building may be a source of groundwater contamination. Potential contaminants are not known due to the paucity of information.

According to a 1945 aerial photograph (No. 88660), the slope leading down to Poplar Creek from the north end of the K-25 Building was used for waste disposal. Subsequent photographs of this area in the late 1960s show the area to be smoothly graded, and the K-1025 Building was built there. But no information is available on how long this area was used for waste disposal.

ee. Trash Area North of Poplar Creek and Blair Road - An area along Blair Road on the north bank of Poplar Creek may be a source of groundwater contamination. Potential contaminants are not known due to the paucity of information.

According to an ORGDP aerial photograph, this area was used for waste disposal in 1945 (photograph No. 88604; MED 257). No information is available on the type of waste disposed of there, or how long before and after 1945 the area was used for disposal. Subsequent photographs in the 1960 show the area to be free from debris.

ff. Old Southern Railway Yard - The Old Southern Railway Yard may be a source of groundwater contamination from oil and diesel fuel spills. Aerial photographs and interviews with ORGDP personnel indicate that the Southern Railway Switchyard located between Poplar Creek and the Oak Ridge Turnpike approximately 1.6 km (1 mi.) southwest of the plant (on DOE land) was used for large-scale railroad operations in the 1940s and 1950s. Activities included maintenance, fueling, and transfers. Fuel spills at such locations are common prior to the onset of environmental regulations and higher fuel prices. An aerial photograph from 1944 (K/PH 77-4570) shows extensive activity at the railyard.

4.5.2.4 Category IV

1. Miscellaneous spills reporting and cleanup. Miscellaneous spills (see below) of hazardous substances are actual or potential sources of contamination of soil and groundwater, and no program exists to identify and remedy these spills. Failure to identify, report and clean up these types of routine spills may result in undetected soil, and groundwater, and non-point source runoff to surface water that cumulatively present a significant contamination threat.

   The following list of spill sites includes a limited compilation based on the observations of the Survey team:

   - K-1420/1421 stained asphalt/gravel;
   - K-1303 oil-soaked asphalt/gravel/grass;
   - K-1098-D roads and grounds garage asphalt stains;
   - K-794 leaking drums (K-33 switchyard) stained soil;
   - K-25 (303-10) oil cooler drain tank oil leaked, pans full; and
   - K-1202/1420A tank and RR pit oily sediment.

   A complete listing of all spill or leak locations at ORGDP is beyond the scope of the Survey. Most of these areas are relatively small (less than 100 square feet) of soil or concrete that appeared to be stained or soaked with an oily substance. The K-794 spill area is described as part of Section 4.5.2.3.1.x. Another spill area is described here as an example.

   Two 15,000-gallon oil tanks (K-1202) and a 30,000-gallon solvent tank (K-1420) are located immediately north of 15th Street, south of the K-1407-B Holding Pond. A railroad track siding is between these tanks and 15th Street. According to Survey team interviews of ORGDP personnel, these tanks were filled by train tankers brought in along this track. This track straddles an 8-foot-deep pit covered with timbers. Oil stains were visible around the oil tanks, railroad tracks, and in the pit. The K-1420-A solvent tank was previously filled with acetone, and an underground line runs to the K-1420 Building. The K-1202 tanks were filled with fuel oil and diesel fuel. The sediment in the bottom of the pit was soaked with oil. A drainage line emptied out of the pit in the northwest corner and appeared to run toward K-1407-B.

   ORGDP does not have a program to systematically identify and remedy hazardous substance spills. Currently, environmental department personnel are responsible for identifying hazardous substance spills. Because of inability of a limited staff such as this to identify all spill locations, many areas are not observed. No educational program, or a component of an existing program, exists at ORGDP to ensure that field technicians in all departments who handle hazardous substances are aware of the need to report all spills and leaks of hazardous substances. This broad-based level of reporting will not only ensure a more complete coverage of ORGDP spills, but will provide a mechanism for reporting releases that are subject to the reportable quantity provisions of CERCLA Section 103(b) (40 CFR 302).

2. <u>Inadequate CERCLA 103(c) Notification</u>. ORO's and ORGDP's June 1981 notification to EPA pursuant to CERCLA Section 103(c) appears to have failed to comply with the regulatory requirements because it was incomplete and has not yet been fully corrected.

A compliant CERCLA notification would include information on all the Phase I sites, as well as the SWMUs listed in the Part B permit application. These facilities are not covered by the limited exemptions and exclusions to the CERCLA notification requirement (46 Fed. Reg. 22144). The purpose of this CERCLA notification requirement is to provide information on potential environmental and health problems associated with facilities that treated, stored, or disposed of hazardous substances. Inclusion in this notification does not constitute an implicit judgment that a problem exists but rather that the potential for a problem exists. The notification is the first step in a process that sorts out which sites pose a threat and determines the relative degree of that threat.

ORGDP contractor, UCCND, submitted to the DOE/ORO a completed 103(c) Notification form in May 1981 (Mitchell, 1981) including over a dozen sites. This submittal included some significant sites such as the K-1407-B/C Ponds and the K-1070-C/D landfill, but excluded others such as the K-1070-A Burial Ground. On June 9, 1987, ORO submitted to DOE a comprehensive 103(c) notification for all ORO facilities. For the ORGDP, ORO claimed an exemption under the Atomic Energy Act (Wing, 1981). Since 1981, ORGDP has submitted information to state or Federal regulatory agencies on virtually every significant site where there has been a potential hazardous substance release, except for the new sites identified during the Survey. Those areas for which additional notification may be appropriate include:

- K-901 Sanitary Disposal Area (Lonnie's Landfill);
- K-1070-S area south of K-1070-F;
- K-710-B/C Sludge Beds/Imhoff Tank;
- K-1035 Acid Pit;

- K-1024 Diluting Pit;
- Flannigan's Loop and road oiling areas;
- Slope on north side of K-25;
- Trash area along Poplar Creek; and
- Southern Railway Yard.

Because the exact locations of the borrow areas have not yet been identified, these may be inappropriate for notification.

In addition, the White Wing Scrap Yard should be included in a DOE notification to EPA or TDHE. It is unclear whether this site has been included in any such notification. It was not included in the original DOE/ORO notification in 1981 (Wing, 1981). It is now being managed by ORNL (X-10). The White Wing Scrap Yard is located at the west end of East Fork Ridge between State Highway 95 (White Wing Road) and the Oak Ridge Turnpike. This 20-acre site has been used since the early 1950s for storing contaminated materials (equipment, tanks, and trucks) from all three of the Oak Ridge plants (Y-12, ORGDP, and ORNL). Addition of new waste was supposed to have ended in 1964. In 1971, some contaminated soils (6,000 cubic yards) and equipment were removed, but some scrap metal, concrete, and other waste remains on the site. Approximately 0.05 pound (25 grams) of plutonium-239 was estimated to be on or in the material from ORNL that was stored on the site. No information is available on the wastes received from the other Oak Ridge plants. In 1971, a radiation survey detected 0.8 to 6.0 mR/hr gamma exposure rate and 0.5 to 4.0 mR/hr exposure rate reported as cesium-137. An aerial survey in 1974 indicated the presence of cesium-137 (estimated at 25 to 100 millicuries), thorium-234, and uranium-235 (EG&G, 1977).

3. Inadequate CERCLA investigation. Failure to carry out a more thorough CERCLA investigation could result in undetected releases of hazardous substances.

The inadequacy of the CERCLA investigation presents a two-fold problem. First, entirely new sites may be identified by performing a more thorough search of files, aerial photographs, old blueprints and logbooks, and by performing interviews with knowledgeable long-time and retired ORGDP employees. During the Survey, over a dozen additional potential CERCLA sites were identified by the Survey team based on a limited review of available information (see Sections 4.5.2.3.1.v through ff). ORGDP personnel have begun this process.

The second concern about the inadequacy of the CERCLA investigation is the failure to obtain accurate information about sites that have already been identified by ORGDP. For example, a quick review of old "Request for Disposal" Forms revealed that cylinder disposal in the K-901-A lagoon continued until 1979 rather than ending in 1975 as stated in the RFI plan for the site (see Section 4.5.2.3.1.c). Failure to adequately account for the inventory of waste at a site will hinder efforts to design an effective remedial action for the site.

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APPENDIX A
SURVEY PARTICIPANTS

APPENDIX A

OAK RIDGE GASEOUS DIFFUSION PLANT
MARCH 14-25, 1988
SURVEY PARTICIPANTS

Larry Weiner	DOE Headquarters	DOE Team Leader
Susan Barisas	DOE Headquarters	DOE Assistant Team Leader
J. K. Alexander	DOE, ORO	ORO Survey Representative
Joseph Crist	NUS Corporation	Air
Joseph Boros	NUS Corporation	Surface Water
Douglas Detman	NUS Corporation	Groundwater/Soil
Ralph Basinski	NUS Corporation	Waste Management
S. Charles Caruso	NUS Corporation	Toxic and Chemical Materials/Quality Assurance
Mark Francis *	NUS Corporation	Radiation
James Werner	ICF Technology, Inc.	Inactive Waste Sites and Releases

* NUS Coordinator
ORO - Oak Ridge Operations Office

APPENDIX B
SITE-SPECIFIC SURVEY ACTIVITIES

APPENDIX B
SITE-SPECIFIC SURVEY ACTIVITIES

B.1 Pre-Survey Preparation

The U.S. Department of Energy (DOE) Office of Environmental Audit, Assistant Secretary for Environment, Safety and Health, selected a Survey team for the Oak Ridge Gaseous Diffusion Plant (ORGDP) in June 1986. Mr. Lawrence A. Weiner was designated the DOE Team Leader, with Ms. Susan Barisas serving as the Assistant Team Leader. Mr. J. K. Alexander was the Oak Ridge Operations Office (ORO) Survey team representative during the on-site phase of the Survey. The remainder of the team was composed of contractor specialists from the NUS Corporation and its subcontractor, ICF. These specialists and their fields of expertise are presented below.

Specialty	Name
Air	Joseph Crist
Surface Water	Joseph Boros
Waste Management	Ralph Basinski
Inactive Waste Sites	James Werner
Hydrogeology	Douglas Detman
Radiation	Mark Francis*
QA/Toxics	Charles Caruso

* NUS Coordinator

Survey team members began reviewing ORGDP general environmental documents and reports in February 1988.

Mr. Weiner, Ms. Barisas and Messrs. Basinski and Werner conducted a pre-Survey site visit on February 10-11, 1988, to gain familiarity with key DOE and site personnel. They toured the facility and completed a cursory review of the documents assembled in response to an information request submitted on December 23, 1987. The request listed environmental documents and reports required by the Survey team for Survey planning purposes. During the pre-Survey visit, a meeting was held with representatives of ORO and ORGDP as well as representatives from the Tennessee Department of Health and Environment and the U.S. Environmental Protection Agency (EPA) - Region IV. The purpose of this meeting was to review environmental issues of concern to the agency and local government and explain the scope of the Survey.

The Survey team carefully reviewed the information received during the pre-Survey visit and prepared a Survey Plan (see Appendix C) for the ORGDP site. This plan describes the specific approach to the Survey for each of the technical disciplines and includes a proposed schedule for the on-site activities. A Health and Safety Plan was also prepared for use by the Survey team.

B.2 On-Site Activities

The on-site phase of the Survey was conducted during the period of March 14 through 25, 1988. The opening meeting was held on March 14, 1988, at ORGDP and was attended by representatives from DOE Headquarters, ORO, ORGDP, NUS Corporation, and ICF Corporation. Discussions during this meeting primarily concerned the purpose of the Survey, logistics at ORGDP, and an introduction of the key personnel involved in the Survey.

During the Survey, team members reviewed pertinent file documents including permits and applications, background studies, engineering drawings, accident reports, and chemical releases and spills, as well as various operating logbooks. The production process was thoroughly analyzed to identify existing and potential pollutants. Site operations and monitoring procedures were observed, where possible. Extensive interviews were held with ORGDP personnel concerning environmental controls, operations, monitoring and analysis, regulatory permits, waste management, and hazardous substances management.

The Survey team members met daily to report observations, discuss findings, and evaluate progress. These meetings were also useful for planning schedule changes, if required, to meet the overall objectives of the Survey.

A site closeout briefing was held on March 25, 1988, at which the DOE Assistant Team Leader presented the Survey team's preliminary findings and observations. The findings were considered preliminary pending additional research and review.

B.3 Sampling and Analysis

The Idaho National Engineering Laboratory (INEL) will conduct the sampling and analysis (S&A) phase of the Survey. INEL will determine sampling and analysis logistics, costs, and schedules. The INEL S&A program includes a quality assurance (QA) plan, as well as a health and safety plan.

B.4 Report Preparation

The Environmental Survey Preliminary Report for the ORGDP site will be prepared for DOE review. The preliminary findings are subject to modification based on comments from the Oak Ridge Operations Office concerning the technical accuracy of the findings and the results of the Sampling and Analysis. The modified findings will be incorporated into the Environmental Survey Summary Report.

TABLE B-1

DOE ENVIRONMENTAL SURVEY MEETING WITH EPA-REGION IV
AND TENNESSEE DEPARTMENT OF HEALTH AND ENVIRONMENT
FEBRUARY 11, 1988

Name	Organization
Susan Barisas	DOE/Washington, D.C.
Larry Weiner	DOE/Washington, D.C.
J. K. Alexander	DOE/ORO
Ralph Basinski	NUS/Pittsburgh, PA
John Shoemaker	ORGDP
Tommy Bowers	ORGDP
Larry Long	ORGDP
Arthur Linton	EPA/Region IV
David Hopkins	EPA/Region IV
Gay Hasbarger	TDHE
Steve Goodpasture	ORGDP
Bobby Davis	DOE/ORO

APPENDIX C
SURVEY PLAN

ENVIRONMENTAL SURVEY PLAN

FOR THE U.S. DEPARTMENT OF ENERGY

OAK RIDGE GASEOUS DIFFUSION PLANT

MARCH 14 - 25, 1988

OAK RIDGE, TENNESSEE

MARCH, 1988

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ENVIRONMENTAL SURVEY PLAN

OAK RIDGE GASEOUS DIFFUSION PLANT

MARCH 14 - 25, 1988

OAK RIDGE, TENNESSEE

1. INTRODUCTION

The Oak Ridge Gaseous Diffusion Plant (ORGDP) Survey is part of the larger Department of Energy (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 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, or 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 ORGDP Survey will be conducted in accordance with the protocols and procedures contained in the August, 1987, Environmental Survey Manual.

2.0 SURVEY IMPLEMENTATION

The Environmental Survey of ORGDP will be managed by the Team Leader, Larry Weiner and the Assistant Team Leader, Susan Barisas from the Office of Environmental Audit (OEV). Mr. Jake Alexander will serve as the Oak Ridge Operations Office (ORO) representative on the Environmental Survey team. Technical support is provided by NUS Corporation and ICF personnel as follows:

Joseph Crist	Air/TSCA (Toxic Materials)
Doug Detman	Soil/Hydrogeology
Joseph Boros	Surface Water/Drinking Water
Ralph Basinski	RCRA (Solid, Hazardous, and Radioactive Wastes)
Charles Caruso	QA/TSCA
Mark Francis	NUS Coordinator/Radiation
James Werner (ICF)	CERCLA (Inactive Sites)

2.1 Pre-Survey Activities

Pre-Survey activities began early in December 1987, when Survey team members submitted requests for information to the Team Leader for materials needed to prepare for the Survey. This was followed by a December 23, 1987, memorandum from Lawrence A. Weiner (OEV) to Wayne Hibbitts (ORO) and ORGDP (via ORO) announcing the pre-Survey site visit and requesting Survey-related information.

The pre-Survey site visit, February 10 and 11, 1988, was conducted by Mr. Weiner, Ms. Barisas, and Messrs. Basinski and Werner. The purpose of the visit was to become familiar with the site, identify potential areas of concern for the purpose of the Survey, review documents collected by ORGDP and identify documents not yet collected, meet with regulatory agency personnel and coordinate plans for the upcoming Survey with ORGDP and ORO personnel. Idaho National Engineering Laboratories (INEL) will conduct the sampling and analysis portion of the Survey, if required. During the pre-Survey visit the team also met with representatives of the Tennessee Department of Health and Environment, and Region IV of USEPA. Team representatives toured the facility and reviewed documents assembled in response to the information request memorandum, identifying these documents not yet provided. The documents were transferred to NUS in Pittsburgh during February for use by team members during the planning phase of the Survey. The additional information requested during the pre-Survey visit was received in late February. This Survey plan is based on information available to team members as of March 1, 1988.

2.2 On-Site Activities and Survey Reports

The on-site portion of the Environmental Survey will be conducted from March 14 - 25, 1988. Tentative agendas for each of the Survey team members are provided as attachments. It is expected that modifications to these agendas will be made as appropriate to minimize disruption of site activities, and to enhance Survey efficiency and effectiveness. All modifications to agendas will be coordinated with site personnel designated as Survey contacts.

The on-site activities of the Survey team will consist of discussions with, among others, environmental, safety, operations, waste management, purchasing, and warehousing personnel; a review of files and documents (including classified documents, if any) unavailable prior to the on-site portion of the Survey; and process-specific and area-specific tours of the facility.

The Preliminary Report for the ORGDP Survey will be prepared from information gathered by Survey team members prior to, during, and after on-site activities. Each team member in addition to identifying environmental problems and areas of environmental risk will also be gathering information from which they will write the following sections of the Preliminary Report:

- Background Environmental Information
- General Description of Pollution Sources and Controls
- Environmental Monitoring Program

A closeout briefing will be conducted on Friday, March 25, to describe the preliminary findings of the Survey team. A copy of the closeout notes will be left with ORO and ORGDP. A Preliminary Report of the ORGDP Survey will be prepared within 2 to 3 months from the conclusion of the Survey. The Preliminary Report will be sent to ORO and ORGDP for review and comment. The report will also be sent to several congressional committees and the U.S. Environmental Protection Agency.

Approximately 3 months after the results are available from the sampling and analyses (S&A) portion of the Survey, if any, (discussed below) an Interim Report will be prepared by the Survey team. The Interim Report will incorporate comments to the Preliminary Report and data from S&A results (if any). The Interim Report will be made available to the public, upon request.

Upon completion of the Environmental Survey effort, a Summary Report will be prepared and will contain a DOE-wide list of environmental problems. The report will be used as an information base for the ranking of DOE's environmental problems.

2.3 Sampling and Analysis

Because of the extensive environmental monitoring program conducted at the Oak Ridge Reservation, of which ORGDP is a part, the need for Survey-related sampling and analysis is not anticipated. However, if Survey-related sampling is necessary, Idaho National Engineering Laboratory (INEL) will provide the field sampling and analytical support.

3.0 AIR

3.1 Issue Identification

The air-related Survey activities will involve an assessment of the air emissions at the site, the administrative and 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, as well as fugitive emission sources, both within and outside the buildings, and mitigative procedures applied to fugitive emission sources including recently shut down facilities. Close liaison will be maintained with the radiation team member because of the importance of air-rad issues. Close liaison will also be maintained with the QA/TSCA team member because of the interaction of several TSCA regulations and air regulations. Facility visits will be coordinated through the ORGDP Environmental Management Department.

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 buildings at the site, evaluate any existing controls applied to the air emissions, and assess the need for additional monitoring or emission controls to characterize or reduce the environmental consequences of the emissions. This review will include the TSCA incinerator.

The ambient air monitoring system will be evaluated to assess the adequacy of the existing monitoring program 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, the meterological tower, 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.

Areas of particular interest will include emissions of the criteria pollutants (e.g., sulfur oxides, nitrogen oxides, hydrocarbons, carbon monoxide and lead) as well as regulated hazardous air pollutants (e.g., radioactive-bearing particulates, beryllium, and asbestos). Although not currently listed as hazardous air pollutants, chlorinated solvents, and freons will be included in this review.

The use of all organic solvents will be assessed as a potential or actual sources of emissions to determine if they are adequately characterized, monitored, and controlled. The non-radionuclide emissions assessment will focus on those substances that the EPA intends to list as hazardous or toxic air pollutants (e.g., methylene chloride, trichloroethylene, perchloroethylene). Non-organic air emissions will also be included (e.g., ammonia, chlorine, chromium, and sulfuric acid).

Fugitive emissions from the resuspension of contaminated soils will be evaluated as a potential contributor to 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 soil contamination and windborne releases.

Several areas of specific interest have been identified during a review of available documentation:

- Control and record keeping for solvent usage, e.g., in vapor degreasers and parts cleaners.
- Past and present control and monitoring of fluorides, radionuclides, and freon emissions.
- Control of chromium emissions, if any, from cooling towers currently in operation.
- Emission potential of fugitive dust sources such as roads.
- Design of controls and administrative procedures in the operation of the new TSCA incinerator.
- Potential for asbestos emissions during building docontamination or demolition.
- Effluent sampling and monitoring operations.

Throughout the Survey, emphasis will be placed on assessing the available data to characterize the overall environmental impact of plant operations.

3.2 Records Required

Files will be reviewed as part of the Survey, including documents not yet reviewed or received (e.g., classified documents, individual files, documents not yet identified). Specific documents and files to be reviewed as part of the Survey include, but will not be limited to, the following:

- PSD ledger
- Air effluent sampling and QA procedures
- Ambient air sampling and QA procedures
- Contractor stack test results
- Effluent fluoride sampling results
- Laboratory records on TSP analyses (ambient)
- Preliminary drafts of SARA 313 reports
- Any other documents pertinent to air emissions from ORGDP buildings

4.0 HYDROGEOLOGY AND SOILS

4.1 Issue Identification

The hydrogeology/soils portion of the Survey will examine the physical and chemical character of the subsurface materials relative to the environmental impact--actual and potential--that the site activities have on these two media. Plant operations and related construction activities have produced both waste and scrap materials. Many of these materials are either actual or potential sources of soil and groundwater contamination; some of which have been or are stored or disposed of on-site.

Each of the potential source areas where materials have been disposed of, stored as scrap, treated for disposal, or spilled will be visited during the site Survey. Since many of these sources are also related to RCRA, CERCLA, surface water, and radiation disciplines; visits will be coordinated with the team members specializing in those fields. Areas to be visited include:

Burial Grounds	
K-1070-A	Old Contaminated Burial Ground
K-1070-B	Old Classified Burial Ground
K-1070-C/D	Classified Burial Ground
K-1070-E	Old Contractors Burial Ground

Storage Facilities	
K-1064-G	Burn Area/Peninsula Storage
K-1099	Blair Road Quarry
K-1085	Old Firehouse Burn Area
K-770	Scrap Metal Yard
K-1515-F	Land Treatment (Sediment Storage) Unit
K-1420	Contaminated Oil Storage Pad
K-1070-D	Waste Oil Storage Yards

Surface Impoundments	
K-1515	Water Treatment Plant Settling Lagoon
K-901-A	RCW Treatment Facility Holding Pond
K-1700	K-1407-B Holding Pond Outlet Stream
K-1407-B	Settling Pond
K-1407-C	Settling Pond

Underground Tanks	
K-25	Cooling Tower Basins (multiple)
K-1414	Gasoline Tanks
K-1232	Treatment Facility Tanks
K-1407-A	Treatment Facility Tank
K-1413	Treatment Facility Tank
K-1007	Gasoline Tank (removed)
K-1401	Degreaser

Process Lines	
K-1401	Acid Line (leads to K-1407-A)
K-1413	Corrosives Lines (leads to K-1407-A)

Waste Piles

K-1407-C	Contaminated Soil Pile
K-1417	Contaminated Soil Pile
K-770	Refuse Pile
K-720	Fly Ash Pile

In addition to examining the actual and potential contaminant source areas, an evaluation of the monitoring systems for those areas will be performed. This evaluation will involve: reviewing the hydrogeologic characterization performed by the site, the well system (location and construction), well purging and sampling techniques, chain-of-custody and field QA/QC procedures, and data analysis and evaluation.

Information relative to the site geology and surface soils, groundwater regime, and environmental monitoring programs and data will be reviewed.

4.2 Records Required

Documents and files will be reviewed as part of the Survey that provide information concerning the presence of contamination, or the monitoring system for the groundwater and soils. A general list of documents and records to be reviewed includes:

- Geologic and geohydrologic reports
- Groundwater and soil monitoring plans and procedures
- Environmental monitoring reports
- Monitoring well locations and as-built records
- Disposal area operation and closure plans
- Groundwater and soil analytical data
- Environmental compliance audit reports
- Unpublished, in-progress, or planned groundwater studies

5.0 SURFACE WATER/DRINKING WATER

5.1 Issue Identification

The focus of the surface water/drinking water portion of the ORGDP Survey will be on the potential for release of polluted or contaminated wastewaters to surface waters draining the site or to groundwater aquifers underlying ORGDP. Pathways for off-site migration of pollutant may include:

- Releases (accidental or planned) to the sanitary sewers or to the storm drains.
- Spills or leaks into permeable soil areas.
- Exfiltration of sanitary wastewaters into soils or groundwater.
- Contaminated surface run-offs into storm drains and nearby Poplar Creek and the Clinch River.

A review of available information indicates that considerable attention has been paid to control of radiological releases, and minimization of the discharge of toxic metal and organic pollutants. The Survey will assess the potential for future contamination of wastewaters, as well as review present conditions of wastewater control and collection systems. Liquid waste sources, processes, collection and handling equipment will be examined and records of operation will be reviewed.

The Survey will include identification of potential discharges to surface waters, or to the on-site sanitary treatment facility at the K-1203 complex, which may not be addressed in operating permits or other documents. The site will be investigated for evidence of possible breaks or obstructions in the sewer systems which could result in releases of wastewater to the environment. The Survey will also address the possibility of cross-contamination of the potable water piping system by either the sanitary or storm drainage systems. Measures taken at ORGDP to prevent back-flow of process wsatewater or sanitary sewer flows into the drinking water piping systems will be reviewed.

With respect to wastewater monitoring and treatment systems, copies of standard operating procedures will be reviewed. Operating logbooks and maintenance records will also be checked. Actual procedures put in normal practice by ORGDP personnel will be observed to determine how closely SOP's are being followed. Interviews with managers and operators of monitoring systems will be conducted in order to understand modifications or significant deviations, if any, from written SOPs. Measures takes to resolve EPA's comments on the flow measurement devices used by ORGDP staff will be assessed.

A walk-through of selected buildings will be made to observe normal routines, including maintenance activities which generate wastewaters. Discharge and monitoring points will be reviewed, and sampling and analytical procedures in use will be observed in action. Emphasis will be placed on the major contributors to wastewater generation, for example:

- Cleaning and decontamination operations as practiced at K-1420.
- The steam plant and ancillary equipment at the K-1501 complex.

- The coal storage yards (K-1501-N and K-1501-S) and the coal pile run-off collection, handling and treatment system.

- The sewage treatment and disposal plant and ancillary equipment at the K-1203 complex.

- The service water and potable water treatment facilities at K-1515.

- Miscellaneous wastewater sources, such as the K-1414 garage and vehicle wash facility, K-1015 laundry, the K-1064C drum cleaning facility, the K-1410 nickel plating operation, and the K-1232 Chemical Recovery Facility.

Wastewater collection, holding and transfer systems will be evaluated under normal operating conditions, as will the effluent monitoring stations scattered around the edges of the ORGDP property. Site surface drainage characteristics, such as culverts, ditches and basins will also be examined, along with the man-made efforts to control surface run-on and run-off.

5.2 Records Required

Files will be reviewed as part of the Survey including documents not yet reviewed or received (e.g., classified documents, individual files, documents not yet identified). Specific documents and files to be reviewed as part of the Survey include, but will not be limited to, the following:

- Documentation of ongoing NPDES permit compliance.

- Recent analytical data on wastewater releases to the receiving streams.

- Notices of violations relating to wastewater releases.

- Operators logbooks and monitoring reports.

- Standard operating procedures for wastewater collection, holding and transfer.

- Progress reports for ongoing improvements and studies, e.g., denitrification of wastewaters; upgrade of the water monitoring system; improving the quality of flow measurements, data on stormwater run-off characteristics.

- Sampling protocols and logbooks.

- Monitoring equipment maintenance records.

- Detailed drawings of the sanitary and fire protection water supply, storage and distribution systems.

- Additional information on the sediment sampling program, data handling and correlation with surface water quality.

- Records of drinking water quality.

- Internal memos or correspondence relating to surface water/drinking water problems, e.g., back-flow prevention measures.

- Other records as determined on-site.

6.0 SOLID/HAZARDOUS/MIXED/RADIOACTIVE WASTE

6.1 Issue Identification

The solid/hazardous/mixed/radioactive waste Survey will be carried out by evaluating all activities generating such wastes, and the facilities used for their accumulation, storage, processing, treatment and disposal, including treatment and/or disposal at off-site facilities and wastes received from off-site facilities.

The management of all solid waste streams including mixed wastes, hazardous wastes, radioactive wastes, radioactive PCB wastes, and non-hazardous non-radioactive wastes will be surveyed. The Survey will consist of several activities: 1) Physical facilities where wastes are generated, accumulated, stored, treated, recycled, processed or disposed will be evaluated; 2) Management and operations personnel involved in these activities will be interviewed; and 3) Documents pertaining to wastes will be reviewed. Based on these activities, the potential for releases that may contaminate the environment will be evaluated.

ORGDP generates a variety of solid wastes, with all wastes currently generated originating from maintenance, laboratory, decontamination, water and wastewater treatment facilities and incineration processes since all production facilities have been shut down. Generating facilities producing solid wastes that will be evaluated include the following:

- Laboratory Facilities K-703, K-1004, K-1006, K-1023, K-1024, K-1405, K--1407, K-1413.
- Maintenance Facilities K-796, K-1015, K-1040, K-1052, K-1095, K-1098-E,F,G, K-1401, and K-1414.
- Water and Wastewater Treatment Facilities & Utilities K-701, K-710, K-715, K-892, K-896.

Personnel from divisions with waste management responsibilities will be interviewed in order to give a detailed understanding of waste management practices. This includes personnel with line operations responsibilities and those responsible for the overall administration ofORGDP environmental programs.

Waste treatment, storage, and disposal facilities to be evaluated include the following:

- Waste Accumulation Areas K-1225, K-1004-L, K-1006, K-1030, K-1401, K-1420, K-310-2, K-310-3, and K-305-5.
- TSCA Incinerator K-1435.
- Storage Areas K-1425, K-1420-A, K-1413, K-1417, K-1407-B, K-1407-C, K-1025-C, K-1035-A, K-30G1V23A, K-305 V 19 & 19B, K-306-1, K-770.
- Treatment Facilities K-1413, K-1419, K-1407-H.
- Landfills K-1070

Various buildings and areas housing inactive processes and experiments (GCEP, AVILIS) and supporting facilities for the inactive processes to be evaluated for the presence of materials that will need treatment, storage, and disposal include the following:

- Process Buildings: K-25, K-27, K-29, K-31, K-37
- Switchyards: K-709, K-732, K-742, K-792 & Associated Facilities
- Experimental Areas: K-1037, K-1052, K-1200, K-1210, K-1220

Several areas of particular concern regarding waste management have been identified at ORGDP and will be evaluated during the Survey. Among these are the following: Inactive process and experimental facilities and associated support facilities may contain large quantities of materials requiring decontamination and/or disposal. This includes contaminated process equipment, PCB and non-PCB oils in electrical equipment, and hydraulic oils and freons in process equipment. Decontamination of process equipment could tax the capacity of the K-1420 decontamination facility, and in turn generate large quantities of mixed wastes requiring disposal sites which currently are not available.

Studies conducted by ORGDP have shown that tie lines and drainage lines associated with several hazardous waste tanks are leaking.

The K-1435 Incinerator will be serving in effect as a commercial disposal facility for several DOE facilities for the incineration of radioactively contaminated hazardous and PCB wastes. Thus, the waste management facilities and procedures associated with the TSCA Incinerator will be evaluated. Operation of the TSCA Incinerator will generate large quantities of a mixed waste ash, which will require long term storage since disposal sites for mixed wastes currently do not exist. Handling facilities for the Incinerator ash will be evaluated.

The ORGDP has been used to process contaminated Y-12 wastewaters. Treatment facilities and procedures will be evaluated for Y-12 wastes and wastewaters.

ORGDP has also identified a number of Solid Waste Management Units (SWMUs) which will require evaluations. Cleanups of these SWMUs if required could generate large quantities of mixed wastes requiring disposal options.

The solid waste Survey will be coordinated with the CERCLA Survey to identify past and present waste management practices that may result in releases of contaminants to the environment; the radiation Survey to identify problems with wastes containing radioactive constituents; the surface water/drinking water Survey since some aqueous process wastes are handled as solid wastes, and water and wastewater treatment produce solid wastes; the air Survey to identify any solid wastes produced by air pollution control devices; the TSCA Survey to identify any problems with PCB wastes and underground storage tanks for hazardous substances; and the hydrogeological and soil Surveys to identify groundwater and soil contamination resulting from the accumulation, storage, treatment and disposal of solid wastes.

6.2 Records Required

Files will be reviewed as part of the Survey, including documents not yet reviewed or received (e.g., classified documents, individual files, documents not yet identified). Specific documents and files to be reviewed as part of the Survey include, but will not be limited to, the following:

- Part A and Part B Application and associated NODs.
- Underground tank storage notification and associated records, and studies.
- Audit and/or inspection records (state, local, and federal DOE and ORGDP).
- Groundwater monitoring, sampling, and analytical documentation.
- Release notification and/or occurrence records.
- Biannual Hazardous Waste Generation Report, Annual Report of Hazardous Waste activities.
- Waste inventory documentation.
- Solid Waste Management Unit Studies and Documents.
- Enforcement action documents.
- Correspondence with regulatory agencies on solid waste.
- Records dealing with the reuse/recycling of wastes.
- Training records.

7.0 TOXIC SUBSTANCES

7.1 Issue Identification

The toxic substances Survey will review the use, handling, storage, and disposal of polychlorinated biphenyls (PCBs), asbestos, pesticides, and other hazardous substances used on the ORGDP site. The control, tracking, and management of toxic substances will be evaluated through interviews with appropriate plant personnel, tours of plant facilities, as well as a review of documents such as purchase and usage records. The primary objective will be to assess the potential for releasing these materials to the environment.

The Survey will assess inventory control of PCB-containing and PCB-contaminated electrical, lubrication, and hydraulic equipment utilized at the plant. The condition of this equipment, its potential for leakage, and the quantity of PCB fluids contained will be considered. Obsolete, stored, or used PCB equipment will be inspected for proper containment and adequate storage protection. Handling, removal, and disposal practices will be reviewed for current and previous inventories to establish the method of disposal and location of disposal sites. Conformance to TSCA reporting regulations for PCB transformers and spills will be evaluated. In addition, a review of any PCB spills and cleanups at the plant will be conducted.

The use of asbestos in the plant will be determined and procedures concerned with its removal, handling, monitoring, and disposal will be reviewed to identify any potential pathways of environmental contamination. This will include its use as construction material, for heat insulation, in cooling towers (e.g., Munter's Fill), and other miscellaneous uses. Some areas where friable asbestos has been removed or its removal is planned will be visited. These sites include K-1004, K-1006, K-1101, K-1501, K-25 (303), and others that may be identified during the Survey.

Many pesticides are used at the ORGDP. The purchase records, application procedures and frequency, personnel training, storage and disposal practices, as well as monitoring program will be reviewed to determine the potential for environmental contamination.

Hazardous substances are used and stored throughout the plant. ORGDP utilizes bulk chemical and bulk fuel storage areas for many of these materials. A major site for chemicals stored in bulk quantities is the K-1420 building and area. Some of the larger storage tanks containing hazardous materials include hydrochloric acid (K-892-Q, K-1401, K-1409), trichloroethane (K-1401, K-1404), nitric acid (K-1420), sulfuric acid (K-894, K-1407-A, K-1501), fuel oil (K-897-A to P), chlorine (K-802), plating solution (K-1420), and sodium hydroxide (K-1401). In addition, many chemicals are stored in moderate quantities in the areas in which they are used. Typically, these are stored in quantities of 55 gallons or less. The management and handling of these and other dangerous materials to prevent or minimize releases to the environment will be evaluated.

7.2 Records Required

As part of the Survey, files will be reviewed including documents not previously received or reviewed (e.g., classified documents, individual files, documents not previously identified). Specific documents and files to be reviewed as part of the Survey include, but will not be limited to, the following:

- Toxic substances labeling and tracking system.
- Procedures for handling, control, and management of toxic substances.
- Inventory of toxic substances and purchasing records of chemical substances.
- PCB annual inventory documents (1978 to 1986).
- Inventory of current PCB-contaminated electrical equipment.
- Records of inspections of PCB transformers (1981 to present).
- PCB handling, storage, and disposal procedures.
- Correspondence with fire department on PCB transformers.
- Locations of buildings containing asbestos, including usage.
- Asbestos disposal records, including method and location of disposal sites.
- Asbestos handling, removal, disposal procedures, and environmental monitoring.
- Records of asbestos use in process equipment and support facilities including the steam plant.
- Pesticide training, handling, storage, disposal records, and environmental monitoring.
- Standard operating procedures for pesticides.
- Special procedures involving handling, storage, use and disposal of chlorofluoroalkanes (freons) and chloroorganic solvents.
- Other records as determined on-site.

8.0 RADIATION

8.1 Issue Identification

Radiological issues to be addressed during the Environmental Survey will center around the air, soil, surface water, and groundwater media. Each of the above mentioned media will be evaluated for radiation concerns by collecting background information and data (including ambient data), identifying existing and decommissioned radiation pollution sources and associated controls, and finally by reviewing environmental monitoring programs designed to gather data on identified pollution sources.

The Survey will also evaluate rad-waste management practices, direct radiation exposure issues, dose assessment methodologies, and radiochemistry quality assurance programs for environmental monitoring data. Review of rad-waste programs including management practices for low-level, transuranic, rad-hazardous (mixed), and adherence to ORGDP procedures will be a major focus of the radiation portion of the Survey. A more detailed discussion of this subject is provided in Section 6.0 of the work plan. The radiological evaluations will be closely coordinated with the other specialists on the Survey team.

Because radiation issues cut across all media evaluated during the Survey, the attached daily agenda has been organized in an attempt to overlap the other specialists' activities when they are evaluating radiation issues. Some inefficiencies are to be expected as a result of this dual coverage approach, however, every effort has been made to minimize duplication. To improve the effectiveness of radiation evaluations, Mr. Francis will rely heavily on the expertise and assistance of various ORGDP personnel for accomplishing Survey objectives and pointing out where work plan inefficiencies exist. Discussions with operating and supervisory personnel will also be utilized to provide needed information critical for complete evaluation. Reports, records, and other data associated with continuous, intermittent, and any accidental or unscheduled releases should be readily accessible for review.

8.2 Records Required

Files will be reviewed as part of the Survey, including documents not yet reviewed or received (e.g., classified documents, individual files, documents not yet identified). Specific documents and files to be reviewed as part of the Survey include, but will not be limited to, the following:

- Radiation-related ambient air quality information.
- Background radiation data for soil, surface water, and groundwater.
- Inventories of air, soil, surface water, and groundwater radionuclide release points and quantities.
- Vegetation radionuclide monitoring data.
- Unscheduled or accidental release reports.

- Radioanalytical quality assurance programs and procedures.
- Dose assessment methodologies, including assumptions, calculations, reporting, etc.
- Building plot plans with process and equipment locations.
- Description of radiation monitoring equipment practices and procedures (e.g., calibration, maintenance, etc.).
- Reports or recommendations for upgrading radiation monitoring systems.
- Reports prioritizing new radiation monitoring installations.
- Off-site and on-site radionuclide sampling point criteria.
- Rad-waste management practices, policies, procedures, and communication mechanisms.
- NESHAPS/DOE Subpart H 61.90-61.98 reports.
- Information regarding employee radiation exposure data.
- Historical rad-waste disposal activity logs and locations.
- State, County and local radiation regulations.

9.0 QUALITY ASSURANCE

9.1 Issue Identification

The quality assurance phase of the Environmental Survey will be primarily an evaluation of the sampling and analytical capabilities at the ORGDP. The objective will be to review and verify the quality assurance procedures for obtaining process effluent and environmental samples, performing the analyses to measure the concentration of pollutants, and the handling and reporting of the data. All aspects of the quality assurance program relating to environmental management of the Oak Ridge plant will be reviewed including: operator training; equipment and instrument calibration/maintenance; precision and accuracy evaluation; blank, split, and spiked sample analyses; sample handling and chain-of-custody procedures; data reduction and validation; data reporting and documentation; as well as the review of calculations and logbooks.

The procedures used for sampling and analysis will be monitored to ensure proper implementation and conformance with accepted practices. The quality assurance program will be reviewed for the sampling and analytical activities, and also for any internal quality assurance audits that have been conducted. Furthermore, the interlaboratory test programs participated in by the ORGDP laboratories, as administered by the DOE's Environmental Measurements Laboratory and the Environmental Protection Agency will be evaluated. The quality assurance procedures of any off-site sampling and/or analytical laboratories utilized by the plant will also be reviewed in this Environmental Survey.

9.2 Records Required

Part of the Survey will consist of a review of pertinent files. This will include documents not previously reviewed or received, such as classified documents (if any), individual files, and documents which have not been identified at this time. Some specific documents and files to be reviewed in this phase of the Survey include, but will not be limited to, the following:

- Environmental sampling and analysis quality assurance programs of the Analytical Chemistry and Environmental Management Departments.
- Quality assurance audits of the analytical laboratories and sampling program.
- Analytical and sampling procedures manuals.
- DOE and EPA quality assurance results of performance evaluation samples.
- Quality assurance reports for the ORGDP Analytical Chemistry Department.
- Training policy and records for the sample collection and analytical laboratory personnel.
- Maintenance and calibration records for the analytical laboratory and sampling instruments/equipment.
- Laboratory notebooks, data reporting forms, and sampling logbooks.

10.0 INACTIVE WASTE SITES/RELEASES (CERCLA)

10.1 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 ORGDP. This aspect of the Survey will be coordinated with the RCRA and hydrogeology team members. The Survey will focus on current and future risks related to the following:

- Past land disposal practices (on and off-site);
- Past spills/releases from tanks, pipes, pits, trenches;
- Potential for future spills/releases; and
- On-going remedial action program.

Facilities that have handled or are currently handling hazardous, mixed, and low-level radioactive substances at ORGDP will be evaluated.

The following areas identified in ORGDP documents will be evaluated:

Visit: K-1407 WAG
- K-1407-A Neut. Pit
- K-1407-B Holding Pond (+ K-1419 Sludge Fix. Fac.)
- K-1070-B Classif. Burial Ground
- K-1700 Creek
- K-1407-C Retention Basin & Soil
- K-1070-C,D Classified Burial Ground
- K-1413 Tmt. Fac.
- K-1232 Tmt. Fac.
- K-25 Storage Areas
- K-1417 Soil
- K-1064G Peninsula Storage & Burn Area
- K-770 Scrap Metal Yard
- K-1085 Firehouse Burn Area
- K-1070-F Contractors Burial Ground
- K-1070-A,B Contam. Burial Ground
- K-901A Holding Pond
- K-1007-B Holding Pond
- K-1515 Lagoon
- K-726 PCB Storage
- K-1420 Oil Storage & Decon.
- K-1421 Incinerator
- K-1099 Quarry
- K-1070-G Burial Ground
- K-1410 Ni. Plat. Fac.
- K-1515F Land Tmt.

The status of activities undertaken pursuant to DOE Order 5480.14 will be assessed. Records of past off-site disposal from ORGDP will be reviewed.

Sites that have undergone or are undergoing remediation will be addressed. Records and analytical data in support of the site cleanup will be reviewed. Also, inactive tanks or containers that may have held hazardous substances will be identified and their status assessed. Former storage areas and staging locations will be included in this effort. The team will also want to review the environmental records pertaining to the past management, disposal (on-site and off-site), clean-up, and regulatory compliance.

Contacts for this portion of the Survey will include personnel from Environmental Management and Nuclear Material Control and Accountability in the Health, Safety, and Environmental Affairs Department and the Chemical Operation personnel in the Fabrication and Maintenance Department.

10.2 Records Required

Files will be reviewed as part of the Survey, including documents not yet reviewed or received (e.g., classified documents, individual files, documents not yet identified). Specific documents and files to be reviewed as part of the Survey include, but will not be limited to, the following:

- Past waste management plans.
- SOPs regarding management of hazardous substances, disposal area 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 burial tanks and structures (existing and removed).
- Historical aerial and surface photographs of the facility.
- "Interview files" for the draft Phase I Installation Assessment report.
- Files pertaining to any radiometric surveys of the site grounds.
- Documents pertaining to past, current, and proposed remedial actions (e.g., C-400 Area TCE) at ORGDP.
- Environmental records pertaining to past facility responses to hazardous substance spills and releases.

RADIATION - M. FRANCIS

MONDAY, MARCH 14	TUESDAY, MARCH 15	WEDNESDAY, MARCH 16	THURSDAY, MARCH 17	FRIDAY, MARCH 18
-Orientation -K-27,29,31 & 33 Process bldgs. w/R. Basinski	-K-25 Process bldg. w/R. Basinski -Rad Air Issues incl: 1420 Decon. Fac. 1004-A Lab Dump Hood 1200 Centrifuge Oper	-K-770 Scrap Metal w/R. Basinski -TSCA Incinerator w/ R. Basinski	-Rad Labs QA/QC w/C. Caruso -K-1232,1407A,B,C Trtmt. Fac. -K-1417,1419 Storage & Fixation w/R. Basinski	-Waste Storage Areas w/R. Basinski - K-711 K-715,1036-A,1061, 1070,1202,1233,1425, 1501 -K-1070 Classified Waste Burial Ground -Mid-Survey Debriefing & Findings Forms Due
MONDAY, MARCH 21	**TUESDAY, MARCH 22**	**WEDNESDAY, MARCH 23**	**THURSDAY, MARCH 24**	**FRIDAY, MARCH 25**
-K-1420 Decon. Fac. w/R. Basinski & J. Boros -Rad Groundwater & Soil issues w/D. Detman	-Rad Water Issues w/ J. Boros -Review Environmental TLD Program -Discuss Unusual Occurrence Reports	-Review Dose Assessment Program: -pathways -calculations for: -Air doses -Water doses -Groundwater doses -Vegetation/food -Rad/CERCLA issues w/J. Werner	-Informal Debriefing w/ORGDP Staff (Reality Check) -Miscellaneous Rad Issues -All Findings forms due	-Detailed Preliminary Report Outline Due -Closeout with ORGDP Mgmt. (Early Afternoon)

SURFACE WATER/DRINKING WATER - J. BOROS

MONDAY, MARCH 14	TUESDAY, MARCH 15	WEDNESDAY, MARCH 16	THURSDAY, MARCH 17	FRIDAY, MARCH 18
-Orientation -K-1501 Steam Plant & Ancillaries (coal piles; water treatment system; blow-off pit; crusher; acid storage)	<u>Operations Dept:</u> -K1203 Wastewater Treatment Plant, incl K1203-2 thru 16 -K1232 Chemical Recov. Facility, incl. K1232-A thru I -K1410 Nickel Plating Facility, incl. 1410B -K1413C Loading Station & Pit	<u>Maintenance Dept:</u> -K1015 Laundry Area -K1414 Garage, incl. Wash Facility, Back-flow Prevention -K1095 Paint Shop -K1064 Salvage Yard, incl. drum cleaning -K1401 Maintenance Building	-Tour all NPDES outfalls and routine surface water monitoring points -Observe sampling procedures -Visit analytical labs to observe check-in procedures	-K1435 TSCA Incinerator incl. storage areas -Visit septic tank sites (rifle range, power house area, water treatment plant) -First week findings forms due -Mid-Survey Debriefing & Findings Forms Due
MONDAY, MARCH 21	**TUESDAY, MARCH 22**	**WEDNESDAY, MARCH 23**	**THURSDAY, MARCH 24**	**FRIDAY, MARCH 25**
-K1420 Cleaning & Decontamination; Uranium Recovery -K1407 Laboratory Building & 1407 Pits Ponds & Basins -K1424 Waste NO_3 Fac. -K1419 Sludge Fixation Facility	-K1514 Water Tank -K1515 Water Treatment Plant & Ancillaries -Discuss potable water systems, review analytical data, and discuss back-flow prevention measures	-Review storm water run-off systems & examine recent data on run-off characteristics -Organize observations and prepare findings for team leader review -Repeat visits as required	-Informal Debriefing w/ORGDP Staff (Reality Check) -Repeat visits as required -Review Files -All Findings Forms Due	-Detailed Preliminary Report Outline Due -Review Files -Closeout with ORGDP Mgmt (Early Afternoon)

HYDROGEOLOGY AND SOIL - D. DETHAN

MONDAY, MARCH 14	TUESDAY, MARCH 15	WEDNESDAY, MARCH 16	THURSDAY, MARCH 17	FRIDAY, MARCH 18
-Orientation -Tour CERCLA sites (K-770, K-1070-F, K-1085, K-1070-A, K-1064-G, K-1070-B, K-1099, K-1070-C) to observe monitoring well installations. -Coordinate w/J. Werner.	-Tour RCRA sites (K-1413, K-1407-A, K-1407-B, K-1407-C, K-1232, K-1070-D) to observe monitoring well installations. -Coordinate w/R. Basinski. -Observe field groundwater monitoring well purging, sampling, QA, & chain-of-custody for 1 or 2 wells. -Coordinate w/C. Caruso	-Review up-to-date groundwater monitoring well analytical data.	-Tour soil sampling areas S18K-S30K, S33 S42 & S43; & vegetation sampling areas PN1-PN5, V1K-V13K, V33, V42 & V43. -Review field soil sampling techniques, QA, and chain-of-custody procedures.	-Review soil & vegetation analytical data. -Prepare or finalize rough drafts of findings for submittal to Team Leaders by close-of-business -Mid-Survey Debriefing & Findings Forms Due
MONDAY, MARCH 21	**TUESDAY, MARCH 22**	**WEDNESDAY, MARCH 23**	**THURSDAY, MARCH 24**	**FRIDAY, MARCH 25**
-Tour known spill, uncontrolled release sites, & other inactive or active sites requiring RFIs or included in the listing of 45 SWMUs. -Coordinate w/J. Werner (CERCLA), R. Basinski (RCRA), M. Francis (Radiation)	-Coordinate assessment of air & surface water findings relative to potential contamination of soil & groundwater w/J. Crist & J. Boros	-Review any reports & analytical data for spill & uncontrolled release sites that has resulted from "special" sampling. -Coordinate w/R. Basinski & J. Werner -Prepare for Reality Check w/Team Leaders	-Informal Debriefing w/ORGDP Staff (Reality Check) -Catch-up day -All Findings Forms Due	-Detailed Preliminary Report Outline Due -Review all Findings Texts -Closeout with ORGDP Mgmt (Early Afternoon)

MONDAY, MARCH 14	TUESDAY, MARCH 15	WEDNESDAY, MARCH 16	THURSDAY, MARCH 17	FRIDAY, MARCH 18
-Orientation -Review of Environmental Analytical Labs (K-1004-A-D) -general requirements -organization -records required	-Evaluate organic & inorganic labs (K-1004, K-1101, K-1423, etc.) incldg: -policies, manuals, sample tracking, data mgmt & cal., training, use of spikes, duplicates, blanks, etc. -Observe groundwater sampling	-Review Toxic Substance Management, Storage, Use, Disposal, etc. -Review Bulk Chemical Storage, Visit sites K-402-9B, K-892-Q, K-894, K-1036-A, K-1058, K-1401, K-1404, K-1407-A, K-1407-H, K-1409, K-1420, K-1501, etc.	-Radiation labs (QA/QC) incldg: policies, manuals, sample tracking, data mgmt, calibration, training, use of spikes, duplicates, etc. -Review environmental sampling/surveillance procedures, incldg. water quality monitoring stations	-Review of Asbestos Program incldg: use, training, handling, removal, storage, disposal, etc. Visit removal/disposal sites (Industrial Hygiene Dept.) -Mid-survey debriefing & Findings Forms Due

MONDAY, MARCH 21	TUESDAY, MARCH 22	WEDNESDAY, MARCH 23	THURSDAY, MARCH 24	FRIDAY, MARCH 25
-PCB Inspections incl transformers in bldgs K-709, K-731, K-791, K-862, K-1037, K-1131, K-1301, K-1401, K-27, K-29, K-31, K-33, K-901-1, K-902-6, K-902-7, K-902-8. -Review Insp. Records -PCB Capacitors in bldgs K-27, K-29, K-31, K-33. -PCB Storage Areas in bldgs K-902-8, K-306-1, K-726 (w/J. Crist)	-Review of Pesticide program incl. use, handling, storage, training, disposal, etc. (Roads & Grounds Dept & Janitorial Dept, bldgs K-301-4, etc. -Review small qty. chemical storage K-1416-E, K-1036A, lab storage (K-1006) -Review fuel storage areas K-897-A to P, K-1435 incinerator, etc.	-Writing and/or revisits day plus S&A review	-Informal Debriefing w/ORGDP Staff (Reality Check) -All Findings Forms Due	-Detailed Preliminary Report Outline Due -Closeout with ORGDP Mgmt. (Early Afternoon)

RCRA - R. BASINSKI

MONDAY, MARCH 14	TUESDAY, MARCH 15	WEDNESDAY, MARCH 16	THURSDAY, MARCH 17	FRIDAY, MARCH 18
-Orientation -K-27,K-29,K-31,K-33 Process Buildings w/M. Francis -1414 Garage -1654 Rifle Range	-K-25 Process Bldg w/M. Francis -K-796 Maintenance, K-1040 Laundry, K-1052 Lab Test Storage -K-1015 Laundry -K-1095 Paint Shop, K-1098 Maint. Fac., K-1401 Maint. Bldg.	-K-770 Scrap Metal w/M. Francis, J. Werner -K-722,K-723,K-774, K-725,K-726,K-1056, K-1058,K-1059,K-10[illegible] Warehouses & Storage Areas -TSCA Incinerator (K-1435) w/M. Francis	-K-1407-H, K-701,K-710, K-715,K-892,K-896, K-1203 Water & Waste-water Treatment -K-1232,K-1407A,B,C Treatment Facilities, -K-1417,K-1419 Storage and Fixation	-K-711,K-715,K-1036A, K-1061, K-1070, K-1202, K-1025C, K-1035A, K-1233, K-1425, K-1501 Waste Storage w/M. Francis -K-1421 Incin w/J. Werner -K-1070 Class. Burial Ground -Mid-Survey Debriefing & Findings Forms Due

MONDAY, MARCH 21	TUESDAY, MARCH 22	WEDNESDAY, MARCH 23	THURSDAY, MARCH 24	FRIDAY, MARCH 25
-K-1420 Decon. w/ M. Francis -K-1037, K-1052, K-1200, K-1210, K-1210, K-1220 Old GCEP Facilities	-K-703, K-1004, K-1005, K-1006, K-1023, K-1024, K-1405, K-1407, K-1413 Lab Facilities -Revisits & Finish above	-K-709, K-732, K-742, K-792 Switchyards & Assoc. Oil Fac. -Revisits & Finish Above	-Informal Debriefing w/ORGDP Staff (Reality Check) -Revisits -All Findings Forms Due	-Detailed Preliminary Report Outline Due -Closeout with ORGDP mgmt. (Early After-noon)

CERCLA - J. WERNER

MONDAY, MARCH 14	TUESDAY, MARCH 15	WEDNESDAY, MARCH 16	THURSDAY, MARCH 17	FRIDAY, MARCH 18
-Orientation -Review Archive Index/Request Documents -Visit K-1407 WAG, K-1407-A Neut. Pit, K-1407-B Holding Pond, K-1419 Sludge Fix Fac., K-1070-B Classif. Bur.Grd., K-1700 Creek, K-1407C Retention Basin & Soil -Visit K-1070C,D Class. Bur. Grd. -K-1413 Tmt Fac.	-Review Files -Visit K-1232 Tmt. Fac., K-25 Storage Areas, K-1417 Soil, K-1064G Peninsula Storage & Burn Area -Review Aerial Photos	-Review Files -Visit K-770 Scrap Metal Yard, K-1085 Firehouse Burn Area, K-1070-F Contractors Burial Ground	-Review Files -Visit K-1070A,B Contam. Burial Grd., K-901A Holding Pond, K-1007-B Holding Pond, K-1515 Lagoon	-Review Files -Visit 726 PCB Storage, K-1420 Oil Storage & Decon, K-1421 Incinerator -Mid-Survey Debriefing & Findings Forms Due
MONDAY, MARCH 21	**TUESDAY, MARCH 22**	**WEDNESDAY, MARCH 23**	**THURSDAY, MARCH 24**	**FRIDAY, MARCH 25**
-Review Files -Visit K-1099 Quarry, K-1070-G Bur. Grd., K-1410 Ni Plat. Fac.	-Review Files -Revisits as Needed -K-1515F Land Tmt.	-Review Files -Revisits as Needed -Rad/CERCLA Issues w/M. Francis	-Informal Debriefing w/ORGDP Staff (Reality Check) -Review Files -Revisits as Needed -All Findings Forms Due	-Detailed Preliminary Report Outline Due -File Review -Closeout with ORGDP Mgmt. (Early Afternoon)

AIR/TSCA - J. CRIST

MONDAY, MARCH 14	TUESDAY, MARCH 15	WEDNESDAY, MARCH 16	THURSDAY, MARCH 17	FRIDAY, MARCH 18
-Orientation -K-27, K-29, K-31, K-33 w/R. Basinski & M. Francis	-TSCA Incinerator -permits -blueprints -air cleaning equipment -administrative controls -SOPs	-Boiler House Fab Shop -K-1501 Steam Plant -K-701 -K-703 Fab Shop -K-1064-C -K-1233-A Drum Cleaning	-Air Monitoring Stations K-1022-1 to 12 and K-1022-F-1 to F-5 -Meterological Tower K-1208	-Air Model Test Facility 1305 -K-1030, K-1401 Maintenance Shops -K-1037-C Smelter House -K-1071 Trash Compactor -Mid-Survey Debriefing & Findings Forms Due
MONDAY, MARCH 21	**TUESDAY, MARCH 22**	**WEDNESDAY, MARCH 23**	**THURSDAY, MARCH 24**	**FRIDAY, MARCH 25**
-Tour of PCB Transformer & Capacitor Locations & Storage Areas w/C. Caruso	-1420 Decontamination -Cooling Towers K-861, K-861-J, K-1004-N, K-1004-N-1 K-1004-N-2, 1006-A, K-725-A, K-801-H, K-802-H, K-822-A,B, K-832-H	-K-1095 Paint Shop -1098-E Heat Treatment -1098-F Sand Blaster -1040-A Lab Dump Hood -1200 Centrifuge -Revisit TSCA Incinerator	-Informal Debriefing w/ORGDP Staff (Reality Check) -All Findings Forms Due	-Detailed Preliminary Report Outline Due -Closeout with ORGDP Mgmt. (Early Afternoon)

APPENDIX D
CHEMICAL SYMBOLS, ABBREVIATIONS, AND ACRONYMS

APPENDIX D

CHEMICAL SYMBOLS, ABBREVIATIONS, AND ACRONYMS

ACD	Analytical Chemistry Department
ACM	asbestos-containing material
AHERA	Asbestos Hazard Emergency Response Act
AIRDOS	Estimation of radiation dose caused by airborne radionuclides in areas surrounding nuclear facilities
Al	aluminum
AL	Alabama
ALARA	as low as reasonably achievable
AnaLIS	Analytical Laboratory Information System
APHA	American Public Health Association
AQCR	Air Quality Control Region
AR	Arkansas
As	arsenic
ASTM	American Society for Testing and Materials
avg.	average
AVLIS	Atomic Vapor Laser Isotope Separation Process
Be	Beryllium
Bldg(s)	building(s)
BMP	Best Management Practices
BOD_5	Biochemical Oxygen Demand (5-day)
Btu	British thermal unit
°C	degrees Celsius (or Centigrade)
^{11}C; C-11	Carbon, Mass Number 11
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CG	Concentration Guide
CH_4	methane
Ci	curie(s)
CIP	Cascade Improvement Plan
Cl	chloride
cm	centimeter(s)
CN	cyanide
CNF	Central Neutralization Facility
CO	carbon monoxide
CO_2	carbon dioxide
COD	Chemical Oxygen Demand
$Cr(OH)_3$	Chromium Hydroxide-Trivalent
CUP	Cascade Upgrade Plan
CY	Calendar Year
D-38	Uranium containing higher concentrations of ^{238}U than found in nature
DCG	Derived Concentration Guide
D&D	decontamination and decommissioning
DL	Discharge Limit
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DOT CL	Department of Transportation Classification

DRE	Destruction Removal Efficiency
DRP	Destruction Removal Plan
E	east
EDTA	Ethylenediamine tetra-acetric acid (or its salts)
e.g.	(exempli gratia) for example
elev.	elevation
ENE	east-northeast
Engng	Engineering
EP	Extraction Procedure Toxicity 40 CFR 261.24
EPA	U.S. Environmental Protection Agency
ESE	east-southeast
et al.	(et alii, aliae, or alia) and others
°F	degree(s) Fahrenheit
FAA	Federal Aviation Administration
Fe	iron
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FMPC	Feed Materials Production Center
FRP	Fiberglass Reinforced Plastic
ft	foot; feet
ft^3	cubic feet
FUSRAP	Formerly Utilized Sites Remedial Action Program
FY	Fiscal Year
GA	Georgia
gal	gallon(s)
GDP	Gaseous Diffusion Plant
GHV	Gross Heating Value
GLP	Good Laboratory Practice(s)
GMP	Good Management Practice(s)
gpd	gallon(s) per day
gpm	gallon(s) per minute
^3H; H-3	tritium
ha	hectare(s)
HEPA	High Efficiency Particulate Air
HF	hydrogen fluoride; hydrofluoric acid
HQ	Headquarters
hr	hour(s)
H-T	Tritiated Hydrogen Gas
HTO	Tritiated Water
I	Interstate
ICRP	International Commission on Radiological Protection
i.e.	(id est) that is
IHD	Industrial Hygiene Department
in.	inch(es)
Inc.	Incorporated
Is.	Island
IWS	ionizing wet scrubber
kg	kilogram(s)
km	kilometer(s)

KY	Kentucky
l	liter(s)
lb	pound(s)
LLW	low-level radioactive waste
LSA	Low Specific Activity
m	meter(s)
Max.	Maximum
MED	Manhattan Engineering District
μCi	microcurie(s)
μCi/g	microcurie(s) per gram
mCi	millicurie(s)
μg	microgram(s)
mg	milligram(s)
Mgal	Million gallons
mgd	million gallons per day
mi	mile(s)
ml	milliliter(s)
mm	millimeter(s)
MMES	Martin Marietta Energy Systems, Inc.
MO	Missouri
mrem	millirem
mrem/yr	millirem per year (10^{-3} roentgen equivalent man/year)
MS	Mississippi
MSDS	Material Safety Data Sheet
N	north; nitrogen
N_2	nitrogen gas
NA	not analyzed; not applicable
NBS	National Bureau of Standards
n.c.	no change
NC	North Carolina
NCRP	National Council on Radiation Protection and Measurements
ND	no date
NE	northeast
NESHAPS	National Emission Standards for Hazardous Air Pollutants
NMHC	Non-methane Hydrocarbons
NNE	north-northeast
NNW	north-northwest
NO	nitric oxide
No.	number(s)
NO_2	nitrogen dioxide
NOS	Not Otherwise Specified
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NRHC	nonreactive hydrocarbons
NW	northwest
O&G	oil and grease
O_3	ozone
ORGDP	Oak Ridge Gaseous Diffusion Plant
ORM-A	Other Regulated Material (e.g., irritant)

ORM-B	Other Regulated Material (e.g., corrosive)
ORM-C	Other Regulated Material (e.g., 49 CFR 177.101 Listing)
ORM-E	Other Regulated Material (e.g., hazardous wastes)
ORNL	Oak Ridge National Laboratory
ORO	Oak Ridge Operations Office
ORR	Oak Ridge Reservation
Pb	lead
PCB	polychlorinated biphenyl(s)
pCi	picocurie(s)
PCS	piece(s)
PGDP	Paducah Gaseous Diffusion Plant
pH	negative logarithm of the hydrogen ion concentration
PM_{10}	particulate matter 10 microns or less in diameter
ppb	part(s) per billion
ppm	part(s) per million
PUEC	Portsmouth Uranium Enrichment Complex
PVC	polyvinyl chloride
QA	Quality Assurance
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
RCW	recirculating cooling water
Res.	residual
RFI	RCRA Facility Investigation
RFP	Request for Proposal
RMI	RMI Extrusion Plant
s	second(s)
S	south
S&A	Sampling and Analysis
SARA	Superfund Amendments and Reauthorization Act of 1986
SC	South Carolina
SCC	secondary combustion chamber
SDM	Standard Deviation of the Mean
SE	southeast
sec	second(s)
SFMP	(remote) Surplus Facilities Management Program
SO_2	sulfur dioxide
SO_4	sulfate
SOP	standard operating procedure(s)
SPCC	Spill Prevention, Control and Countermeasures
sq. mi.	square mile(s)
SSE	south-southeast
STP	Sewage Treatment Plant
SSW	south-southwest
SW	southwest
SWMU	Solid Waste Management Unit
T-1,2DCene	Trans-1,2 dichloroethylene
^{99}Tc; Tc-99	technetium-99
TCDD	tetrachlorodibenzo-p-dioxin
TCE	trichloroethylene

TCLP	toxicity characteristics leaching procedure
TDS	Total Dissolved Solids
TDHE	Tennessee Department of Health and Environment
THC	total hydrocarbons
TICH	total identifiable chlorinated hydrocarbons
TLD	thermoluminescent dosimetry
TN	Tennessee
TOC	total organic carbon
TON	Threshold Odor Number
TRC	Total Residual Chlorine
TRU	transuranic
TSCA	Toxic Substances Control Act
TSP	total suspended particulates
TSS	total suspended solids
TTLC	Toxic Threshold Limit Concentration
TTO	Total Toxic Organics
TVA	Tennessee Valley Authority
^{235}U; U-235	uranium-235
^{238}U; U-238	uranium-238
UCCND	Union Carbide Corporation Nuclear Division
UF_6	uranium hexafluoride
UNK	Unknown
U.S.	United States
UST	underground storage tank
VA	Virginia
VOC	Volatile Organic Compound
W	west
WAA	Waste Accumulation Area(s)
WAG	Waste Area Grouping
WNW	west-northwest
WSW	west-southwest
Y-12	Y-12 Plant
yd^3	cubic yard(s)
yr	year(s)
α	alpha
β	beta
σ	sigma
%	percent
'	minute(s)
"	second(s)
~	approximately
≥	greater than or equal to
>	greater than
<	less than
&	and

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