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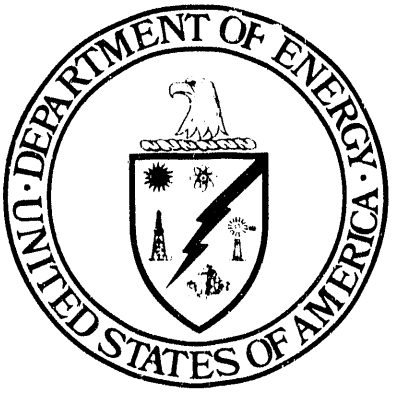
Environment, Safety and Health
Office of Environmental Audit



Environmental Survey
Preliminary Report

Portsmouth Uranium
Enrichment Complex

Piketon, Ohio

August 1987

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PREFACE
TO
THE DEPARTMENT OF ENERGY
PORTSMOUTH URANIUM ENRICHMENT COMPLEX
ENVIRONMENTAL SURVEY PRELIMINARY REPORT

This report contains the preliminary findings based on the first phase of an Environmental Survey at the Department of Energy (DOE) Portsmouth Uranium Enrichment Complex (PUEC), located at Piketon, Ohio. The Survey is being conducted by DOE's Office of Environment, Safety and Health.

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

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

August 1987
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 United States Department of Energy (DOE) Portsmouth Uranium Enrichment Complex (PUEC), conducted August 4 through 15, 1986.

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. Team specialists are being supplied by a private contractor. The objective of the Survey is to identify environmental problems and areas of environmental risk associated with PUEC. The Survey covers all environmental media and all areas of environmental regulation. It is being performed in accordance with the DOE Environmental Survey Manual. This phase of the Survey involves the review of existing site environmental data, observations of the operations performed at PUEC, 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 Argonne National Laboratory. When completed, the results will be incorporated into the PUEC Environmental Survey Interim Report. The Interim Report will reflect the final determinations of the PUEC Survey.

Site Description

PUEC occupies 16.2 km^2 of Federally owned property in south-central Ohio. The nearest community with a substantial population is Piketon (population 1,726), which is approximately 8 km north of the plant on U.S. Route 23. PUEC was operated by the Goodyear Atomic Corporation from 1954 to 1986. The facility is currently operated by Martin Marietta Energy Systems, Inc. The main mission of PUEC is the separation of uranium isotopes via gaseous diffusion. The enriched uranium is part of the fuel cycle for national defense and commercial reactors.

The Ohio Environmental Protection Agency (OEPA), in meetings with the Survey team, expressed concerns over the adequacy of PUEC's waste characterization and management practices and environmental monitoring and assessment programs. PUEC is currently the subject of a Federal

Facility Compliance Agreement (FFCA), which addresses violations of the Resource Conservation Recovery Act (RCRA). In addition, OEPA plans to take civil action against PUEC for violations of state environmental laws not addressed in the FFCA. The concerns and violations identified by both the Federal and state regulatory agencies are addressed in this report.

Summary of Findings

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

- Groundwater in several areas on-site is known to be contaminated with chlorinated organics, radionuclides, and heavy metals; levels of trichloroethylene exceed drinking water standards by several orders of magnitude; the nature and extent of on-site and off-site groundwater contamination cannot be determined with the existing groundwater monitoring system; groundwater investigations are under way.

- There are approximately 25 sources of known or suspected groundwater contamination; the sources include active and inactive waste management areas, surface impoundments, sumps, process lines, and spill areas. Characterization and remedial action is under way for some of the sources.

- Lack of sufficient treatment, storage, and disposal capacity for hazardous, mixed, and radioactive wastes results in improper storage and handling of these wastes on-site and in an increased potential for a release of hazardous and radioactive constituents to the environment.

- Hazardous and mixed wastes are being stored on-site without a RCRA permit; several waste streams suspected of containing hazardous constituents have not been tested pursuant to RCRA.

Overall Conclusions

The Survey found no environmental problems at PUEC that represent an immediate threat to human life. The preliminary findings identified at PUEC by the Survey team do indicate that the site is affected by a number of substantial environmental problems, most of which are a legacy of past practices. The most pressing problem facing the site at present, aside from groundwater contamination, is the critical shortage of on-site and off-site treatment, storage, and disposal

capacity for hazardous, mixed, and radioactive wastes. The quantity of these wastes, as well as the length of their storage period, increases daily as does the potential for releases to the environment.

The environmental problems described in this report vary in terms of their magnitude and risk. Although the Survey-related sampling and analysis to be performed at PUEC will assist in further identifying environmental problems at the site, a complete understanding of the significance of some of the environmental problems identified requires a level of study and characterization that is beyond the scope of the Survey. Actions currently under way or planned at the site, particularly the groundwater investigation and site remediation activities, will contribute toward meeting this requirement.

Transmittal of Results

The findings of the Environmental Survey of PUEC were shared with the DOE Oak Ridge Operations Office, the DOE Area Office, and the site contractor at the Survey closeout briefing held August 15, 1986. By letter of October 23, 1986, the Operations Office directed the site contractor to address those findings amenable to near-term response actions. An action plan covering these findings was prepared by PUEC and submitted to Oak Ridge Operations on December 17, 1986. Those findings that involve extended studies and multiyear budget commitments will be the subject of the Environmental Survey Summary Report and DOE-wide prioritization.

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

1.0 INTRODUCTION

The purpose of this report is to present the preliminary findings of an Environmental Survey, conducted August 4 through 15, 1986, at the Department of Energy's (DOE) Portsmouth Uranium Enrichment Complex (PUEC), in Piketon, Ohio. PUEC consists of the Gaseous Diffusion Plant (GDP), in operation since 1954, and the Gas Centrifuge Enrichment Plant (GCEP), construction of which was halted in 1985. PUEC was operated for DOE by the Goodyear Atomic Corporation (a subsidiary of the Goodyear Tire and Rubber Company) prior to and during the time of the Survey. In late 1986, operation of the plant was taken over by Martin Marietta Energy Systems, Inc.

The PUEC Survey is part of the DOE-wide Environmental Survey announced by Secretary John S. Herrington on September 18, 1985. The purpose of the overall 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 PUEC Environmental Survey was conducted by an interdisciplinary team of technical specialists headed and managed by a Team Leader and Assistant Team Leader from DOE's Office of Environmental Audit. A complete list of Survey participants and their affiliations is provided in Appendix A.

The Survey team focused on all environmental media and used 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 (DOE, 1986). Substantial use of existing information, plus 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) whereas Chapter 4 includes those that are non-media

specific (e.g., waste management, direct radiation, and quality assurance). Because the findings v greatly in terms of magnitude, risk, and characterization, and consequently require different level 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 an 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 wherein 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 wherein residual impacts pose an immediate potential for human population exposure.

- Evidence that a health-based environmental standard may be exceeded, as discussed in the preceeding situation, within the time frame of the DOE-wide Survey.

- Evidence that the likelihood is high for an unplanned release as the result, for example, of 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 wherein 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 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 time frames for response, are the greatest. Environmental problems included within this category will typically require lengthy investigation and remediation phases, and 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 regulation 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 and, hence, warrants inclusion as an environmental problem. Likewise, the presence of regulated materials in concentrations below those established by regulatory authorities that 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 in which 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 Program Office for appropriate action.

Based on the professional judgment of the Team Leader, the findings within categories in each section 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 PUEC survey is sampling and analysis (S&A). Argonne National Laboratory (ANL), the S&A team for PUEC, will be taking samples over a 2-week period beginning in August 1987. Prior to sampling, an S&A Plan will be prepared by DOE and ANL in accordance with the protocols in the DOE Environmental Survey Manual. The results generated by the S&A effort will be used to assist the Survey team in further defining the existence and extent of potential environmental problems identified during the Survey.

An Interim Report will be prepared 8 to 12 weeks after the completion of the S&A effort. The Interim Report will incorporate the results of the S&A effort as well as any changes or comments resulting from the review of the Preliminary Report. Based on the S&A results, the preliminary findings and observations made during the on-site Survey may be modified, deleted, or moved within or between categories. The Interim Report will serve both as the site-specific repository for

information generated by the Survey, and ultimately as the site-specific source of information for the DOE-wide prioritization of environmental problems.

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

2.0 GENERAL SITE INFORMATION

2.1 Site Setting

The Portsmouth Uranium Enrichment Complex (PUEC) occupies 16.2 km^2 of Federally-owned property in Pike County, Ohio. The plant location is shown in Figure 2-1. Figure 2-2 depicts the plant itself and the immediate environs. From start of operations in 1954 until November 1986, PUEC was operated by Goodyear Atomic Corporation, a subsidiary of Goodyear Tire and Rubber Company. Since November 1986, PUEC has been operated by Martin Marietta Energy Systems, Inc. (Site setting information obtained from ERDA, 1977; NUS, 1985; and GAT, 1973.)

Several small communities, such as Piketon, Wakefield, and Jasper, lie within a few kilometers (km) of the plant. Piketon, the only nearby urban center (population 1,726), is located approximately 8 km north of the plant on U.S. Route 23. Because of a lack of major employers in the immediate area, the population is not expected to increase significantly. Population centers within 50 km of the plant are Portsmouth (population 25,943), 32 km south; Chillicothe (population 23,420), 34 km north; Jackson (population 6,675), 29 km east; and Waverly (population 4,603), 11 km north. The total population of the area lying within an 80-km radius of the plant is approximately 600,000.

Piketon is in a rural, agricultural area with very few other industrial air pollution sources. There are no major nuclear facilities in the vicinity other than PUEC. Other businesses nearby consist of lumberyards, asphalt-gravel companies, and the State Highway Department Office and Garage (at the intersection of U.S. 23 and S.R. 124). None of these employ large numbers of personnel nor would they be expected to have any significant environmental impact.

Aside from the above small businesses, the only significant commercial activities are farming and forest activities (lumbering and pulp wood), which might have a significant, but localized, environmental impact.

The area surrounding the plant, except for the Scioto River floodplain, consists of marginal farmland and densely forested hills. The Scioto River Valley is farmed extensively, particularly for grain crops.

The terrestrial community consists of gently rolling hills, many of which have dry ridge tops, dry to moist slopes, and low-lying bottom lands. The vegetation community is dominated by a tree cover consisting chiefly of white oak, red oak, and hickory. The animal species, their abundance, and their relative distributions are typical of those found in southern Ohio. Pike County is located in a humid-

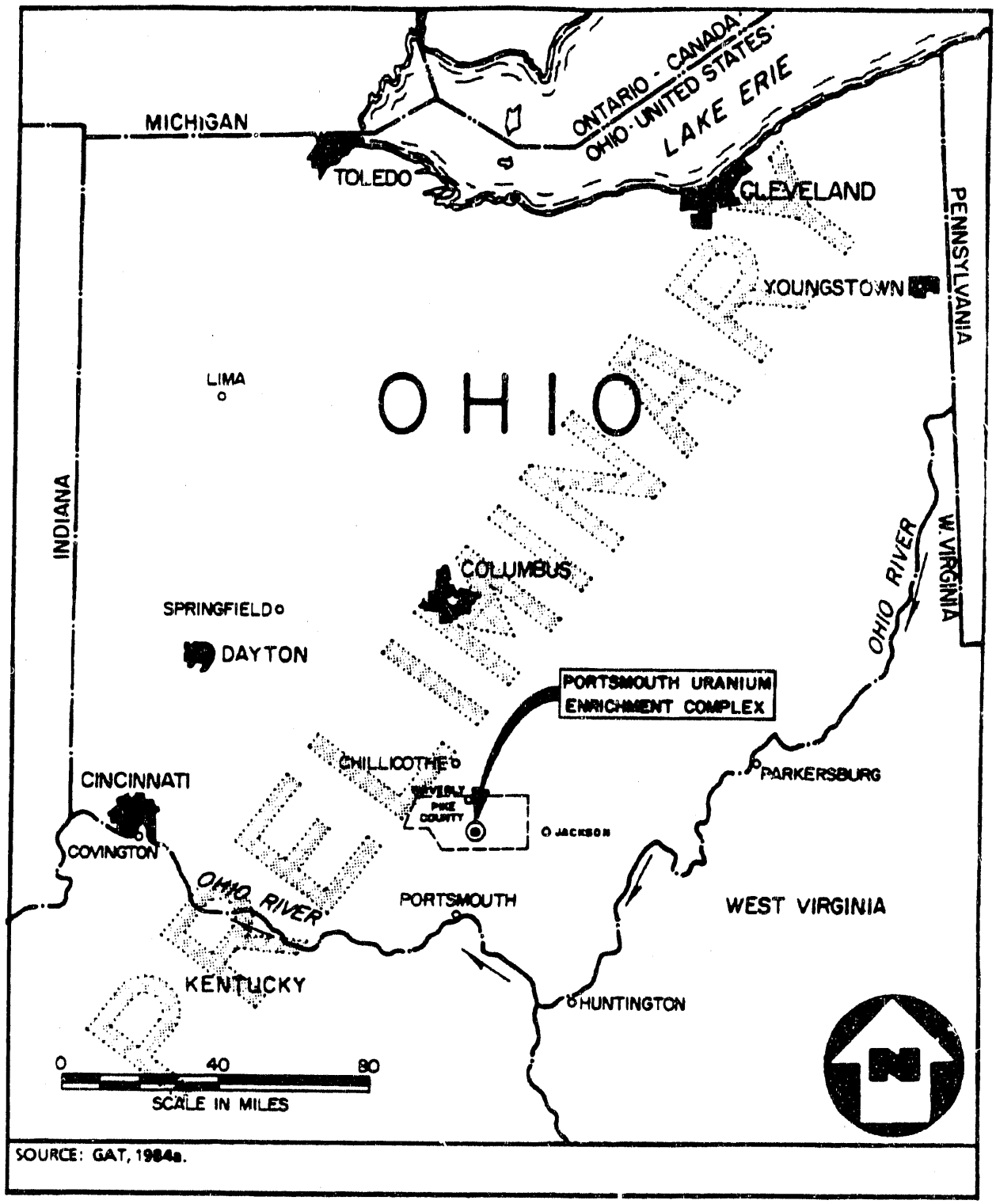

FIGURE 2-1

LOCATION MAP
PUEC – PIKETON, OHIO

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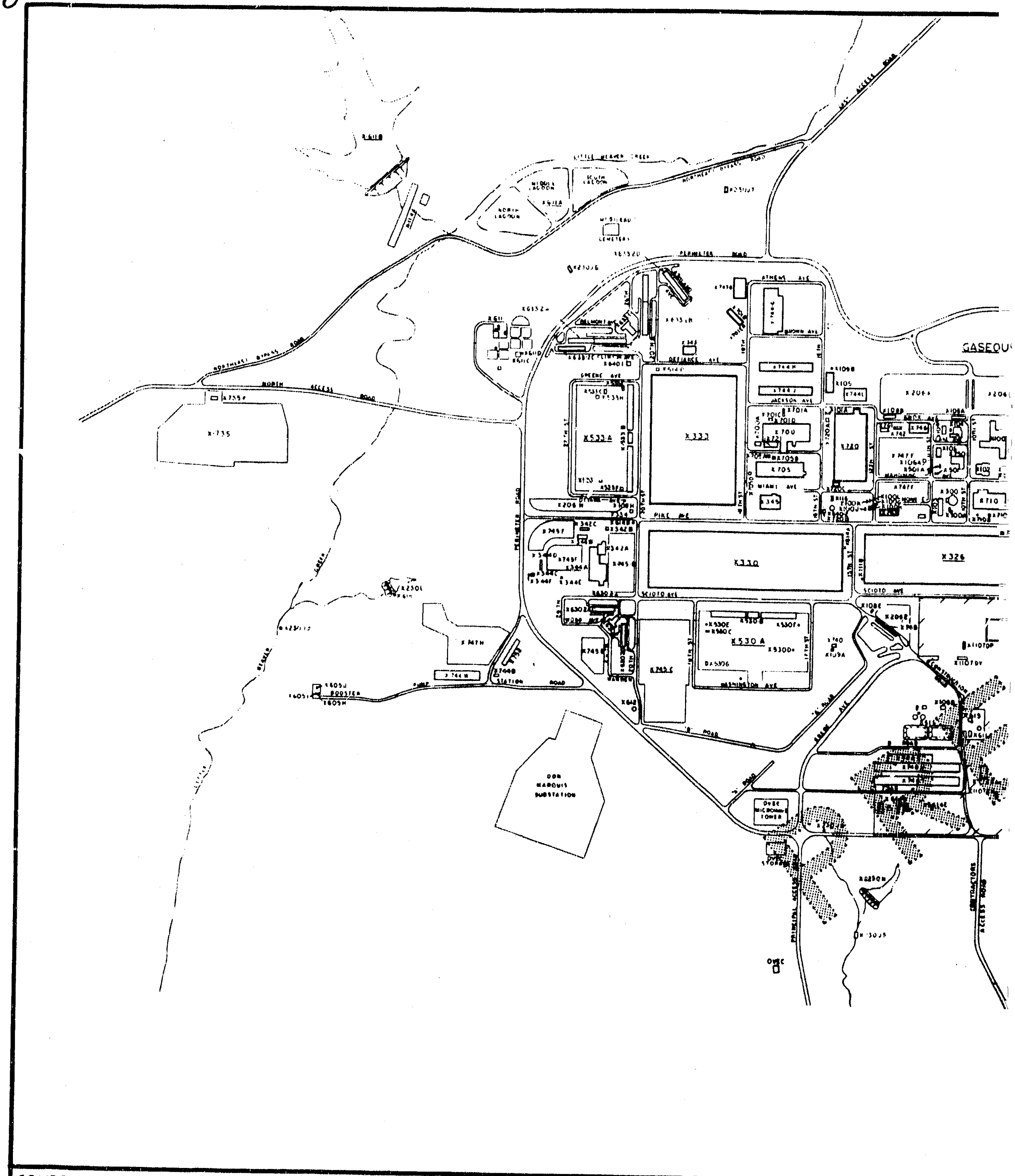


SOURCE: GAT, 1984a.

PLANT
PUEC-PI

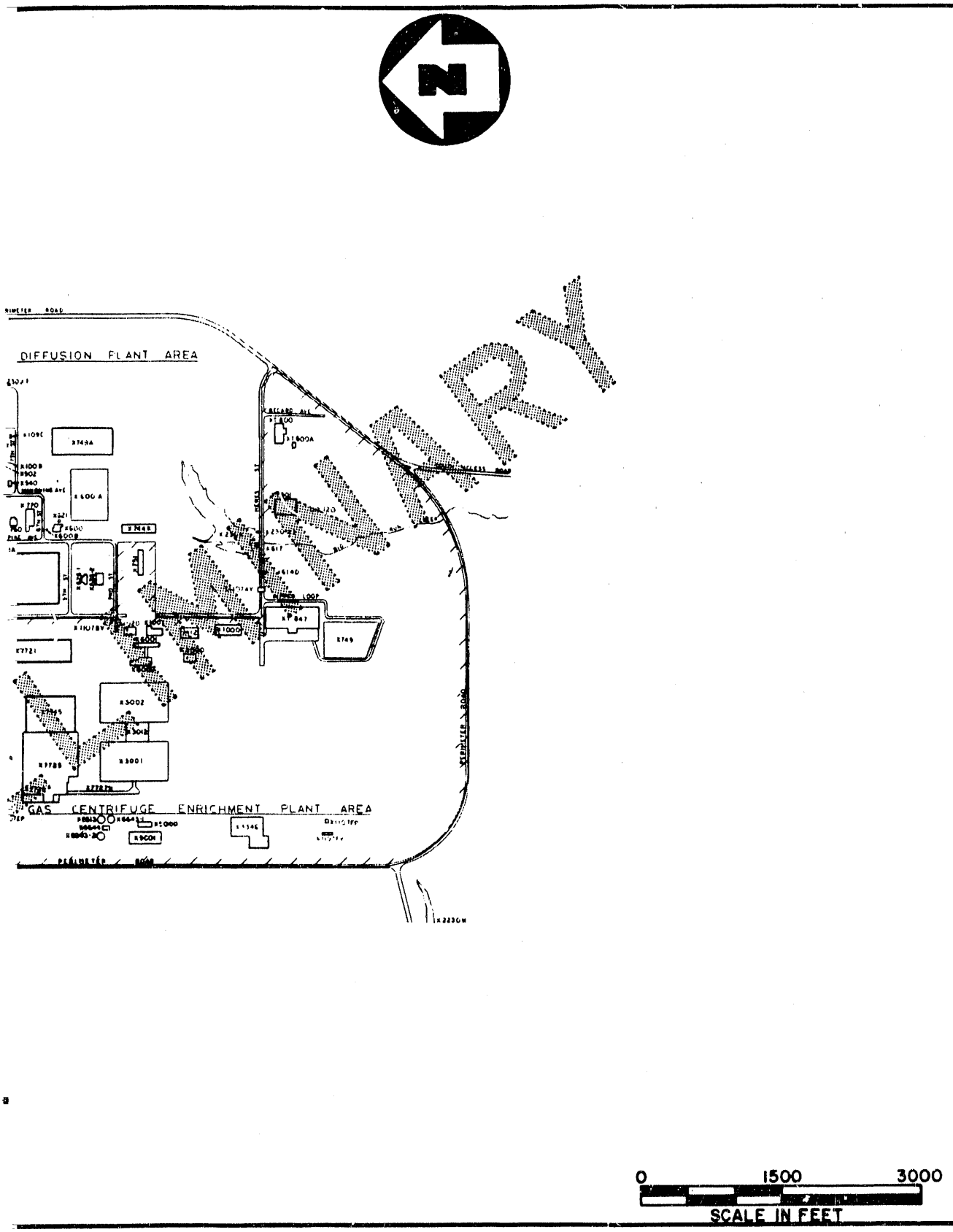


FIGURE 2-2

SITE MAP
PIKETON, OHIO

continental climatic zone. This zone, unique to the Northern Hemisphere, lies between the dominating polar front and the tropical climates. Temperature and precipitation extremes, such as heat waves, cold waves, blizzards, and cloudbursts, are relatively common.

At Waverly, Ohio, near PUEC, a weather station operated by the National Oceanic and Atmospheric Administration has collected meteorological data since 1889. Winters are moderately cold, with an average of 112 days of 32°F or lower temperature but only 3 days of sub-zero temperatures per year. The summers are moderately warm and humid, with an average of 27 days of 90°F or above temperature per year. During the period 1936 to 1974, the average temperature at Waverly was 53.3°F, which was approximately 1.5°F below the average for south-central Ohio. The average daily maximum and minimum temperatures for the period were 65.3° and 41.4°F, respectively.

Precipitation varies widely, with a yearly average of about 39.8 inches. The precipitation is usually well distributed throughout the year, although fall is often the driest. Average snowfall is 20.4 inches with considerable variability. Barometric pressures averaged 29.42 during the period between 1956 and 1970.

The average relative humidity at Waverly is approximately 80 percent at 1 a.m. and 7 a.m., 60 percent at 1 p.m., and 70 percent at 7 p.m. Clouds are most frequent during the winter and least frequent during the summer. The percentage of sunshine ranges from 70 percent in July to 35 percent in December. Fog occurs most often during the late summer and fall, and at times it may reduce visibility to less than one-fourth of a mile.

2.2 Overview of Major Site Operations

The principal process in the PUEC plant is the separation of uranium isotopes at the gaseous diffusion plant. Support operations include the feed and withdrawal of material from the primary process, treatment of water for both sanitary and cooling purposes, decontamination of equipment removed from the plant for maintenance or replacement, recovery of uranium from various waste materials, and treatment of sewage wastes and cooling water blowdown.

The Gaseous Diffusion Plant has been operating since 1954, enriching uranium for national defense and commercial nuclear reactors. Light-water nuclear reactors are fueled with uranium containing from 2 to 4 percent of uranium-235 isotope. Since naturally occurring uranium contains only 0.7 percent uranium-235, the uranium must be processed to enrich it in the U-235 isotope. Several DOE facilities (PUEC, Paducah, Kentucky, and the K-25 Plant at Oak Ridge, Tennessee) enrich

uranium by the gaseous diffusion process. Only PUEC enriches to beyond the 2 to 4 percent range (as high as 97 percent) for other uses.

Construction of a new enrichment facility, using centrifuge technology, was started during 1979 at PUEC. Because of a DOE decision not to pursue the centrifuge-enrichment technology, construction was halted in June 1985. Studies are being conducted to determine the most cost-effective method of decommissioning the Gas Centrifuge Enrichment Plant and its ancillary systems.

2.3 State/Federal Concerns

Representatives of the Survey team met with the Ohio Environmental Protection Agency (OEPA) and Ohio Department of Health on July 2, 1986. The U.S. Environmental Protection Agency (USEPA), Region V Office, did not attend the meeting. The purpose of the meeting was to explain the Survey process to the regulatory agencies and to identify any environmental concerns they might have about PUEC so that these concerns could be reviewed during the Survey.

The state agencies raised a number of environmental concerns both during the meeting and in followup correspondence. A complete list of the state's concerns is provided in Appendix D. In summary, the major concerns raised by the state centered on the need for more information in the following areas:

- Identification and characterization of hazardous, radioactive, and mixed waste streams.
- Identification and characterization of radiological and nonradiological air emissions from the process buildings.
- Assessment of the environmental and human health impacts resulting from releases or potential releases from RCRA, CERCLA, and solid waste management areas, and air emissions from the process buildings.
- Adequacy of the environmental monitoring program.

Currently, PUEC is the subject of a Federal Facility Compliance Agreement (FFCA), entered into by DOE and USEPA on September 30, 1986, which addressed violations of RCRA. The violations include

- Failure to analyze all waste streams for hazardous constituents.
- Failure to maintain waste storage drums in good physical condition.
- Failure to maintain adequate freeboard in the X-616 surface impoundment.

The FFCA also required PUEC either to install an unsaturated zone monitoring system at the X-231B land treatment facility or to close the facility, and additionally, to submit groundwater assessment plans for a number of land disposal units.

In February 1987, the OEPA informed DOE that it was planning to take civil action against PUEC for violations of state environmental laws not referenced or addressed in the FFCA. The violations cited by the state include those in the FFCA, except for the waste storage drum violation. Additional state violations included unpermitted waste management units and inadequate or nonexistent record keeping and reporting.

The substantive concerns and violations identified by the state and Federal regulatory agencies in meetings, correspondence, and enforcement actions are addressed in this report.

3.0 MEDIA-SPECIFIC SURVEY FINDINGS

The sections in this chapter pertain to existing or potential environmental problems in the air, soil, water, and groundwater media. Each section is media specific and includes a summary of the available background environmental information, a description of the pollution sources and controls, a review of the environmental monitoring program, and a categorization and explanation of the environmental problems found by the Survey team related to each medium.

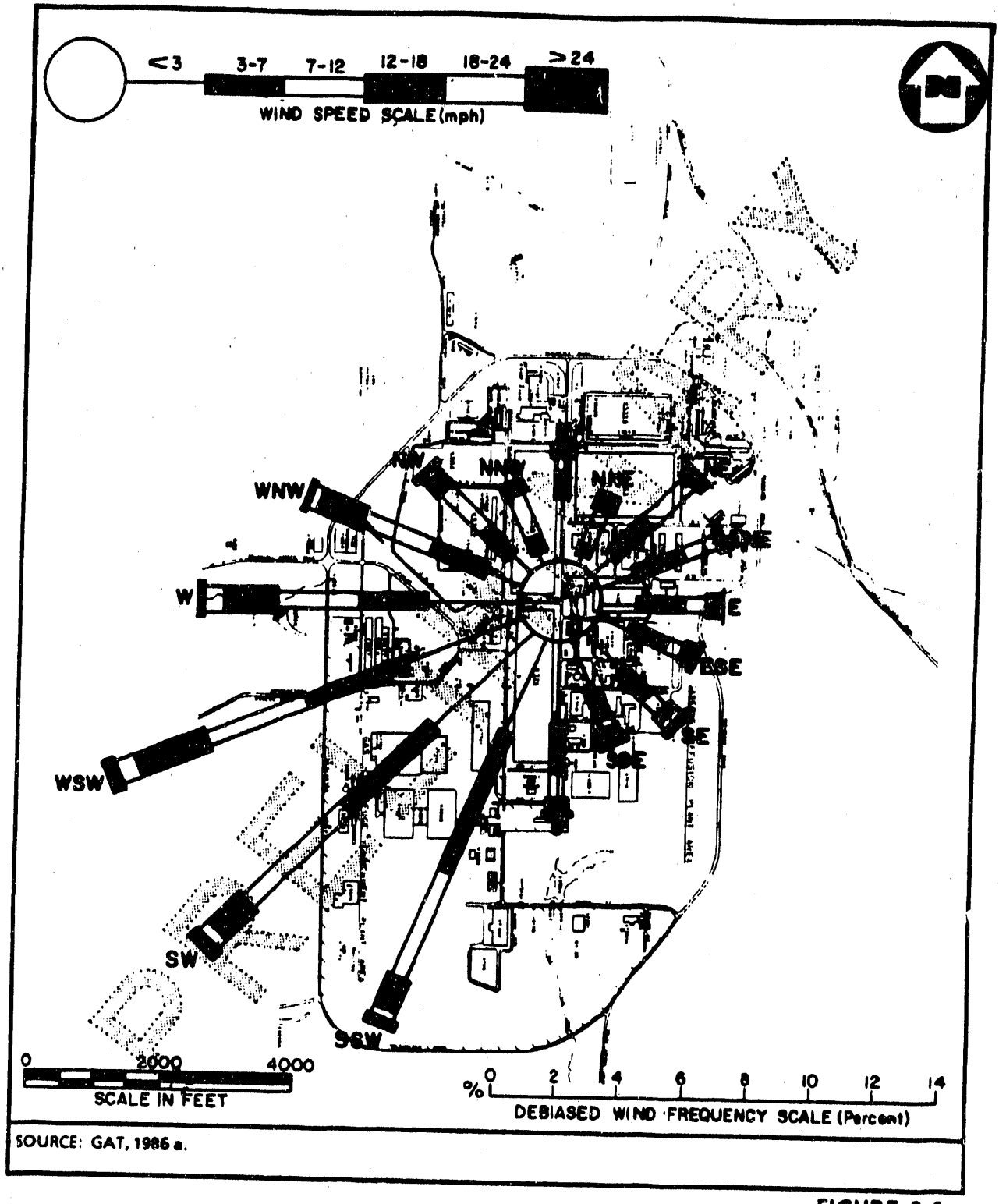
3.1 Air

3.1.1 Background Environmental Information

Pike and adjacent Ross Counties are in the Wilmington-Chillicothe-Logan air quality control region. Scioto County is in the larger Huntington-Ashland-Portsmouth-Ironton interstate air-quality control region located farther south of the plant. All of Pike, as well as the nearest sections of Ross and Scioto Counties, have been designated as attainment areas for particulates, sulfur dioxide, and nitrogen oxides. With regard to ozone, these areas are all designated as "cannot be classified or better than national standards." Background uranium concentrations, the primary radionuclide emitted, as reported by the EPA for January-June 1985 at the Columbus, Ohio monitoring station were $2.3 \pm 0.8 \times 10^{-18}$ µCi/ml ^{235}U and $33.3 \pm 4.2 \times 10^{-18}$ µCi/ml ^{238}U.

Meteorological data summarized in Section 2.1 provides details on the Pike County air environmental setting. As shown on the attached wind rose (Figure 3-1), the winds come primarily from the southwest (SW, SSW, and WSW). These three compass points account for approximately 42 percent of the prevailing wind-direction frequencies. None of the nearby urban centers (shown in Figure 3-2) lie in these directions. The average windspeed is approximately 5 mph. Higher windspeeds are usually associated with thunderstorms.

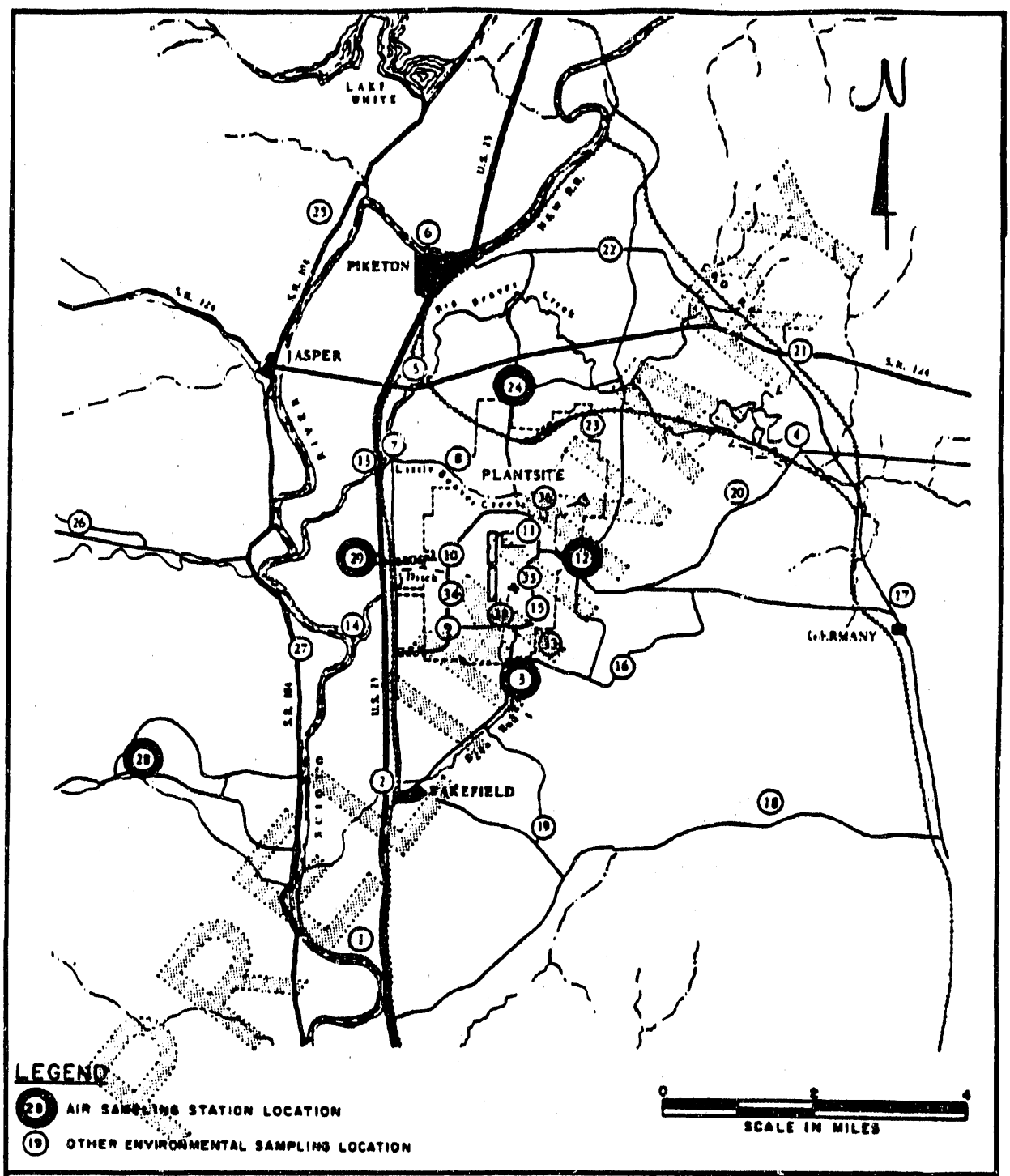
There is a growing environmental concern relative to the anthropogenic emissions of toxic air pollutants (TAPs). At present, NAAQS have not been established for these air contaminants, but many state regulatory agencies have, or are in the process of developing, regulations governing TAPs. Table 3-1 lists those air emissions currently classified as toxic air pollutants in the State of Ohio (Lee, 1986). The Ohio Environmental Protection Agency (OEPA) is in the process of preparing a formal list of toxic air pollutants.



SOURCE: GAT, 1986 a.

FIGURE 3-1

UNBIASED WIND ROSE
PUEC – PIKETON, OHIO



SOURCE: GAT, 1986 a.

FIGURE 3-2

AMBIENT AIR MONITORING STATIONS
PUEC – PIKETON, OHIO

TABLE 3-1

STATE OF OHIO TOXIC AIR POLLUTANTS
PUEC - PIKETON, OHIO

Acetaldehyde	Ethylene
Acetonitrile	Ethylene dibromide
Acrylonitrile	Ethylene dichloride
Ammonia	Ethylene oxide
Arsenic and compounds	Fluorine
Benzene	Formaldehyde
Benzo(a)pyrene	Hydrogen cyanide
Beryllium and compounds	Maleic anhydride
Bromine	Methyl chloride
Butadiene	Methyl methacrylate
Cadmium and compounds	Methylene chloride
Carbon disulfide	Perchloroethylene
Carbon tetrachloride	Phosgene
Chlorine	Styrene
Chlorobenzene	Titanium tetrachloride
Chloroform	Toluene
Chromium (VI) compounds	Toluene diisocyanate
Cyanide and compounds	Vinyl chloride
Dioxin	Xylene
Ethylbenzene	

Source: Lee, 1986

3.1.2 General Description of Pollution Sources and Controls

The PUEC vent study lists well over 500 individual vents releasing a broad range of contaminants. Some of these exhaust only room air and some are inactive, such as vents in the Gaseous Centrifuge Enrichment Plant (GCEP) operations. Fewer than 50 of the 500 vents are releasing an estimated 95 percent of the major contaminants of concern. Uranium-containing compounds and fluorides have received primary attention at PUEC. Because of the high impact to coal-burning power plants in the acid rain controversy, OEPA has focused much attention on the steam plant.

Primary pollution sources, associated contaminants released, controls in place for each contaminant, and quantities emitted (if available) are listed in Table 3-2.

Only five sources at PUEC are covered by permits from the OEPA. These are the three boilers at the steam plant and two fugitive sources, the landfills. An additional 16 sources, including the waste incinerator, are registered with OEPA. OEPA is presently permitting smaller sources that, until now, were considered too small to warrant registration. Applications for an additional 74 permits for sources such as degreasers, exhaust hoods, fuel storage tanks, etc., have been submitted, or are in preparation.

Volatile organic emissions estimated from 1984 PUEC purchasing data are outlined in Table 3-3. Air emissions have been estimated using EPA guidelines for 1,1,1-trichloroethane and trichloroethylene, along with conservative estimates for Freons, acetone, hydrocarbon solvents, methyl ethyl ketone, and isopropyl alcohol. Process cooling (using Freon-114) followed by degreasing and other maintenance/cleaning activities (using Freon-113 and the solvents listed below it on Table 3-3) are the principal uses of these materials.

3.1.3 Environmental Monitoring Program

The three major portions of the program are ambient air monitoring, emissions monitoring, and calculation of dose to the public.

TABLE 3-2

POLLUTION SOURCES AND CONTROLS
PUEC - PIKETON, OHIO

Pollution Source	Airborne Contaminants	Controls	Quantities Emitted (Actual or Estimated Annual)
Top & Side Purge Cascades	Uranium Technetium HF, F_2 Cl, SO_2, SO_2F_2 Freon 114 CF_3(B), CF_4(B)	Alumina traps Partial MgF_2 trapping Partial control with alumina traps None Freon degrader None	0.028 curies 0.123 curies (A) Not Available None(F) 13,500 & 12,800 lbs (est.)
Cold Recovery and Wet Air Evacuation Systems	Uranium Technetium	Alumina traps Alumina traps - efficiency unknown	Included above Included above
Steam Plant	Particulates SO_2	Electrostatic precipitation None(C)	Not available 175 tons
Cooling Water in Cooling Towers from Process Cascades (X-633, X-630, X-626)	Freons Cr+6	None None	217,390 lbs (est.) 6.1 tons (est.)(at maximum load)
Numerous Solvent Useage Processes	VOCs(D) Freon-113	Numerous exhaust vents with no air cleaning devices.	See Table 3-3
Decontamination Operations (X-705)	Radionuclides NO_x	Particulate filters Scrubber	Not available Not available
Chromium Water Treatment Facility (X-616)	SO_2	None(E)	Not available

Source: DOE Survey team.

(A) Total fluorides (including HF and SO_2F_2) estimated by PUEC to be 16.5 tons in 1985.
(B) Products of freon degrader.
(C) Coal sulfur content is limited to 3% by contract.
(D) See Table 3-3.
(E) Excessive venting of SO_2 to atmosphere is controlled by limiting SO_2 usage to that required for pH control and chromate reduction.
(F) Assuming 100% destruction in Freon degrader.

TABLE 3-3

ORGANIC AIR EMISSIONS
PUEC - PIKETON, OHIO

Compound	1985 Purchases (1)	Estimated Percent Volatilized (2)	Air Emissions (1) x (2) Pounds
Freon-114	221,000 lbs	90*	200,000
Carbon tetrafluoride	None		12,800**
Chlorine trifluoride	None		13,500**
Freon-113	19,320 lbs	90	17,390
Trichloroethylene	1,483 gal	90	17,150
1,1,1-trichloroethane	140 gal	90	1,470
Acetone	144 gal	90	950
Hydrocarbon solvents	60 gal	90	350
Methyl ethyl ketone	1.7 gal	90	11
Isopropyl alcohol	1.7 gal	90	120

Source: DOE Survey team.

* Some of the Freon-114 used as a heat-exchange medium in the cascades leaks into the cooling water and is subsequently evaporated to the atmosphere in the cooling towers.

** Based in part on information in the Final Safety Analysis Report, (GAT, 1985a) p 4.1-4.28, and assuming that the Freon, which leaks into the process, is completely degraded according to the reaction:

$$C_2Cl_2F_4 + 5F_2 \rightarrow 2\,CF_4 + 2\,ClF_3$$

(Freon-114) (fluorine) (carbon tetrafluoride) (chlorine trifluoride)

This reduces Freon-114 air emissions by 12, 500 pounds per year.

3.1.3.1 Ambient Air Monitoring

The PUEC ambient air monitoring program, both now and in the past, focuses primarily on radionuclide emissions from various operations. The ambient program consists of four off-site ambient air monitoring stations located north, east, south, and west of the plant site and a background station approximately 4.5 miles upwind (see Figure 3-2). These stations contain high-volume (hi-vol) samplers for collection of particulates. In addition, four off-site locations also monitor airborne radionuclides collected by low-volume (lo-vol) samplers. The off-site stations have in recent years been equipped to monitor fluoride concentrations using an impinger collection method. Alpha radiation, beta-gamma radiation, uranium, technetium, and fluorides are the only airborne contaminants continuously monitored from PUEC operations at this time.

As mentioned above, radionuclides and fluorides are the two air pollutants of major concern emitted from the PUEC. Results from monitoring have indicated no significant (<6 percent of the applicable EPA limit) environmental impacts from radionuclide releases. The maximum fluoride level in vegetation observed to date is 22 percent of the 30 microgram per gram level considered safe for cattle (Suttie, 1969).

The maximum monthly average concentration of gaseous hydrogen fluoride (HF) detected at the plant boundary during 1985 was above the acceptable average monthly HF levels established by five other states (Kentucky, New Hampshire, Texas, Washington, and Tennessee). In 1986, however, fluoride results showed that PUEC is in 100 percent compliance with even the most stringent (0.8 micrograms per cubic meter, Kentucky) of the five previously mentioned state fluoride standards (Russell, 1986a). This improvement is attributable to changes in analytical methodology resulting in (1) less opportunity for sample contamination, (2) improved scrubbing, (3) improved detection limits, and (4) less opportunity for sampling train loss.

Future improvements in ambient fluoride monitoring include increasing the height of the solution in the impinger to allow for more complete gas/liquid interface, more frequent checking to prevent evaporation to dryness, and changing of the large impinger (monthly samples) to smaller impingers (weekly samples) (Russell, 1986a). Once a final decision is made on sample train configuration, all stations will be converted to that configuration.

As part of the PUEC air monitoring program, an air vent and exhaust survey (Mentges, 1986) was conducted to list all air vents. Vents were classified by primary type of contaminant emitted. Seven classifications, including radionuclides, toxic chemicals, highly volatile compounds, low volatile

compounds, inorganic chemicals, standard ventilation exhausts, and sanitary and storm sewer condensate/miscellaneous vents were listed by building/facility number. While the PUEC vent survey was useful for locating vents, data on quantities of raw materials used and quantities vented were not included. Several vents observed by the Survey team were not listed in the PUEC vent survey, and others that had been removed from service were not taken off the PUEC vent survey listing. The PUEC Vent Committee has a program to (1) remove vents from the list when removed from service, (2) to install two additional continuous monitoring systems, and (3) to prioritize installations on seven currently unmonitored sources (Mentges, 1986).

3.1.3.2 Emissions Monitoring

Within the past 1.5 years, six continuous, isokinetic, radionuclide/fluoride monitoring systems have been installed on process building vents: three on the purge cascades, one on the cold recovery exhaust in Building 330, and two on the cold recovery exhausts in Building 333. These computerized systems sample those vents which are assumed to be releasing the majority of radionuclides and fluorides from all PUEC operations. In that there are other radionuclide vents which are not presently monitored, the exact proportion of quantified versus unquantified radionuclide emissions cannot be calculated. It is, however, apparent to the Survey team that these unmonitored vents account for a very small percentage of the total PUEC operations radionuclide and fluoride emissions.

The only nonradiological airborne contaminant that is continuously monitored is fluorides. Source fluorides are sampled simultaneously with the six isokinetic radionuclide systems mentioned above. Alumina sampling trap materials are homogenized and separate portions used for individual radionuclide and specific-ion-electrode analysis for fluorides.

Other airborne contaminants of environmental concern emitted from PUEC operations include Freons, volatile organic compounds, chromium compounds, sulfur dioxide, total particulates, and nitrogen oxides. None of these contaminants are monitored on either a continuous or intermittent basis at the present time. Therefore, historical data on PUEC emissions are only available for radionuclides (1955 and on) and fluorides (1972 and on) (Russell, 1986b).

3.1.3.3 Dose Assessment

Public radionuclide dose assessment due to atmospheric releases is based upon evaluation of ambient air inhalation, vegetation, meat, and milk food pathways and, to a lesser extent at PUEC,

direct radiation. The direct radiation pathway is discussed in greater detail in Section 4.3. Figure 3-3 depicts various modes by which man can be exposed to radionuclide emissions.

Environmental monitoring programs in place to collect data for atmospheric release dose assessment calculations include a thermoluminescent dosimeter (TLD) sampling program (discussed in greater detail in Section 4.3), airborne alpha and beta-gamma detection, crop monitoring from seven farms, a soil sampling program, milk sampling, and occasional meat sampling programs (GAT, 1986).

As required by NESHAPs regulations, PUEC calculated predicted doses using the computer modeling program AIRDOS-EPA. The AIRDOS calculated estimates are lower than calculated dose commitments using actual fencepost monitoring data collected by PUEC. Therefore, to be on the conservative side, measured data, rather than predicted data, is used for dose assessment. Calculations are also made by PUEC to estimate effective whole-body population dose (within 80 km of the site, approximately 600,000 persons).

The maximum "measured" dose to an individual living at the site perimeter (4.8 millirems) in 1985 was about 6 percent of the applicable EPA target organ limit (75 millirems). This calculated dose is a result of ingested technetium, which involves both the atmospheric and aquatic pathways (see Finding 3.1.4.3.1). Predicted critical organ dose assessment for Piketon is approximately 0.13 millirem stomach wall, which is 0.2 percent of the applicable EPA 75 millirem target organ limit. The predicted 80 km average dose, based on 1985 data, indicates exposures of 0.0016 millirem effective whole body, 95 percent of which is due to the ingestion pathway.

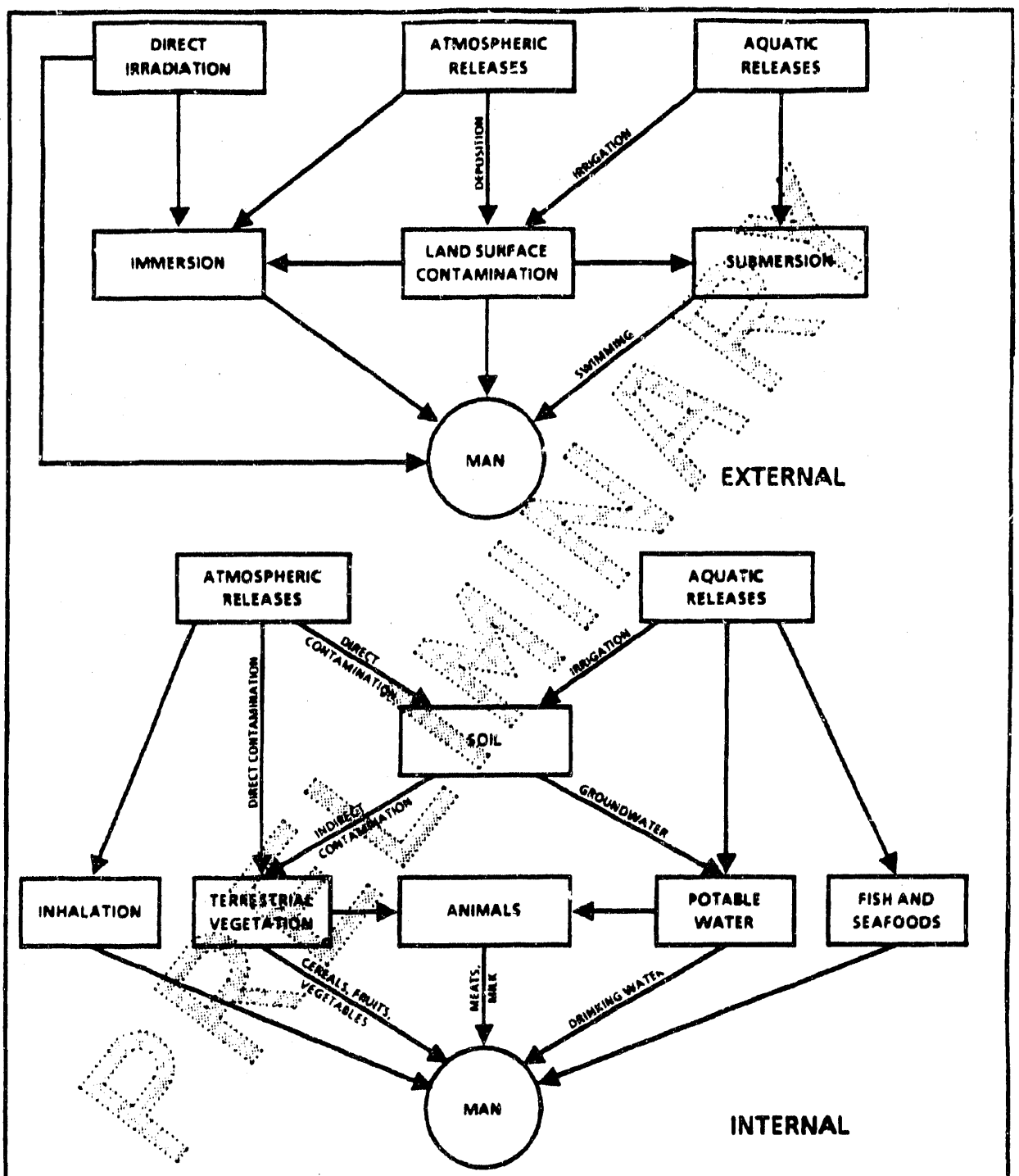
3.1.4 Findings and Observations

3.1.4.1 Category I

None

3.1.4.2 Category II

1. Contaminated Burnable Waste Incinerator. Lack of emissions control equipment on the incinerator may result in radionuclide and toxic chemical releases with associated human health and environmental consequences as a result of incineration of burnable contaminated wastes. Human health and environmental impacts as a result of unauthorized hazardous waste burns may have also occurred (see Finding 4.1.2.2.3).



SOURCE: Rothrock et al., 1986

FIGURE 3-3

PATHWAYS FOR EXPOSURE OF MAN FROM
ATMOSPHERIC AND AQUATIC RELEASES OF RADIOACTIVE EFFLUENTS
PUEC - PIKETON, OHIO

Trash contaminated with uranium and classified documents are the primary wastes incinerated. In addition, a review of the incinerator burn log by the Survey team, and a subsequent investigation by PUEC, revealed that waste oils and solvents (hazardous wastes) were burned intermittently in 1981, 1985, and early 1986. While there is a secondary chamber designated to completely burn any combustibles not burned in the primary chamber, non-combustible particulates such as uranium oxides and all gaseous decomposition products will then be released to the atmosphere uncontrolled and unmonitored.

Dioxins may have been entering the environment when wastes that may have contained PCBs, e.g., waste oil, solvents, and/or carbonless forms with PCB coatings, were burned in the incinerator. Upon incomplete combustion of PCBs, dioxins can be formed and be distributed throughout the area of the incinerator by the effluent gas leaving the stack.

Location of the incinerator immediately adjacent to the X-705 Decontamination Facility and the X-700 Maintenance Facility combined with short stack height results in release of emissions below adjacent building heights. Consequently, there is a potential for increased exposure to incinerator emissions to employees in nearby working areas. Survey-related sampling is planned.

2. Unscheduled Process-Building Radionuclide Releases. There is a potential for increased human health and environmental impacts from unscheduled, uncontrolled process-related radionuclide releases (primarily uranium) to the atmosphere.

Compromises of existing prevention and detection systems including lack of operational real-time monitoring or other observation capabilities have resulted in unscheduled, uncontrolled releases (primarily uranium) at PUEC. Over the past 8 years these releases have accounted for as much as 81 percent (i.e., 50 kg uranium accidental vs. 61.8 kg uranium 1983 total) of the yearly releases of uranium. Other documented releases include an estimated 49.5 kg of uranium during the period December 20, 1985 to January 10, 1986 and a 6 kg uranium release during the on-site portion of this survey.

Failure to address numerous procedural and operator training deficiencies creates conditions conducive to additional unscheduled radionuclide releases. Probable causal factors, the results of which the survey team and others have observed (Rothrock, et al., 1986) include, but are not limited to the following:

- Misinterpretation and violation of procedures and the failure of building supervision to adequately enforce procedures.

- Lack of adequate leak testing and purging.

- Inadequate response to and interpretation of emission monitoring data.

- Undetected leaks in process valving.

- Operation of the wet air evacuation system air jet when not required to support normal process operations.

- Failure to monitor and replace trap material.

- Failure of management information systems to identify procedure problems and potentially harmful trends.

- Technical information systems not providing adequate information to operations personnel.

- Insufficient process training.

Failure to address Survey-related and previously identified deficiencies may lead to more "accidental" releases of potentially larger quantities with associated human health and environmental consequences.

3.1.4.3 Category III

1. Technetium Releases. There is a potential for increased human health and environmental radiological impacts because portable magnesium fluoride traps do not completely remove "bubbles" of technetium compounds flowing through the cascade.

   Technetium, which is a contaminant in the UF_6 feed material, is present in the entire cascade and is thought to "plate-out" on equipment surfaces as well as exist in vapor form. Technetium will occasionally be released from the "heel" in feed UF_6 cylinders into

process flow and for reasons not completely understood will rapidly pass through the cascade in a "bubble." Portable trapping units are placed at critical locations in the cascade in an effort to trap or filter-out technetium "bubbles." Because of the unpredictability of the size, timing, and other "bubble" parameters, including complicated two-phase flow, not all of the "bubbles" can be removed from the cascade resulting in releases to the environment.

In 1985, technetium accounted for 74 percent of the total curies released to the air from site operations. Because of unpredictabilities mentioned above, evaluation of technetium "bubble" release quantities versus continuous releases is difficult. Survey-related sampling is planned.

2. Pinhole Freon Leaks. Pinhole leaks between the heat exchange zone and the cooling water zone in the process cascades result in the release of approximately 200,000 lb/yr of Freon-114 (estimated by the Survey team chiefly from purchasing records, see Table 3-3) to the atmosphere. The Freon mixes with the cooling water and is released to the atmosphere when it is vaporized in the cooling towers. The portion of Freon-114 which leaks into the process zone is converted in the Freon Degrader to CF_4 and ClF_3 (See Table 3-3). While the amount of Freon degraded is low in comparison with the 200,000 lb/yr, each pound of Freon destroyed yields one pound of ClF_3 and one pound of CF_4.

   There is no immediate health hazard. Studies on the effects of Freons on the ozone layer and resultant ionizing radiation exposure (as the ozone layer is depleted) are continuing. The ozone-Freon studies and future regulations may restrict the amounts of Freon emitted from such use and could severely affect PUEC operations.

3. Chromium Discharges. There is a potential for increased health and environmental impact because hexavalent chromium, a known human carcinogen, is being discharged to the air with the "drift" (the droplets of water in the discharged air) leaving the cooling towers.

   The Survey team estimated that 30 pounds of hexavalent chromium are released per day. This figure was arrived at using a concentration of 20 ppm of chromate in the cooling water and the estimated "drift" from the environmental impact statement (ERDA, 1977). No more recent estimate of the quantity of drift is available.

EPA has announced its intent to list chromium or hexavalent chromium as a hazardous air pollutant (EPA, 1985a). The current EPA schedule calls for listing and proposing a NESHAP regulation for chromium by June 1988 and issuing a final regulation by December 1989. At that time, use of an alternative inhibitor or improved demisters may be mandated. PUEC has been evaluating alternative inhibitors for over a year. Survey-related sampling is planned.

4. X-705 Radionuclide Vent Problems. Inaccurate public dose assessment may result because approximately seven vents identified by the Vent Committee at the X-705 (Decontamination) Building have not been monitored for potential radionuclide emissions.

   It is not likely these potential releases are large compared to process and purge-cascade emissions. Ambient air monitoring results confirm that these releases, if any, are small. However, because of the sporadic nature of decontamination operations involving widely varying quantities of radioactive materials, data are needed for accurate assessment of this operation's contribution to off-site dose.

3.1.4.4 Category IV

1. Volatile Organic Emissions. Lack of a comprehensive inventory of volatile organic emission sources prevents identification and accurate assessment of environmental impacts associated with each emission source.

   A site inventory constructed from purchasing records is included in Table 3-2. One of the high-volume organics is trichloroethylene, which EPA has announced it intends to list as a toxic air pollutant (EPA, 1985b). The existing vent survey did not list several vents that are in service and listed other vents that had been removed.

2. Particle-Size Fractions. Accurate characterization of the potential human health impacts resulting from the accidental release of airborne particulate emissions is not possible because of the lack of particle size fraction data.

   Airborne particle size information is of particular value for evaluating human health effects because it relates to respiratory tract deposition of airborne particulates in the

0.1-10 micron size range. PUEC personnel indicated they presumed a fibrillar particle of about 1 micron in size from limited experimentation. A "worst case" assumption of 0.3 micron would raise the dose to the lungs from 0.1 percent (as calculated previously) to 0.2 percent.

3. Air Monitoring Stations. Lack of air monitoring stations particularly in the predominant downwind direction from PUEC operations may result in underestimation of human health and environmental impacts associated with airborne releases.

   Original siting criteria for the five monitoring stations primarily related to the four compass points (see Figure 3-2). The background station was located in a predominantly upwind direction. Lack of downwind stations, particularly in the northeastern direction, may result in false negative results or underestimation of measured environmental impacts. Information needed for the location of additional stations has been accumulated by PUEC. PUEC is planning additional stations which will more than double the number of offsite stations.

4. Hydrogen Fluoride Emissions. Hydrogen fluoride (HF) emissions from the cascades are uncontrolled and have the potential to increase health and environmental impacts through respiratory tract irritation, vegetation damage, and subsequent food pathway accumulation.

   Several other fluoride compounds (see Table 3-1) are uncontrolled in the same cascade vents. Concerns regarding nuclear criticality have prevented use of conventional control technologies such as wet scrubbing. Sampling conducted prior to 1986 gave uncertain ambient air concentration results. Recent (1986) analyses indicate good compliance would be achieved with the most stringent of any state standard promulgated to date. Currently Kentucky has the most stringent standard while Ohio has yet to promulgate fluoride emission standards.

5. Line Loss in Monitoring Equipment. Ambient air concentrations for constituents currently monitored including radionuclides may be underestimated due to inlet line loss at all of the ambient air monitoring stations.

   Line loss refers to the deposition or other interaction that can occur in any sampling train when an inlet line, duct, or other conveyance for the sampled material is placed in front of

the collection media. Losses can occur due to electrostatic interactions, chemical interactions, or just simple changes in direction of the air stream causing inertial impaction. The result is that "sampled" material can remain in the inlet line and not be deposited or otherwise delivered to the sampling media. When such samples are analyzed, the reported value would be lower than the actual value because of loss of part of the sample in the line. The impact of such a line loss is much higher when concentrations being measured are low (i.e., 1 µg line loss/10 µg on a filter is more significant then 1 µg line loss/100 µg on a filter). Measurements made by PUEC since the survey have not shown significant amounts of radiation.

6. Sampling-Train Configuration. Radionuclide particulate air emission concentrations from X-345 and X-744 may be underestimated as a result of sampling train configuration on systems in those buildings.

   These configurations result in the sampling media being a considerable distance downstream of the sample inlet. Failure to account for the length and effect of inlet lines on sampling results constitutes a design deficiency (see Finding 3.1.4.4.5). Both glove boxes in these buildings are minor sources, operating only a few hours per year.

3.2 Soil

3.2.1 Background Environmental Information

The natural soils found at PUEC are derived from the lacustrine sediments and/or sandstones or shales found in the valley. They are fine-grained silty loams with low permeabilities. The Omulga Series is the predominant soil at the site, but there are minor occurrences of the Rardan and Coolville Series. The Omulga is a silty clay loam that commonly forms on alluvial and lacustrine sediments. The Rardan and Coolville are residual soils formed on shale. In many places, however, the natural soils are covered with fill that was emplaced during facility construction.

The PUEC complex is the only significant source of radionuclides and organic chemicals in the immediate area. However, the bedrock does contain natural uranium, and the soils derived from these shales would also be expected to contain uranium. Background activities in Ohio soils are approximately 1.4 pCi/g ± 0.79 for uranium-238 (Myrick, 1983).

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 in other areas. There are several actual and potential sources of soil contamination at PUEC. Based on soil monitoring data, X-700 and X-705 appear to be major sources of radionuclide contamination in soils . Other suspected sources include the tails storage areas, the X-231A and X-231B Oil Biodegradation Plot, the X-749 Contaminated Material Disposal Facility, and the grounds in the vicinity of the X-705 incinerator.

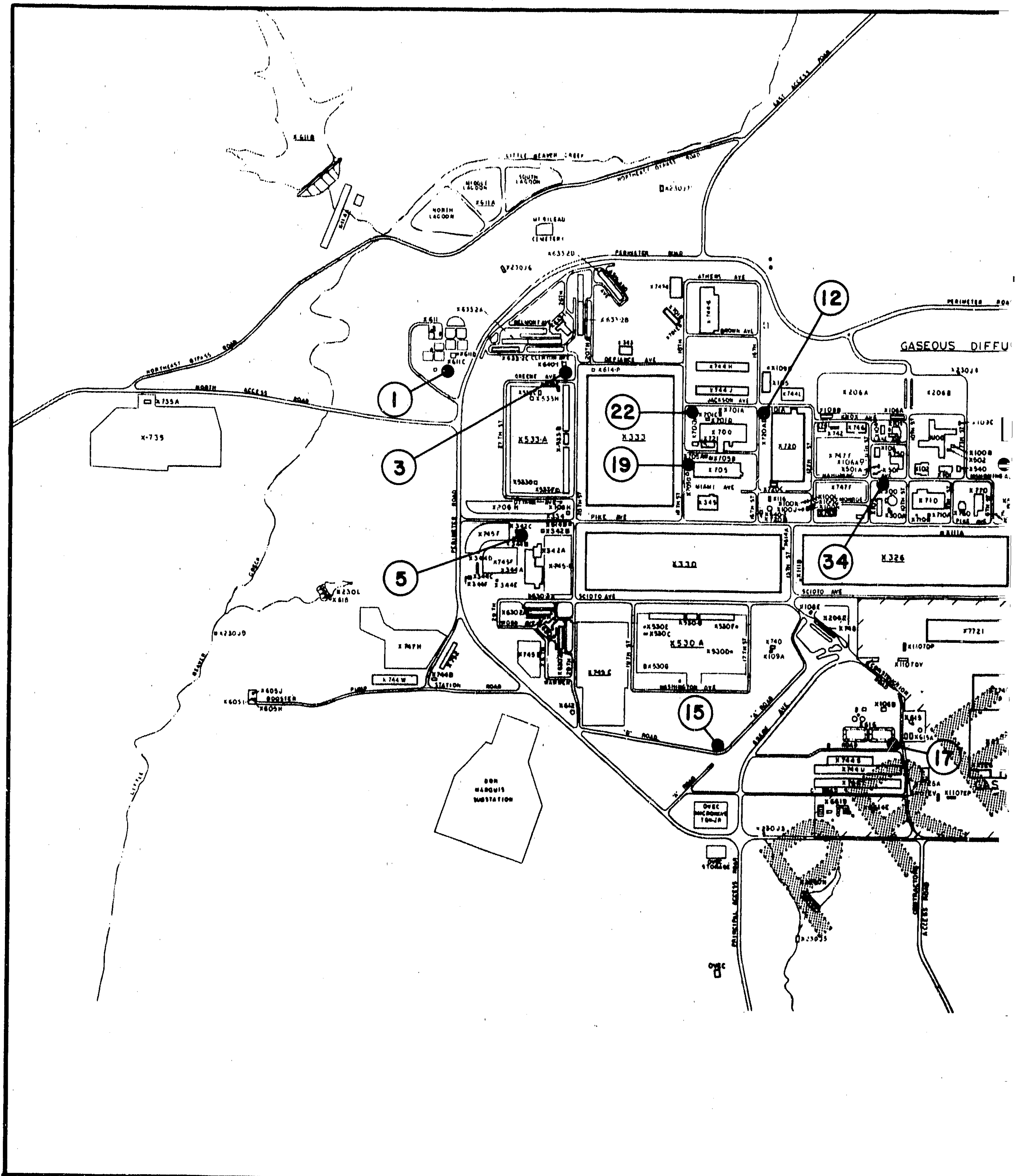
There are a number of tails storage areas where no soil samples have been collected, so that soil contamination cannot be evaluated in those locations. Runoff from these areas could contaminate soil and, in the case of the mobile radionuclides such as technetium-99, groundwater. The primary contaminant that may be released from the tails storage area is uranium hexafluoride (UF_6). UF_6 typically reacts almost instantaneously with ambient air to form uranyl fluoride particulates and a gas (HF vapor), which creates a cloud of white smoke. Because both of these by products would usually be readily windborne, soil contamination is unlikely. Nonetheless, as the 1978 PUEC release demonstrated a UF_6 release can deposit reaction products on the ground during rain or snow. In addition to these sources of radionuclides, disposal areas or buildings where chemicals are used could be sources of contaminants in soils. Improper handling or disposal can result in environmental releases of chemicals. At PUEC, most of the chemicals used are mobile in the environment and may end up in the groundwater. Residual low levels of contaminants would be bound in the soil matrix, and subsequent precipitation or infiltration of low-pH water could continue to mobilize contaminants. It is for this reason that these sources are presented in more detail in Section 3.4.

3.2.3 Environmental Monitoring Program

PUEC has implemented a soil sampling and analysis program in order to evaluate radionuclide contamination resulting from site activities. Soil samples both inside and outside the perimeter road are analyzed for radionuclides.

There are 14 soil (and vegetation) sampling locations within the perimeter road, which were sampled monthly through 1985, but which are now sampled semi-annually. These are referred to as the RIS (Routine Internal Soil) and RIV (Routine Internal Vegetation) samples. The sample locations are shown in Figure 3-4. In addition to the samples collected inside the perimeter road, there are 8 soil (and vegetation) sample locations on the facility property line (Group I), 6 sample locations within about 1 mile of the property line (Group II), and 12 sample locations within about 5 miles of

2



SOURCE: GAT, undated a.

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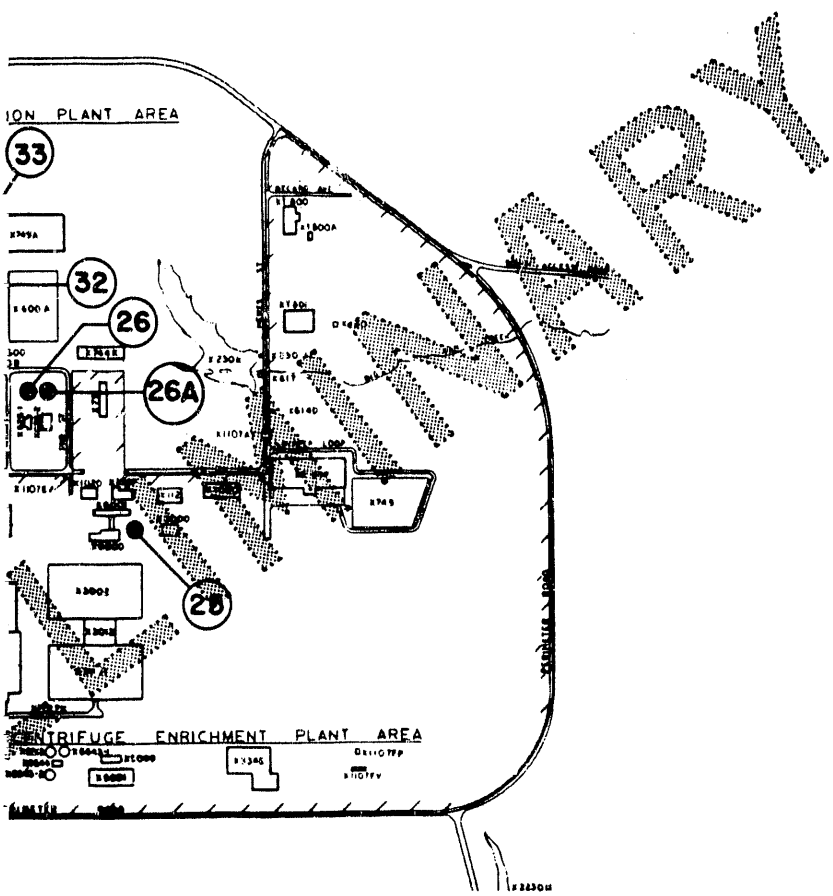

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OIL AND VEGETATION SAMPLING POINTS
I-ANNUAL)
IKETON, OHIO

FIGURE 3-4

the property line (Group III), all of which are sampled semi-annually. These samples are referred to as the SAS (Semiannual Soil) and SAV (Semiannual Vegetation) samples, and locations are shown in Figure 3-5.

The current soil sampling technique is to clear a 1-meter square area of vegetation and take a 2-inch-deep plug of soil from each corner and from the center of the square. This method ensures that the same amount of surface soil is collected from each plot. Vegetation is more randomly sampled--a few handfulls of broadleaf grasses are clipped and placed in bags for analyses.

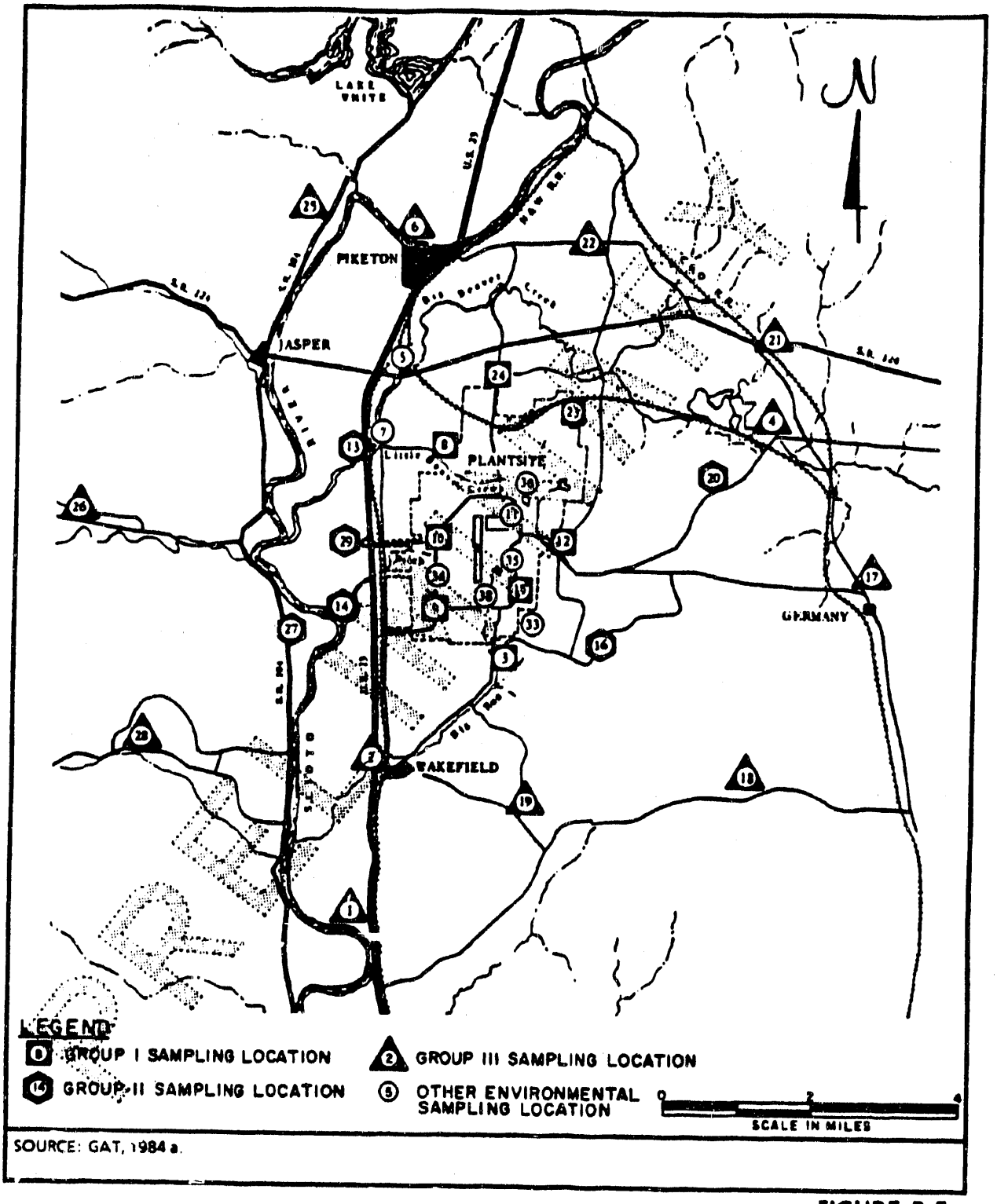
Soil samples are analyzed for uranium and gross alpha activity by the on-site laboratory. Selected soil samples are also analyzed for technetium. Vegetation samples are analyzed for fluorides.

Analytical results from the soil sampling program are routinely presented in the annual environmental monitoring reports. Uranium is the primary constituent detected in the soil samples and the level of uranium at each location has remained relatively constant over the past few years.

Table 3-4 presents a summary of recent analytical results for the RIS samples, while Table 3-5 presents data for the SAS samples.

The highest concentrations of uranium and technetium were found in the samples collected near X-705, X-700, X-720, and the southern end of X-326, suggesting that these or nearby buildings may be sources of radionuclide emissions. Table 3-5 shows that there is little or no difference between radionuclide levels in the site perimeter samples (4.6 mg/kg uranium) versus those collected up to 5 miles away (5.1 mg/kg uranium), leading to the conclusion that PUEC has no significant impact on the soils beyond the areas immediately surrounding a few of the buildings.

Table 3-6 summarizes the vegetation analytical results from 1985. This table shows only slight differences in fluoride levels between the Group I and Group III samples (2.3 to 4.0 mg/kg in Group I and 1.8 to 3.0 mg/kg in Group III). These data suggest that airborne fluorides are not resulting in adverse environmental effects; fluoride levels of 30 mg/kg may be harmful to cattle, while levels of 250 mg/kg may cause acute reactions in the vegetation itself.



SOURCE: GAT, 1984 a.

FIGURE 3-5

LOCATION OF SEMIANNUAL SOIL AND VEGETATION SAMPLING POINTS
PUEC - PIKETON, OHIO

TABLE 3-4

ANALYTICAL RESULTS - ROUTINE INTERNAL SOIL SAMPLES
PUEC - PIKETON, OHIO

Sample Numbers[1]	February 1985[2]				September 1985			
	U-235 (mg/kg)	U-238 (mg/kg)	U-natural (mg/kg)	Fluoride (mg/kg)	Uranium (mg/kg)	Gross α (d/m/g)	Technetium (d/m/g)	Fluoride (mg/kg)
1	0.026	3.4	3.7	200	4.5	4.8	<2	307
3	0.027	5.1	4.1	150	8.0	7.9	<2	347
5	--	--	--	--	8.4	11	<2	453
12	0.034	4.9	3.6	200	10	19	8	443
15	--	--	--	--	2.5	6.1	<2	362
17	0.029	4.4	3.8	150	7.5	8.1	<2	347
19	0.060	4.3	3.4	620	25	86	44	506
22	0.087	8.8	7.2	350	--	--	8	616
25	0.050	5.7	5.7	430	7.5	7.9	<2	424
26	0.056	6.8	7.4	240	4.9	12	24	408
26A	--	--	--	--	4.5	10	3	376
32	--	--	--	--	3.2	6.0	3	379
33	--	--	--	--	--	--	<2	352
34	--	--	--	--	--	--	--	--

Source: Adapted from GAT, 1986b (Goodyear Atomic Corporation, August 1986. Unpublished Radionuclide Monitoring Data.)

(1) See Figure 3-4 for sample locations.
(2) Analytes changed after this round of sampling to those shown for September.

TABLE 3-5

ANALYTICAL RESULTS - SEMIANNUAL SOIL SAMPLES
PUEC - PIKETON, OHIO

Sample Points(1)	Uranium (mg/kg)					
	February 1985			September 1985		
	Minimum	Maximum	Average ± 2σ	Minimum	Maximum	Average ± 2σ
Group I	4.1	6.0	4.6 ± 1.6	2.3	6.7	4.6 ± 3.0
Group II	3.0	3.6	3.3 ± 0.6	4.3	6.1	5.2 ± 1.4
Group III	3.4	8.9	5.1 ± 3.6	2.8	7.6	4.4 ± 2.6

Sample Points(1)	Alpha Radioactivity (pCi/g)					
	February 1985			September 1985		
	Minimum	Maximum	Average ± 2σ	Minimum	Maximum	Average ± 2σ
Group I	2.7	4.0	3.1 ± 1.0	1.4	4.1	2.6 ± 1.9
Group II	1.8	2.3	2.1 ± 0.6	2.2	4.5	3.0 ± 1.8
Group III	2.3	6.8	3.7 ± 2.8	2.0	5.4	2.9 ± 2.0

Source: GAT, 1986b (Goodyear Atomic Corporation, August 1986. Unpublished Radionuclide Monitoring Data.)

(1) See Figure 3-5 for sample locations.

TABLE 3-6

FLUORIDE CONCENTRATIONS IN VEGETATION (mg/kg)
PUEC - PIKETON, OHIO

Sample Points (1)	June 1985			September 1985		
	Minimum	Maximum	Average ± 2σ	Minimum	Maximum	Average ± 2σ
Group I	1.1	3.7	2.3 ± 1.8	1.4	6.5	4.0 ± 3.0
Group II	1.1	4.0	2.3 ± 2.2	1.8	6.5	3.5 ± 3.4
Group III	0.8	4.2	1.8 ± 1.8	1.0	6.0	3.0 ± 2.2

Source: GAT, 1986b (Goodyear Atomic Corporation, August 1986. Unpublished Radionuclide Monitoring Data).

(1) See Figure 3-5 for sample locations.

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. Possible Radionuclide Soil Contamination. On-site radionuclide contamination of soils may not be fully characterized by the existing sampling network.

   The UF_6 cylinder storage yards (X-745B) and tails storage yard (X-745C) may be sources of alpha (and possible gamma) activity in soils. Even though the UF_6 cylinders are built to withstand many disasters, a cylinder could be damaged either in transit or handling, thereby allowing UF_6 to leak out. The cylinders are not enclosed by berms. In addition, there are a number of cylinders in these areas that are old and that have been exposed to the elements for years which could increase the potential for leakage.

   These storage areas are large (see Figure 3-4) and at any given time may contain several hundred cylinders which arrive and depart as orders are filled for clients. Although PUEC inspects cylinders during handling, accidents have occurred in the past.

   A third area potentially contributing to radionuclide soil contamination is the X-342 Feed Vaporization Area. This is the same sort of situation as with the feed and tails storage areas, although the number of cylinders at this facility at any time would be less than in the storage yard.

   Soil from these three areas has never been sampled. The existing sampling network (either surface water or soil) could not pinpoint a problem in these areas, unlike the surface water sampling conducted downstream of storage yards. Survey-related sampling is planned.

2. Soils in the X-705 Incinerator Area. Soils around the X-705 Incinerator may be contaminated with radionuclides and dioxins. Uncontrolled and unmonitored particulate and gaseous emissions are released from the incinerator at a height below that of the adjacent X-700 (Maintenance) and X-705 (Decontamination) buildings. The emissions are subject to aerodynamic downwash caused by the buildings and consequently impact the soil near the incinerator (see Finding 3.1.4.2.1). Survey-related sampling of the soil for radionuclides and dioxins is planned.

3.2.4.4 Category IV

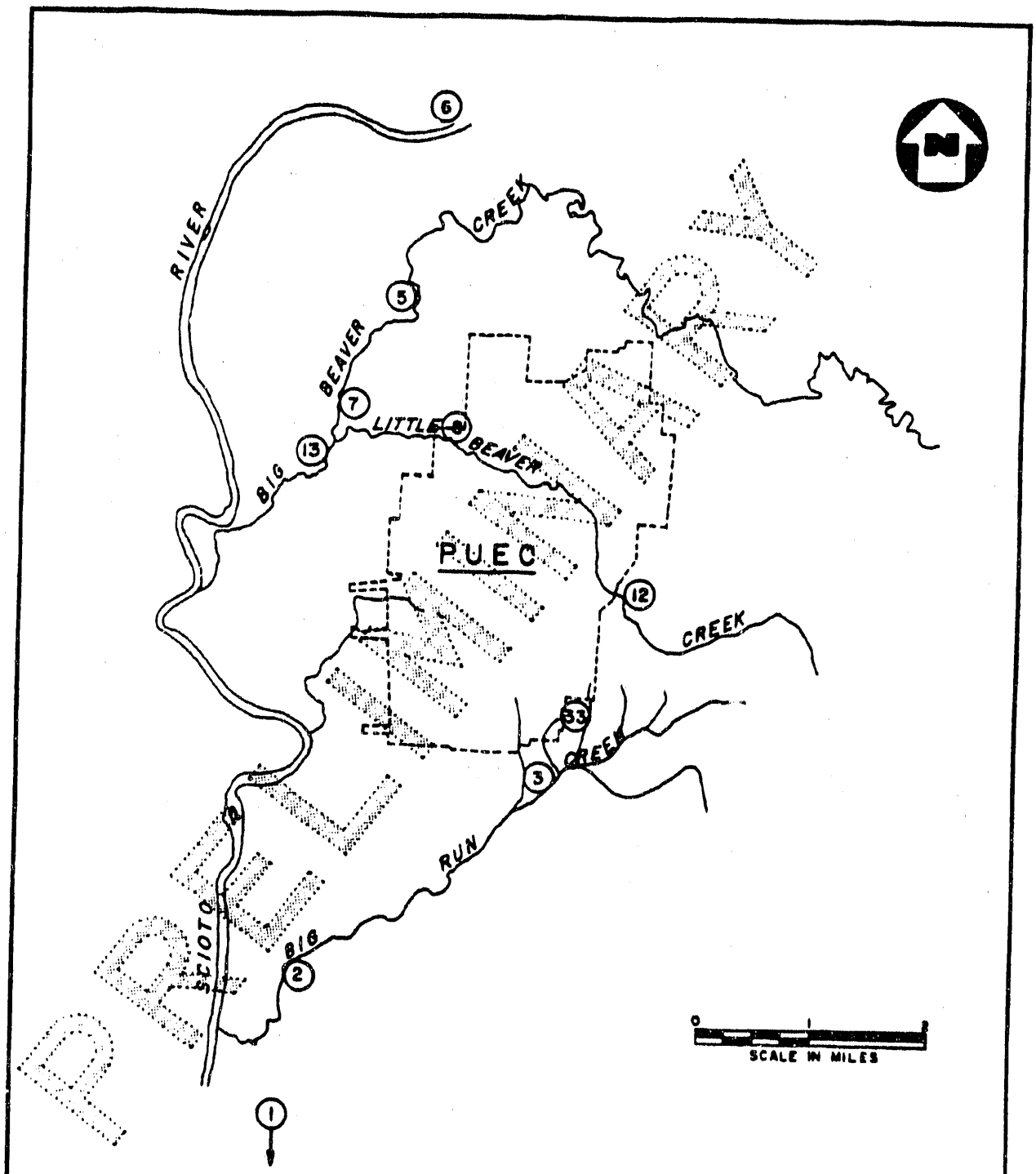
None

3.3 Surface Water

3.3.1 Background Environmental Information

The PUEC lies above the 100-year floodplain of the Scioto River. The site proper is drained by several tributaries to the Scioto, including Little Beaver Creek, Big Run Creek, two unnamed tributaries, and two pipelines direct to the mainstream of the Scioto. Refer to Figure 3-6 for PUEC's location relative to these receiving streams. The figure also gives locations for environmental sampling points to be discussed in Section 3.3.3.2 below. Water flow in the river ranges from a dry-weather, low flow of 14.2 m^3/sec (324 mgd) to immeasurable high flows during the spring when the river frequently overflows, flooding a large portion of the 2.1 km (1.3 mile) wide valley. The annual average flow rate is approximately 150 m^3/sec (3,424 mgd) (GAT, 1985d).

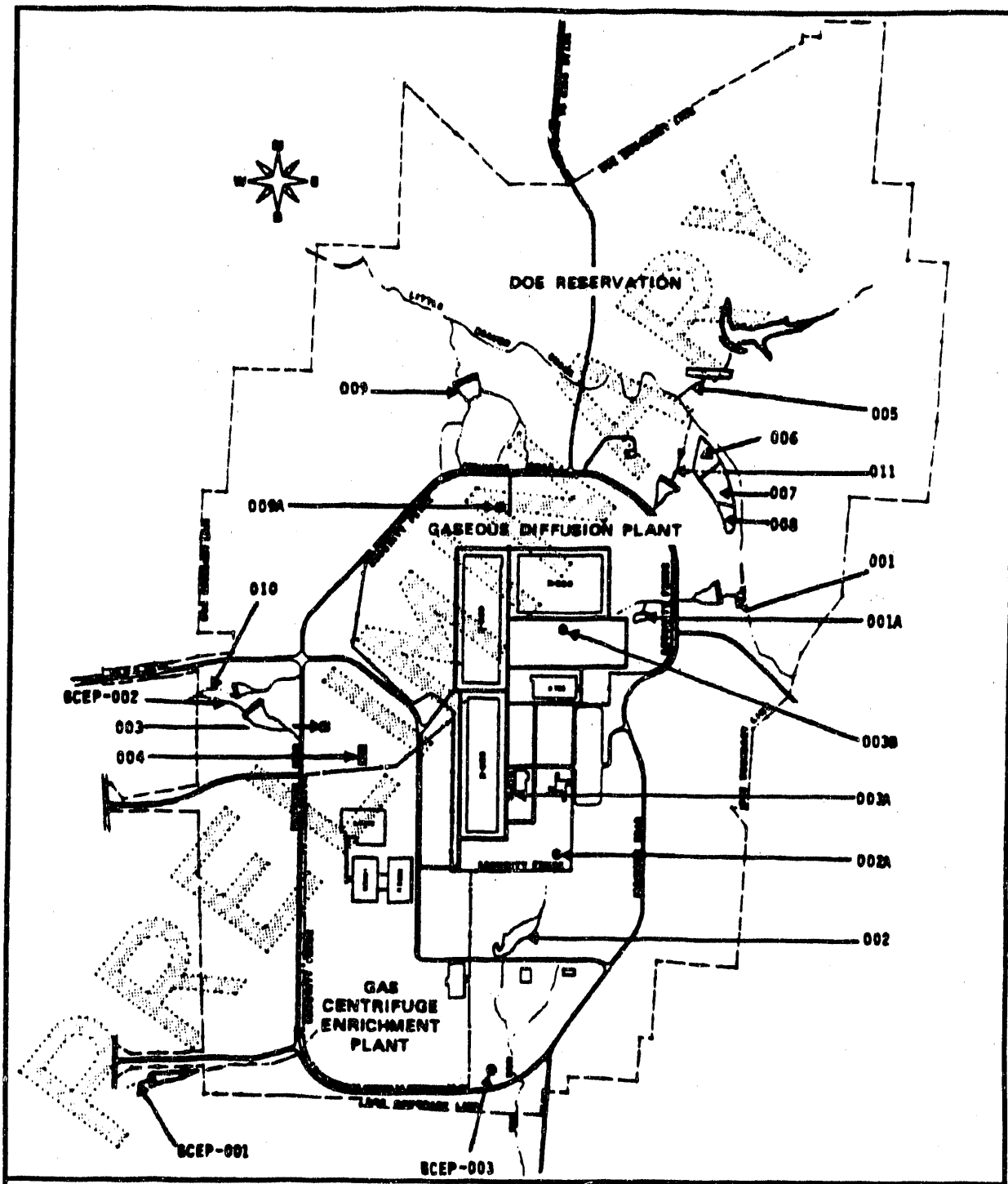
Plant effluents and area runoff flows also show a wide range, but the best estimate, based on more than 5,000 individual flow measurements, indicates a long-term average total flow of 0.21 m^3/sec (4.8 million gallons/day) from the Gaseous Diffusion Plant (GDP) and the Gas Centrifuge Enrichment Plant (GCEP) sites. Approximately 80 percent of this total originates with the GDP site, with the remaining 20 percent from the GCEP site. With respect to receiving streams, Little Beaver Creek receives 39 percent of the total flow, Big Run receives 9 percent, and the Scioto receives 27 percent directly via two plant sewers. The remaining 25 percent also flows to the Scioto River via two unnamed tributaries draining the western and southwestern areas of the site. Refer to Figure 3-7 for location of all liquid effluent discharge points controlled under the NPDES Permit Program.



SOURCE: GAT, 1986 a.

FIGURE 3-6

STREAMS RECEIVING PUEC SURFACE WATER DISCHARGE
PUEC - PIKETON, OHIO



SOURCE: GAT, 1986 a.

FIGURE 3-7

LOCATION OF LIQUID EFFLUENT SAMPLING POINTS
PUEC - PIKETON, OHIO

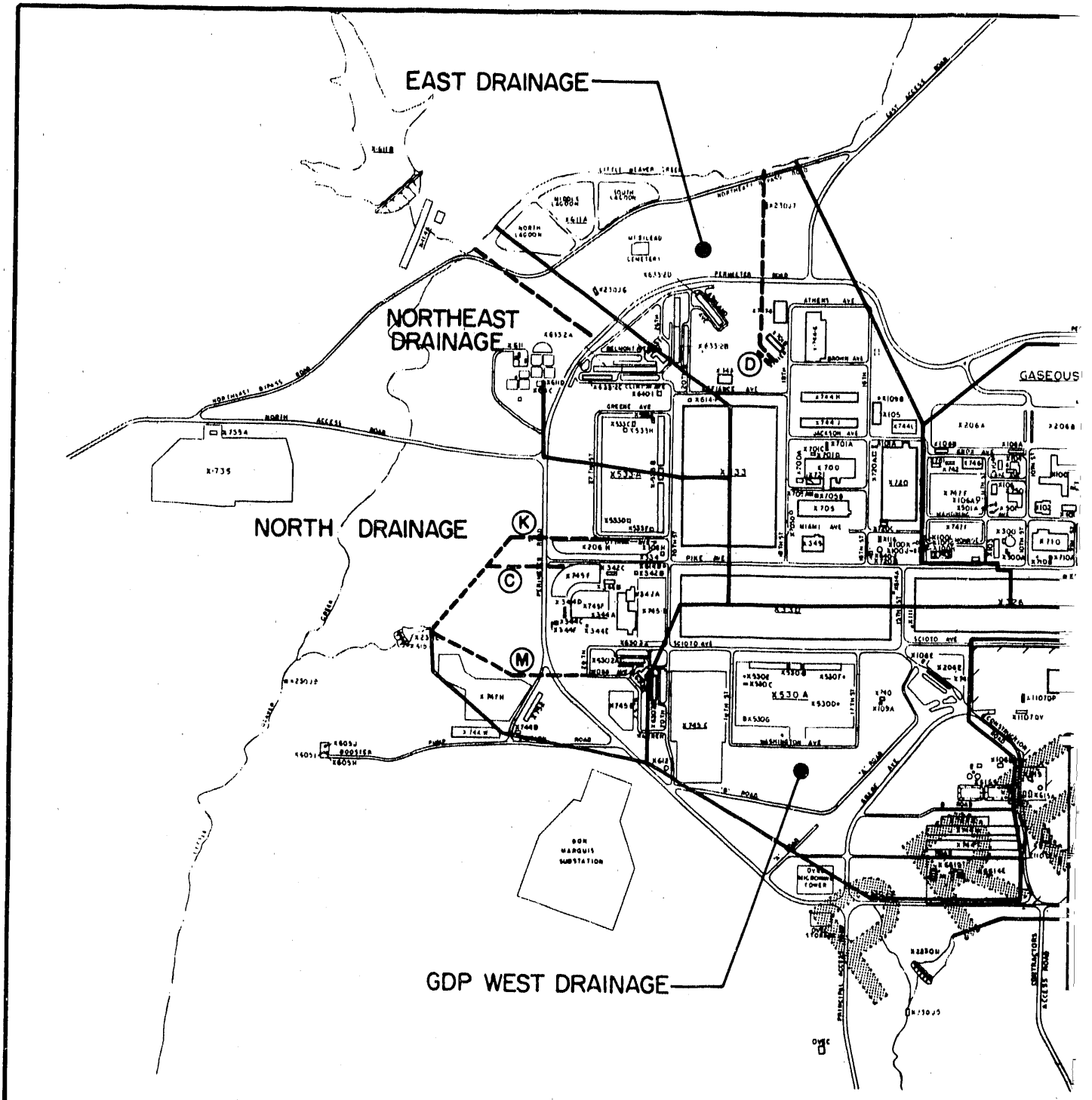
The three major process wastewater effluent flows are discharged into three different receiving streams. Treated effluents from spray-booth rinse waters, barrier grinder discharges, evaporator condensates, and building foundation drainage enter Little Beaver Creek via Outfall 001. Treated blowdown from the recirculating cooling water (RCW) system enters the Scioto River via Outfall 004. Treated steam plant and coal pile runoff wastewaters are discharged to Big Run Creek. The sewage treatment plant effluent contains small volumes of treated process wastewater, and it also enters the Scioto River directly via its own sewer line at Outfall 003. The other effluent streams consist primarily of storm runoff and sanitary water used for once-through cooling purposes. Refer to Figure 3-8 for a view of the site drainage patterns for each area of the PUEC.

Maximum flows from all plant areas during heavy rainfall reach 0.9 m^3/sec (20.5 mgd), but at such times the river's flow rate is also higher than normal. As a general rule, discharges from the GDP and GCEP sites represent less than 0.2 percent of the Scioto River's total volume, corresponding to a dilution rate of at least 500 parts river water to one part plant discharge.

The Scioto River, Big Run Creek, and Big Beaver Creek all share the same OEPA water-use designations, namely, a warm-water aquatic life habitat, an agricultural/industrial water supply source classification, and primary contact recreational usage. Little Beaver Creek also shares these same three designations, but is additionally defined by OEPA as a State Resource Water (OEPA, 1985a). Such waters lie within park systems; wetlands; and wildlife refuges, areas, andpreserves, and include waters of exceptional recreational or ecological significance as determined by the Director of OEPA. This designation imposes more stringent non-degradation requirements on the release of toxic substances and any other pollutants that may interfere with any designated use for Little Beaver Creek. This issue deserves special attention because half of PUEC's treated process effluents are discharged to Little Beaver Creek.

Currently, groundwater is the source of all process and potable water used at PUEC. It is pumped to the surface from 31 wells at three well fields between the site and the Scioto River. Depending on production levels, between 7 million and 20 million gallons of groundwater are withdrawn each day, the majority being used as process water. The total flow is chemically treated and conditioned for use throughout plant process water systems. Approximately 3.5 million gallons per day are treated further using recarbonation, chlorination, and filtration for use in the potable and fire protection water systems at both the GDP and GCEP sites. Water treatment plant sludges are pumped to a permanent holding pond for dewatering. Supernatants are recycled to the water treatment plant.

2



SOURCE: GAT, 1985 b.

SITE D
PUEC - I

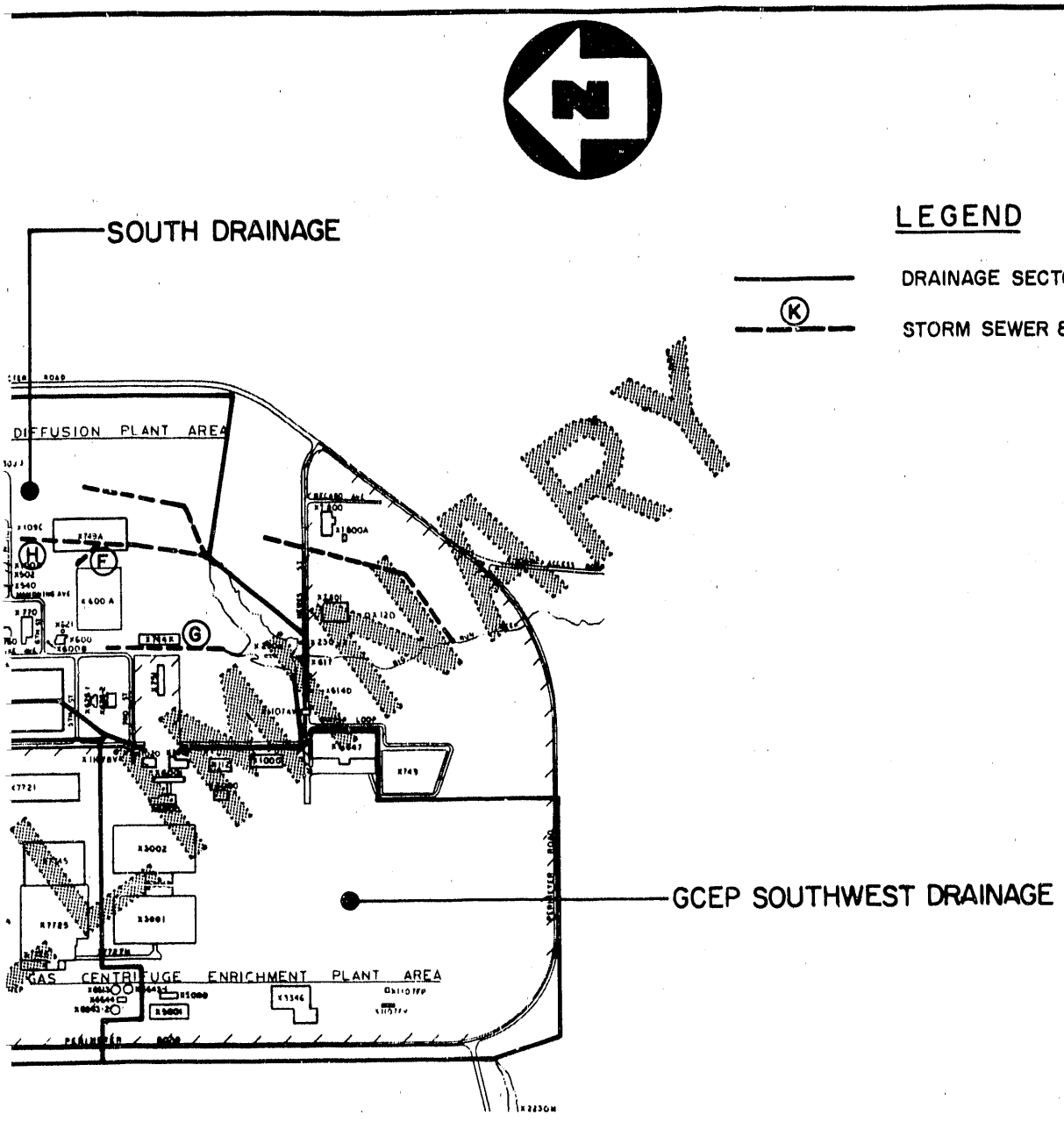


FIGURE 3-8

RAINAGE MAP
IKETON, OHIO

The potable water system provides drinking water for all employees and for processes requiring clean water. The plant prefers to use treated groundwater for these uses rather than treated Scioto River water, as was done in the past, because river water is more costly to pump and treat than groundwater. However, a raw water pumphouse at the Scioto River has been maintained in a ready condition in the event of emergencies. Currently, neither the plant nor any downstream public water supplies are using the Scioto River as a source of drinking water.

Background radionuclide measurements of the Scioto River upstream from the PUEC discharge point for gross alpha and gross beta-gamma are obtained weekly. Environmental and effluent samples with a beta-gamma radioactivity concentration in excess of 30 disintegrations/minute/100 milliliters are analyzed for ^{99}Tc. Upstream (background) results for 1985 indicate gross alpha concentrations ranging from $<0.14 \times 10^{-8}$ µCi/ml (detection limit) to 1.35×10^{-8} µCi/ml with an average of $<0.91 \times 10^{-8} \pm 0.16$ µCi/ml. Beta-gamma results for the same location ranged from $<4.50 \times 10^{-8}$ µCi/ml (detection limit) to 5.86×10^{-8} µCi/ml with an average of $<4.54 \pm 0.6 \times 10^{-8}$ µCi/ml. Uranium in water samples for this upstream collection point ranged from <1 µg/l (detection limit) to 23 µg/l with an average of $<2.20 \pm 1.00$ µg/l.

3.3.2 General Description of Pollution Sources and Controls

All major sources of polluted or contaminated wastewaters have been identified at PUEC, and appropriate controls are being applied. The following paragraphs provide basic information on process-related and non-process wastewater sources.

The RCW system is designed to cool and recycle up to 550 million gallons per day of cooling water to serve the three main process buildings (X-326, X-330, and X-333). Concrete basins provide 25 million gallons of RCW holding capacity adjacent to the three main process buildings. The system requires 10 to 15 million gallons of make-up water per day to replace losses due to evaporation, drift, and deliberate blowdown (necessary to limit the concentration of dissolved solids and prevent fouling). Addition of a proprietary corrosion inhibitor has been successful in eliminating corrosion problems, but as a result, all blowdown flow (averaging 1.1 mgd) must be treated at the X-616 (now referred to as the Liquid Effluent Control Facility) prior to direct discharge to the Scioto River. Treatment consists of sulfur dioxide addition to lower pH and to reduce hexavalent chromium to trivalent; followed by pH adjustment and polymer addition resulting in flocculation, precipitation and settling of solids in a clarifier. Clarified water is discharged to the Scioto River, and the solids are stored in a surface impoundment. (GAT, 1980).

Decontamination activities located in Building X-705 are another major source of waterborne pollutants. A small, but highly contaminated portion of Building X-705 wastewaters originates as raffinates from the uranium recovery process, and contain radioactive materials (uranium and technetium), nitric acid, heavy metals, and tributyl phosphate. These waste flows, ranging from 21,000 to 43,000 gpd, must be pretreated prior to release to the sewage treatment facility. Treatment steps include precipitation of heavy metals including uranium, filtration, ion exchange separation of the technetium, and fluidized bed biodenitrification. The last step is currently at the pilot-plant stage but must be upgraded to full-scale by January 3, 1988. Other liquid wastes from Building X-705, averaging 30,000 gpd, are treated by lime precipitation of metals and quiescent settling of solids at X-701B Holding Pond. Studies under way are aimed at replacing this facility (the holding pond) with a state-of-the-art waste treatment facility (GAT, 1985c). On July 9, 1987, approval was granted by the Ohio EPA to send the treated effluent from this new facility to the X-616 Liquid Effluent Control Facility. Ultimate discharge will be to the Scioto River. Pretreated raffinates will continue to be discharged to X-6619, the Sewage Treatment Plant, but all other X-705 wastewaters will be treated by this new facility.

Runoff from a coal storage pile and various steam plant wastewaters are collected and treated at the X-621 Coal Pile Treatment Plant prior to release to the South Holding Pond. Flows from the coal pile average 16,000 gpd and from the steam plant processes 37,000 gpd, but total flows have been measured as high as 200,000 gpd. The intermittent nature of these sources has caused operating difficulties in the existing treatment system, which consists of pH adjustment to precipitate metals, polymer addition to aid in settling, a Lamella settler for clarification, and a centrifuge for sludge dewatering. PUEC plans to upgrade the existing system by providing separate treatment for the ash wash waste stream and the hydrogen zeolite backwash wastewaters, and using the existing facility to treat coal pile runoff, floor and yard drainage, and bearing cooling water only. Effluents from treatment would continue to flow to the South Pond for further settling and pH adjustment as required prior to ultimate release to Big Run Creek (GAT, 1986a).

The Sewage Treatment Facility (X-6619) was designed to serve both the GDP and the GCEP, replacing the original X-615 treatment plant. Besides controlling sanitary sewage, the new plant also treats other biodegradable wastes, including minor quantities of organic process wastes from X-700, X-705, and X-720 buildings; pretreated X-710 laboratory wastes; and the pretreated raffinates from the biodenitrification facility. Although design capacity anticipates a normal flow of 700,000 gpd, the plant can handle peak surges up to 1,200,000 gpd. The sewage treatment system is an activated-sludge facility with diffused aeration for activation and digestion, secondary clarification, granular

media filtration, and postchlorination prior to discharge. Treated effluents are conveyed approximately 2 miles to the Scioto River via a 15-inch vitreous clay sewer line. (GAT, 1983).

There are dozens of intermittent releases from various process buildings to the X-701B Holding Pond, the X-230J-7 Holding Pond, the X-6619 Sewage Treatment Plant, and to storm sewers (if unpolluted) from maintenance and cleaning operations, instrument rooms, air conditioners, filter screen washings, diesel air, and nitrogen plants. PUEC is actively tracking these flows to ensure that all waters requiring treatment and control are receiving appropriate attention.

A nondeliberate, non-process flow of bright orange-red seepage was observed at the southeast corner of Peter Kewitt and Sons Landfill, entering Big Run Creek downstream of the South Holding Pond. Refer to Section 4.5 for discussion of this wastewater source.

General precipitation run-off from all GDP and GCEP areas is collected by the X-230C storm sewer system (D'Antonio, 1985). Thirteen separate lines collect run-off, and certain lines also serve to drain off noncontaminated, once-through, sanitary cooling water and other clean waters. Refer to Figure 3-8 for details on site drainage.

The four large sludge dewatering lagoons serving to control lime sludges generated by the X-611 Water Treatment Plant generally release no water to Little Beaver Creek. Flow monitoring of the three inactive lagoons (X-611A) indicated no overflows in 1985 or 1986. Lagoon X-611B, the active pond, reported two overflows in 1985 and none so far in 1986. PUEC is investigating methods for increasing the capacity of X-611B by 30 percent (GAT, undated b).

3.3.3 Environmental Monitoring Data

Extensive amounts of data exist covering all 11 NPDES outfalls at the GDP and 3 outfalls at GCEP. In addition, OEPA has required PUEC to monitor the performance of several separate treatment components within the GDP, namely, the X-701B Holding Pond, the X-621 Coal Pile Treatment Plant, the Biodenitrification Pilot (and eventually full-scale) Plant, and the Batch Treatment Facility serving the fluorine generator cleaning operation. A summary of the requirements of the NPDES permit is shown as Table 3-7. The limitations covering Outfalls 601, 602, and 604 (X-701B Holding Pond, Coal Pile Treatment Plant, and the Biodenitrification Plant) were relaxed effective April 8, 1985, as part of the OEPA Director's Final Findings and Orders (OEPA, 1985b). Final negotiations are ongoing between PUEC staff, Oak Ridge Operations Office, and OEPA and are aimed toward issuance of a final NPDES permit covering GDP and GCEP.

TABLE 3-7

NPDES PERMIT EFFLUENT MONITORING REQUIREMENTS
PUEC - PIKETON, OHIO

Parameter	Sample Type	Frequency	Limitations	
			30-Day Average	Daily Maximum
<u>Outfall 001 (East Drainage Ditch)</u>				
Flow	Continuous	--	--	--
Total Suspended Solids	Composite	1/week	20 mg/l	30 mg/l
Oil & Grease	Grab	1/week	10 mg/l	15 mg/l
Temperature	Grab	1/week	--	--
Total Residual Chlorine	Grab	1/week	--	0.02 mg/l
pH	Grab	1/week	--	6.5 to 9.0
<u>Outfall 001A (X-'01B) Effluent (New 601)</u>				
Flow	Continuous	--	--	--
Nitrate (N)	Composite	2/week	--	--
Ammonia (N)	Composite	2/week	--	--
Total Copper	Composite	2/week	--	--
Total Zinc	Composite	2/week	0.05 kg/day	0.09 kg/day
Total Iron	Composite	2/week	8.30 kg/day	0.60 kg/day
Total Nickel	Composite	2/week	--	--
Total Chromium	Composite	2/week	0.007 kg/day	0.014 kg/day
Chromium (+ 6)	Composite	2/week	--	--
Trichloroethylene	Grab	2/week	--	--
pH	Continuous	7/week	--	--
<u>Outfall 002 (X-230K, South Holding Pond)</u>				
Flow	Continuous	--	--	--
Total Suspended Solids	Composite	1/week	20 mg/l	30 mg/l

TABLE 3-7
NPDES PERMIT EFFLUENT MONITORING REQUIREMENTS
PUEC - PIKETON, OHIO
PAGE TWO

Parameter	Sample Type	Frequency	Limitations	
			30-Day Average	Daily Maximum
Outfall 002 (X-230K, South Holding Pond) (Cont'd)				
Total Arsenic	Composite	1/week	--	--
Total Copper	Composite	1/week	--	--
Total Nickel	Composite	1/week	--	--
Total Iron	Composite	1/week	--	--
Total Manganese	Composite	1/week	--	--
Total Zinc	Composite	1/week	--	--
Total Residual Chlorine	Grab	1/week	--	0.02 mg/l
Oil & Grease	Grab	1/week	10 mg/l	15 mg/l
pH	Grab	1/week	--	6.5 to 9.0
Outfall 002A (X-621 Coal Pile Treatment Plant) (New 602)				
Flow	Continuous	--	--	--
Total Suspended Solids	Composite	1/week	--	50 mg/l
Total Iron	Composite	1/week	3.0 mg/l	6.0 mg/l
Total Manganese	Composite	1/week	2.0 mg/l	4.0 mg/l
Total Copper	Composite	1/week	--	--
Total Zinc	Composite	1/week	--	--
Total Nickel	Composite	1/week	--	--
Total Arsenic	Composite	1/week	--	--
pH	Grab	1/week	--	6.0 to 10.0
Outfall 003 (X-6619 Sewage Treatment Plant)				
Flow	Continuous	--	--	--
BOD_5	Composite	1/week	26.3 kg/day	40.0 kg/day
Total Suspended Solids	Composite	1/week	31.8 kg/day	47.7 kg/day
Fecal Coliform	Grab	1/week	1000 N/100 ml	2000 N/100 ml

TABLE 3-7
NPDES PERMIT EFFLUENT MONITORING REQUIREMENTS
PUEC - PIKETON, OHIO
PAGE THREE

Parameter	Sample Type	Frequency	Limitations	
			30-Day Average	Daily Maximum
Outfall 003 (X-6619 Sewage Treatment Plant) (Cont'd)				
Total Residual Chlorine	Grab	1/week	--	0.5 mg/l
Total Nickel	Composite	1/week	--	--
pH	Grab	1/week	--	6.5 to 9.0
Outfall 003B (Biodenitrification Plant) (New 604)				
Flow	Continuous		--	--
Nitrate	Composite	2/week	11.0 kg/day	13.0 kg/day
Total Copper	Composite	2/week	0.007 kg/day	0.014 kg/day
Total Zinc	Composite	2/week	0.055 kg/day	0.110 kg/day
Total Iron	Composite	2/week	0.23 kg/day	0.45 kg/day
Total Nickel	Composite	2/week	0.018 kg/day	0.036 kg/day
pH	Grab	2/week		6.5 to 9.0
Outfall 004 (X-616 Chromium Treatment Plant)				
Flow	Continuous		--	--
Total Dissolved Solids	Composite	1/week	3500 mg/l	4000 mg/l
Total Suspended Solids	Composite	1/week	75.8 kg/day	113.5 kg/day
Total Zinc	Composite	1/week	1.9 kg/day	3.8 kg/day
Chromium (+ 6)	Composite	1/week	0.2 kg/day	0.4 kg/day
Total Chromium	Composite	1/week	1.9 kg/day	3.8 kg/day
Total Iron	Composite	1/week	3.8 kg/day	5.7 kg/day
Total Copper	Composite	1/week	1.9 kg/day	3.8 kg/day
Total Residual Chlorine	Grab	1/week	--	0.02 mg/l
Trichloroethylene	Composite	1/week	--	0.001 mg/l
pH	Grab	1/week	--	6.5 to 9.0

TABLE 3-7
NPDES PERMIT EFFLUENT MONITORING REQUIREMENTS
PUEC - PIKETON, OHIO
PAGE FOUR

Parameter	Sample Type	Frequency	Limitations	
			30-Day Average	Daily Maximum
<u>Outfalls 005, 006, 007, 008 (X-611 Sludge Lagoons)</u>				
Flow	Estimate	during	--	--
Total Suspended Solids	Grab	periods	10 mg/l	15 mg/l
pH	Grab	of flow	--	6.5 to 10.0
<u>Outfall 009(North Holding Pond)</u>				
Flow	Weekly Measurement	1/week	--	--
Total Suspended Solids	Grab	--	--	--
Oil & Grease	Grab	1/week	30 mg/l	100 mg/l
Fluoride	Grab	1/month	10 mg/l	15 mg/l
Total Residual Chlorine	Grab	1/week	--	--
pH	Grab	1/week	--	0.02 mg/l
			--	6.5 to 9.0
<u>Outfall 009A (Fluorine Generator Cleaning) (New 609)</u> <u>Limited to Six Batches/Year</u>				
Flow	Batch Measurement	1/batch	--	--
Total Suspended Solids	Composite	1/batch	--	0.68 kg/batch
Fluoride	Composite	1/batch	--	0.68 kg/batch
<u>Outfall 010 (West Drainage Ditch)</u> <u>Outfall 011 (Northeast Drainage Ditch)</u>				
Flow	Monthly Measurement	1/month	--	--
Oil & Grease	Grab	1/week	10 mg/l	15 mg/l
pH	Grab	1/month	--	6.5 to 9.0

TABLE 3-7
NPDES PERMIT EFFLUENT MONITORING REQUIREMENTS
PUEC - PIKETON, OHIO
PAGE FIVE

Parameter	Sample Type	Frequency	Limitations	
			30-Day Average	Daily Maximum
GCEP Outfalls 001, 002, 003				
Flow	Continuous	--	--	--
Total Suspended Solids	Grab	1/week	30 mg/l	100 mg/l
Oil & Grease	Grab	1/week	10 mg/l	20 mg/l
pH	Grab	7/week	--	6.5 to 8.5

Source: OEPA Director's Final Findings and Orders (OEPA, 1985b).

Note: Parameters for which limits are not specified are required to be monitored. Results are to be reported to the OEPA.

All local tributaries and the Scioto River itself are relatively unpolluted except for agricultural runoff. PUEC Environmental Control personnel collect surface water samples from upstream and downstream locations in all receiving streams routinely, on at least a monthly basis. Samples are also collected from all outfalls on a schedule mandated by NPDES permit requirements. Additional upstream/downstream comparisons are also made for uranium and alpha radioactivity in sediments taken from all receiving streams (GAT, 1986a). In the spring and fall of 1981, an intensive water survey was conducted at 29 sample points in and around the PUEC site. Analysis was performed for 25 specific parameters, along with IR/GC spectra scans for organics.

Even though some of the analytical data from PUEC's organic, inorganic, and radiological laboratories may be subject to question because of QA/QC shortcomings identified in Section 4.4, conclusions regarding the effect of PUEC discharges on the environment are not likely to be changed. Plant effluents had only minor impact on the Scioto River's water quality. The parameters known to exist on-site (fluorides, nitrates, chlorides, uranium, and alpha and beta activity) were present at the same levels in upstream and downstream samples. Only total hardness appeared to have a measurable increase of 2.7 percent over a background value of 235 mg/l. Other background concentrations observed included COD at 28 mg/l, sulfates at 57 mg/l, alkalinity at 155 mg/l, chloride at 30 mg/l, fluoride at 0.35 mg/l, and nitrate at 5.4 mg/l. Metals, including uranium, were at less-than-detectable levels, as were readings taken for gross alpha and beta radioactivity (GAT, 1982).

Even though plant discharge impacts on the Scioto River are minimal, those on Little Beaver Creek and Big Run are not. With long-term average daily flows of 0.08 m^3/sec (1.8 mgd) and 0.02 m^3/sec (0.45 mgd), respectively, from the plant to these streams, plant discharge represents the major source of stream flows for much of the year. Any contaminants released from the plant areas would have a negative effect on these smaller streams. For example, the PUEC discharges into Little Beaver Creek during the 1981 survey increased the concentrations of alkalinity from 48 to 65 mg/l, of fluoride from 0.1 to 0.3 mg/l, of nitrate from 0.4 to 1.7 mg/l, of phosphate from 0.015 to 0.054 mg/l, of chloride from 10 to 24 mg/l, and of trichloroethylene from less than detectable to 7 µg/l. Weekly and monthly routine analyses for radioactive characteristics in 1985 showed a similar pattern of nearly undetectable upstream concentrations and measurable downstream results. Uranium concentrations increased from an annual average of <1.10 µg/l to 23.6 µg/l, whereas alpha radioactivity increased from $<0.80 \times 10^{-8}$ µCi/ml to 10.1×10^{-8} µCi/ml. Technetium concentrations increased from less than detectable in upstream samples to 65×10^{-8} µCi/ml in downstream samples. The detection limit was 4.5×10^{-8} µCi/ml, so the increase was at least 14 times background. Impacts

on Big Run Creek were not as pronounced. Increases were noted in sulfates from 106 to 155 mg/l, total hardness from 142 to 186 mg/l, and chlorides from 8.8 to 40 mg/l. Alpha activity concentrations were reported from $<0.75 \times 10^{-8}$ to $<1.43 \times 10^{-8}$ µCi/ml, whereas uranium and beta activity, including technetium, were unchanged at less than detectable (GAT, 1982).

PUEC has made progress in reducing the number of recurring NPDES violations. Future improvements in several areas will further enhance PUEC's ability to comply with all permit requirements. The current level of compliance with all OEPA Director's Final Findings and Orders and all applicable NPDES limits is uniformly high, approaching 100 percent. Permits cover 18 separate monitoring points and require that 101 parameter-outfalls (the sum of all parameters at all outfalls) be measured on a regular schedule. Of these parameter-outfall sets, 38 are not governed by numerical limits, being monitoring requirements only (e.g., continuous flow measurements). The remaining 63 do have specific concentration or mass load limits, specified as daily or instantaneous maxima. Forty-eight of the sixty-three limits were never exceeded on any day during the first 7 months of 1986, and thus attained 100 percent compliance with requirements. Of the remaining 15 sets, 14 achieved compliance more than 93 percent of the time, an indication of steady improvement over 1985 values. Only one limitation--total suspended solids (TSS) at Outfall 002--was yielding a compliance rate lower than 93 percent. This outfall, the South Holding Pond, exceeded permit limitations for TSS 23 percent of the time for a 77 percent compliance rate. However, compliance is expected to improve sharply after modifications to the coal pile treatment plant are completed.

With respect to 30-day average limitations, a similar compliance pattern is apparent. Numerical limits are specified for 38 of 81 parameter-outfalls, and 31 of these demonstrated 100 percent compliance for the first 7 months of 1986. Two of the remaining seven were out of compliance only once during the period. The worst case was GCEP Outfall 001, with 3 TSS exceedances. With respect to daily maximum limits, Outfall 002 also showed TSS exceedances, which are likely to be eliminated or sharply reduced after treatment modifications are made.

This compliance record has been achieved through various PUEC programs, the most notable of which involves the X-616 Chromium Treatment Plant, which discharges via Outfall 004. Improvements in operating practices have enabled this unit to reduce instances of NPDES permit noncompliance from 13 in 1985 to 0 in 1986. Exceedances had been common at this plant, especially since permits place numerical limits on 10 parameters as daily maxima and 7 parameters as 30-day averages. Each month provides 47 to 57 measurements against which compliance is determined. Several of the compliance record improvements at other discharge points are attributable in part to

more realistic (i.e., relaxed) limitations made effective on April 8, 1985, by the OEPA Director's Final Findings and Orders (OEPA, 1985b). Limitations at Outfall 004 were left unchanged, so the improvements cited above are related to improved practices.

3.3.3.1 Drinking Water Standards

PUEC produces its own potable water at the X-611 Water Treatment Plant. The water is monitored daily for pH, alkalinity, hardness, and free and total chlorine, and weekly for phosphate. Samples are also submitted to Ohio's Department of Health (ODH) at least quarterly to make certain that all requirements of the Ohio Administrative Code 3745 and Ohio Revised Code Chapter 6109 are being met. The OEPA's Division of Public Water Supply also makes periodic site visits to conduct evaluation surveys of PUEC's potable water supply system.

PUEC's operators have been certified to operate the system, and conduct required sampling and testing. ODH laboratory results cover analyses for toxic organics such as hydrocarbons, pentachlorophenol, PCBs, pesticides, alachlor, and carbofuran as well as inorganic parameters such as NO_3/NO_2, fluoride, sodium, arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. Alpha and beta radioactivity is also measured routinely each quarter by ODH analysts. All tested parameters have continuously met all Ohio drinking water standards. To help ensure that this record continues, PUEC pursues an effective continuing program of self-evaluation, including periodic inspection of all possible sources of contamination. Wherever processes make use of potable water, feed lines are protected with vacuum breakers or approved back-siphonage protection valves. Staff engineers routinely check to make certain that protective devices are correctly installed and in good working order.

3.3.3.2 Other Environmental Monitoring Data

In addition to data gathering required as a condition of NPDES permits and OEPA water quality administrative codes, PUEC collects data on surface water upstream and downstream of each NPDES outfall, including those at the Scioto River. Refer to Figure 3-6 for locations of these external and perimeter sampling points. Stream sediments are also collected monthly from 4 upstream and 9 downstream locations associated with PUEC outfalls. There is also an annual fish sampling/analysis program wherein fish are collected from Little Beaver Creek, Big Beaver Creek, Big Run Creek, West Drainage Ditch, and the Scioto River.

All of these routine environmental samples (surface water, sediment, and fish) are analyzed for uranium, gross alpha, and gross beta-gamma radioactivity. If beta-gamma radioactivity count is greater than 30 d/min/100ml, the sample is analyzed for technetium. Refer to Section 4.3 for additional information regarding radioactivity measurements.

PUEC also conducts special analytical programs for assessing the impact from on-site activity as the need arises. For example, fish samples collected in September 1984 and September 1985 were analyzed not only for radioactivity but also for PCB content. Data showed higher levels of PCB in fish taken from on-site streams than from the Scioto River. Refer to Section 3.3.4.3 for details.

In 1979, PUEC instituted a voluntary program for semiannual monitoring of local residents' sanitary well water systems for the same characteristics listed above. All samples collected to date indicate that activity levels are well below USEPA standards for protection of the general public, usually at less than detectable limits. The ODH has also sampled and analyzed some of these wells and cisterns independently, with similar results.

All findings relating to the various water sampling activities are incorporated into an annual Environmental Monitoring Report, which PUEC's Environmental Control Division prepares for DOE as an account of work. The most recent of these reports covers calendar year 1985 (GAT, 1986a). A typical report organizes and summarizes data from more than 5,000 routine environmental samples representing more than 15,000 individual analyses. And these totals do not include the voluminous pH data and flow measurements generated by continuous automatic monitors at selected NPDES outfalls. PUEC provides a thorough accounting of releases via the surface-water/drinking-water routes.

3.3.4 Findings

3.3.4.1 Category I

None

3.3.4.2 Category II

1. Coal Pile Runoff. Because acidic runoff from the coal storage pile can bypass the treatment system, it can contaminate the X-230K South Holding Pond and thus increase the migration of soluble metals to both surface water and groundwater in that area.

The coal storage pile is surrounded by an unlined diversion ditch to collect and convey runoff into a holding pond until it can be treated at the X-621 Coal Pile Treatment Plant. This ditch not only has a permeable bottom that could allow accumulated water to percolate into the ground, but also is too shallow and lacks sufficient grade to keep it from overflowing during moderate rainfall events. The runoff contains acids, sulfates, chlorides, organic compounds, arsenic, copper, iron, nickel, manganese, and zinc, all of which occur naturally in coal and are readily leached from the storage pile. Untreated coal-pile runoff concentrations reported in PUEC's NPDES permit application renewal forms (GAT, 1984b) indicated daily maxima of 410 mg/l for iron (exceeded in November 1985 when a new maximum of 860 mg/l was recorded), 1.28 mg/l for manganese, 0.13 mg/l for arsenic, 0.30 mg/l for copper, 0.38 mg/l for nickel, and 2.15 mg/l for zinc. Historical data also indicate pH values as low as 3.0 for coal-pile runoff. At such pH levels, precipitated and adsorbed metals are redissolved from sludge or soil. The increased mobility of the metals and subsequent migration could cause pollution of downstream receptors and groundwater. Finding 3.4.4.3.1 presents details on groundwater contamination of the wells in the area of the coal pile.

When untreated coal-pile runoff bypasses treatment and enters the South Holding Pond, it typically lowers the pH of the pond to a point where further solubilization of metals in the sludge occurs. Pond effluent pH readings as low as 5.8 units were reported in the permit renewal forms (GAT, 1984b), and earlier data show readings as low as 3.0 in pond effluent (OEPA, 1983). Metal concentrations were not measured, but would be expected to be high because of the low pH. Downstream impacts on Big Run Creek from untreated releases could be serious because acids, heavy metals, and organics are toxic to fish and other biota and will not be controlled effectively by simple settling in the South Holding Pond.

PUEC has finalized plans for improving the operation of the X-621 Coal Pile Runoff Treatment Plant, but is not certain that the planned upgrade will eliminate the problem of runoff bypassing the treatment system. The past use of sandbags and temporary dikes in an effort to control runoff has proved to be ineffective. Since the Survey, the diversion ditch has been regraded and deepened, but the extent and effect of these improvements are not known. Moreover, no plans exist for remediating percolation from directly under the coal pile to the ground below. Even if all other channels are collected and properly treated, raw runoff will continue to migrate downward beneath the pile.

2. Seepage from Peter Kewitt and Sons (PKS) Landfill. A bright orange-red seepage, a potential source of heavy metals and/or toxic organics, is discharging from the southeast corner of the PKS landfill. This seep could be a potential pathway from the landfill to Big Run Creek and a source of groundwater contamination in the area.

   In appearance the seep resembles acid mine drainage, but the only analytical data available from an April 1981 Environmental Survey conducted by PUEC environmental staff was limited to radionuclides and pH. Sediments and leachates showed concentrations of uranium, technetium, and alpha activity at or below background levels. Sampling reports did not record any weather observations or estimate any flow rates. Samples were not analyzed for heavy metals (other than uranium) or for organics. Since the PKS landfill dates back to the 1952 construction activities and remained in use until 1968, there is a strong possibility that the landfill contains not only construction debris but also hazardous wastes. It is likely that heavy metals and/or organics are present in this seepage, but this cannot be confirmed using available data. There are similar naturally occurring seeps of iron-laden waters in other areas near the PUEC site, so this on-site seepage may be unrelated to hazardous waste releases. But the fact that this condition has persisted from 1981 to the present without further investigation is a matter of concern. Survey-related sampling is planned (see Finding 4.5.2.3.3).

3. Release of Pesticides to Surface Waters (and Groundwater). Pesticides and/or herbicides may be released to surface waters or stream sediments and groundwater without PUEC's knowledge because the pesticides analyzed for in quarterly monitoring activities are not representative of those actually used on-site. Consequently, the impacts on surface water and groundwater, if any, cannot be assessed.

   PUEC analyzes for a standard list of pesticides, including aldrin, chlordane, DDT, dieldrin, endosulfan, endrin, heptachlor, lindane, malathion, and toxaphene, as given in OEPA's Water Quality Standards (OEPA, 1985). Actual compounds used on-site include Spike Treflan 6G, Round-Up, Simazine 80w, and Weedone 170. Of these, only Simazine will be positively identified by analyzing for the OEPA list (see Finding 4.2.2.4.3). Survey-related sampling of groundwater monitoring wells is planned. No samples of surface water or stream sediments are to be taken, because of the highly biodegradable nature of these products when exposed to air. The absence of air and bacteria in groundwater raises

doubts as to the biodegradability of these compounds in groundwater. Sampling and analysis will provide information currently lacking.

3.3.4.3 Category III

1. Sewage Treatment Plant Efficiency. Chronic exceedances of fecal coliform and BOD_5 could result if either production or staff increases bring the sewage treatment plant's inlet flows nearer to capacity. Potential impacts on the receiving stream (the Scioto River) are difficult to assess, but are likely to be minor though measurable.

Optimum operating conditions cannot be achieved at the X-6619 Sewage Treatment Plant because poorly-designed floating weirs at the aeration basins allow surging to occur. The aeration basins overflow to the clarifiers as incoming raw wastewater displaces the activated (aerated) wastewaters. The floating weirs fail to smoothly regulate the flow of activated mixed liquor from the aeration basins, and at times cause water to be held back prior to release. When flow does commence, the sudden surge over the weir often carries partly-treated or raw wastewaters along with properly-treated effluents to the clarifiers. Normal overflow rates vary from 0 to 350 gpm, but surges appear to flow at higher rates for short periods of time.

Under present conditions the X-6619 Treatment Plant is achieving a high compliance rate with permit requirements: BOD_5, TSS, nickel, and pH limits have been in compliance 100 percent of the time in 1985 and 1986. Residual chlorine requirements were met 98 percent of the time in 1985 and 100 percent of the time in 1986.

Fecal coliform counts were exceeded 4 percent of the time in 1985 and 3 percent of the time in 1986. But this good record primarily results from the fact that the sewage treatment plant was designed and built to serve both the GDP and GCEP operations at PUEC. Rated design capacity anticipated a normal flow of 700,000 gallons per day, with peaks up to 1.2 million gallons per day. Current operating rates with only the GDP facilities in operation average less than 300,000 gallons per day. As a result the plant has sufficient retention time to provide adequate treatment. However, if the inlet volumes were increased for any reason (activation of GCEP or increased activity at GDP), the faulty weirs could cause inadvertent releases of fecal coliform and BOD_5 to the Scioto River.

2. Release of PCBs to Surface Waters. Evidence exists that migration of PCBs via surface water pathways is occurring at PUEC and that PCBs may be entering the food chain for consumption by humans.

Minnows taken from streams on-site contain PCBs (measured as PCB-1260) at concentrations 2.5 to 36 times higher than minnows collected from the Scioto River. Sources are not obvious but are distributed across all receiving streams to some extent. Data from September 1984 and 1985 fish tissue surveys conducted by PUEC showed the following concentrations for each source:

Background Levels: (concentrations in micrograms/gram)

	September, 1984	September, 1985
Scioto River	0.14 µg/g	0.05 µg/g
Big Beaver Creek	0.12 µg/g	0.15 µg/g

On-Site Receiving Steams:

	September, 1984	September, 1985
Big Run Creek	0.35 µg/g	0.25 µg/g
Little Beaver Creek	1.70 µg/g	0.35 µg/g
West Drainage Ditch	1.15 µg/g	1.80 µg/g

There are no current Federal Drug Administration (FDA) action levels for samples of this type. Typical action levels for similar food products include a concentration limit of three micrograms of PCB per gram of red meat (3 ppm). Although the reported concentrations in minnows are all less than FDA action levels for red meat, some specimens (West Drainage Ditch in September 1985; Little Beaver Creek in September 1984) have retained more than 50 percent of the limit, and these specimens are immature young species. Adult fish may yield increased concentrations of PCBs. The minnows sampled did confirm PCB increases over background levels. These increases are serious enough to warrant further assessment of present and potential impacts from PCB releases and identify a need to investigate sources, past and present.

PUEC conducts the fish tissue sampling and analysis program annually for radioactivity characteristics, but it is not clear whether PCBs are measured annually. Refer also to Finding 4.2.2.3.1 for further discussion of this environmental problem. Survey-related sampling is planned.

3.3.4.4 Category IV

1. Lack of Compliance with Standard Operating Procedures (SOPs). Untreated contaminants have been released, treatment facilities have been overloaded, and available resources (labor, time, chemicals, and energy) have been misused as a result of inconsistent compliance with written SOPs and operating methods. Such releases may constitute a threat to the environment, both on- and off-site. Procedures exist for notifying affected parties whenever dumps or accidental spills of concentrated solutions occur, or when critical treatment facilities must be shutdown or otherwise restricted in their ability to handle incoming wasteloads. There is evidence that these procedures are not always enforced because of a lack of communication between groups responsible for notification.

   For example, monitoring reports for September 1985 for Outfall 004 (X-616 Chromium Water Treatment Facility) indicate no flow leaving the plant on September 25, 1985, and carry the notation, "Facility was shutdown for repairs on 9/24/85 without notification" (emphasis added). Samples collected by environmental protection staff were rendered invalid, required monitoring had to be rescheduled for later in the week, and labor hours were expended inefficiently because of lack of prior notification.

2. Lack of Spare Parts. Lack of sufficient or proper spare parts for an instrument recording flow rates at NPDES Outfall 011 resulted in a prolonged downtime. The downtime resulted when the instrument was struck by lightning, which caused extensive damage. Replacement parts had to be shipped in from overseas. Consequently, the instrument was out of service for 6 months.

   OEPA requires that flows at that outfall must be measured once a month, hence PUEC was technically in violation for 6 months. OEPA could have penalized PUEC for making no attempt to measure flows by any other method during the period when the flow monitor was out of service. In this case, no environmental problem resulted from failure to track

flow rates from this source (the Northeast Drainage Ditch conveys non-contact cooling water and surface runoff to a holding pond and then to Little Beaver Creek).

3.4 Hydrogeology

3.4.1 Background Environmental Information

3.4.1.1 Regional Geology

The PUEC plant is located in the Central Stable Physiographic Province on the western flank of the Appalachian Plateau. Geologically, the region consists of a basement of Precambrian igneous and metamorphic rocks overlain by younger flat-lying to gently dipping sedimentary rocks of Paleozoic age. Structural features in the Precambrian basement influence the geometry of Paleozoic sedimentary rocks. The sedimentary rocks are thin over the arches and domes of Precambrian rocks and thicken in the intervening basins.

During much of the Paleozoic Era, the region was covered by seas; thus, successive layers of clay, calcareous clay, sand, gravel and occasional salt and gypsum were deposited in a variety of depositional environments. Subsequent to deposition, lithification of the sediments resulted in the formation of shales, limestones and dolomites, sandstones, siltstones, conglomerates and coal.

Near the end of the Paleozoic Era, the region was uplifted. This upheaval caused a change from a predominantly depositional to an erosional environment. Paleozoic rocks, which were uplifted during the Permian Period, were exposed to erosive forces from the Permian to the Quaternary Period. Thus, rocks of Mesozoic age were not deposited in the region.

During the Quaternary Period, continental glaciers spread as far south as the northern portion of the study region. North of this boundary, glacial deposits generally overlie bedrock. Glaciers indirectly influenced conditions south of this boundary. The result was the local deposition of alluvial and lacustrine sediments and the altering of drainage patterns.

Glacially influenced surface drainage produced several alluvial valleys in the PUEC region. The Teays River flowed northwestward across the region a few miles north of PUEC. A major tributary, the Portsmouth River, flowed northward through the area presently occupied by the PUEC site, joining the Teays River near Piketon. During the Pleistocene, the Teays River was dammed at a point north of the study region, presumably by a glacier. This formed a large lake, which has been named Lake

Tight. Lake Tight occupied the main Teays River valley as well as tributary stream valleys and produced a series of finger lakes. Alluvium deposited in the Teays and Portsmouth River valleys and lacustrine material deposited within Lake Tight are present within the study region.

Modifications to the regional drainage system occurred as Lake Tight filled and sought another outlet. These alterations initiated the Deep Stage drainage. Because stream gradients of the newly created drainage system were high, rapid downcutting of stream valleys ensued, an event which produced deep narrow valleys. The most significant Deep Stage stream in southern Ohio was the Newark River. The Newark River rose in east-central Ohio and flowed southwesterly from Chillicothe to Portsmouth, where it joined the Cincinnati River, which in turn flowed through the valley presently occupied by the Ohio River. Flow in the Newark River was to the south; that is, the reverse of the direction water flowed in the Teays and Portsmouth Rivers.

The Newark River was a major channel for alluvium-bearing meltwater from the Pleistocene continental glaciations. The deep Newark River valley was partially filled with silt, sand, and gravel outwash from continental glaciers to the north. The present Scioto River flows southward on this glacial outwash above the bed of the old Newark River. The Scioto apparently has a smaller flow and hence a more restricted channel than had the Newark River.

3.4.1.2 Site Geology

The PUEC site lies on a segment of the pre-glacial Portsmouth River Valley that trends north-south and is separated from the Scioto River by a series of low-lying hills. At the site, the Portsmouth River Valley is approximately 1 mile wide.

Bedrock consists of interbedded sandstones and shales, which are relatively impermeable. The Sunbury Shale is the uppermost bedrock unit over most of the southern and eastern portion of the site. It is approximately 19 feet thick, but at the site, erosion has removed about half its thickness, leaving a unit about 10 feet thick. The Berea Sandstone lies beneath the unconsolidated deposits over the northern and western portions of the site, or under the Sunbury Shale where it has not been completely eroded (in the southern and eastern portions of the site). The Berea is about 30 feet thick.

Overlying the bedrock are river deposits laid down by the Portsmouth River. The Gallia Sand, as this formation is known, consists of silty to clayey sand and gravel. This unit usually contains more than

30 weight percent silt and clay. The average thickness of this unit is about 5 feet, although in some places it does not appear to be present.

Lacustrine deposits are present over most of the sites. These deposits and the soils derived from them are exposed at the surface, or they may lie beneath a thin veneer of fill emplaced during construction of the plant. These fine-grained sediments are known as the Minford Clay member of the Teays Formation, and consist primarily of silts and clays. The Minford Clay may be as thick as 40 feet at the site.

Small areas in the southern portion of the site contain alluvium and colluvium. Areas along Little Beaver Creek may also contain alluvium. This material is found primarily below elevations of 630 feet, which is the approximate bottom of the Portsmouth River channel. There erosion has removed the lacustrine and fluvial deposits, and bedrock is obscured by the alluvium or the colluvium.

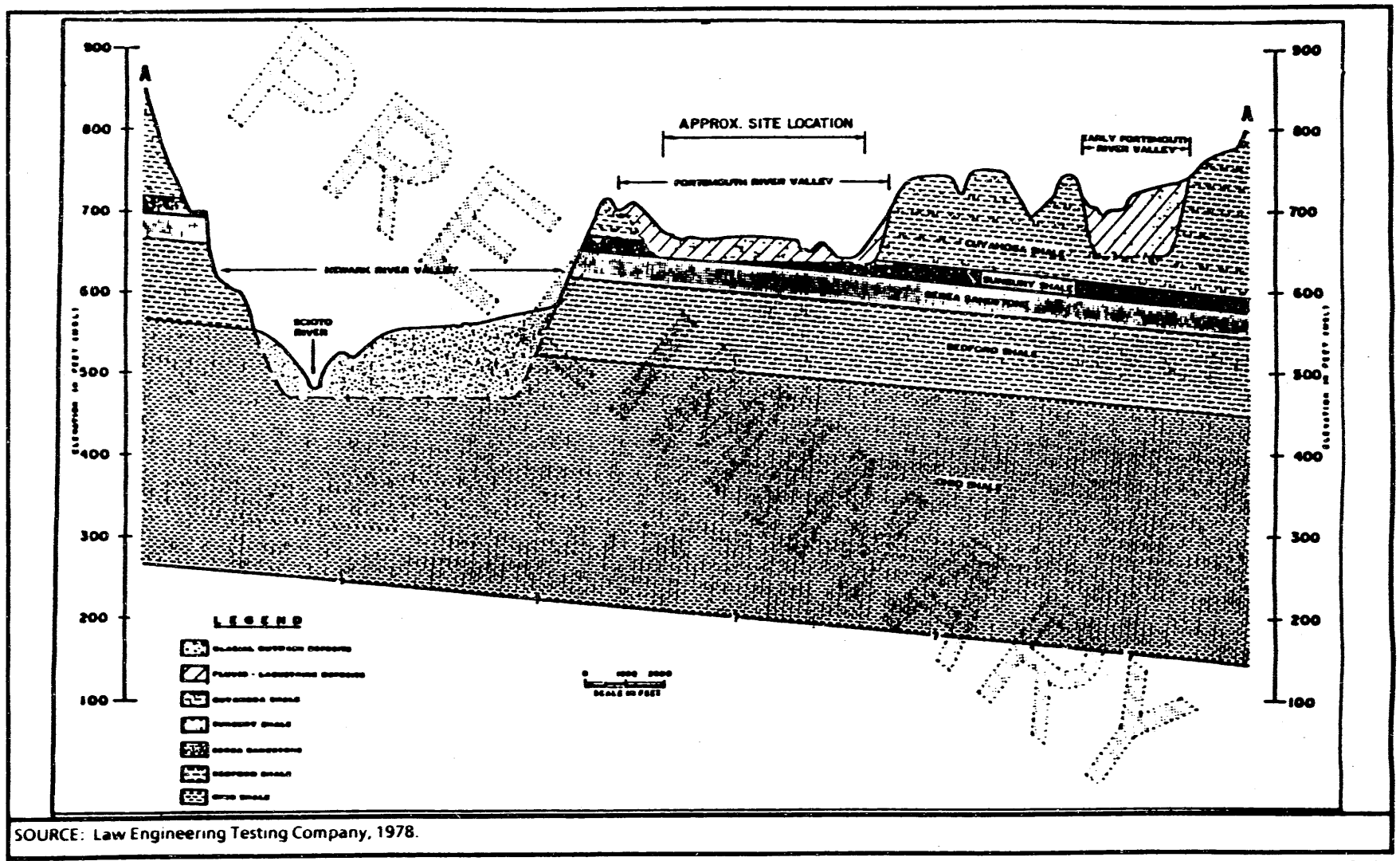
Fill emplaced during facility construction occupies a significant portion of the area within the perimeter road. The original ground surface was cut and filled to provide flat land for construction. As much as 29 feet of fill may have been placed in drainage channels to bring them to grade. After leveling, crushed stone was placed in construction staging areas.

Figure 3-9 is a generalized geologic cross-section that presents the spatial relationships between the units described above.

3.4.1.3 Hydrogeology and Groundwater Use

There are two types of aquifers in Pike County--the consolidated rocks, which can be generally characterized as poor aquifers, and the unconsolidated materials, which are good to excellent aquifers.

The sandstones and shales yield small amounts of hard water that may be adequate for domestic use. Locally, wells in the bedrock yield an average of 5.6 gallons per minute (gpm), although many dry holes have been drilled (Law Engineering Testing Company, 1982). Bedrock well yields are generally greater in valley bottoms than on adjoining hills (Ohio Department of Natural Resources, 1953). The occurrence of water in these rocks depends primarily on the presence of fractures and bedding planes (secondary porosity). Most of the residential wells in the area are completed in the fractured bedrock, usually at depths of 150 to 200 feet. These open boreholes usually intercept a number of



SOURCE: Law Engineering Testing Company, 1978.

FIGURE 3-9

GENERALIZED GEOLOGIC CROSS-SECTION
PUEC – PIKETON, OHIO

fractures or bedding planes, which provide a reliable amount of water from several small sources. Water from the bedrock aquifer can be high in dissolved solids (approximately 2,900 mg/l) and total hardness (approximately 1,300 mg/l). A low pH could be expected in the shales; a pH of 4.1 has been reported (Law Engineering Testing Company, 1982). Based on 17 packer-type permeability tests for which flow was measured, the Bedford Shale has a geometric mean hydraulic conductivity of 2.66×10^{-5} cm/sec in the site vicinity (Law Environmental Testing Company, 1978).

The unconsolidated sediments in the Portsmouth River valley are fluvio-lacustrine deposits of the Teays Formation. The basal unit, which rests on bedrock, is the Gallia Sand member, a clayey-silty sand. The Gallia is overlain by the Minford Clay member.

At PUEC, the Gallia is capable of yielding moderate amounts of water and has a hydraulic conductivity of 10^{-2} to 10^{-3} cm/sec. Local flow directions are, for the most part, toward surface water bodies (i.e., streams) where the groundwater is believed to discharge. However, the regional flow within the Portsmouth River Valley is thought to be from north to south, generally following topography, with the final discharge point as the Ohio River. Although the overlying Minford Clay has very low vertical hydraulic conductivity (10^{-8} to 10^{-9} cm/sec; Geraghty and Miller, 1986a), it does not act as a confining layer for the Gallia Sand. The clustered monitoring wells on-site revealed virtually no difference in hydraulic head between the shallower wells screened in the Minford Clay and the deeper wells screened in the Gallia Sand (Geraghty and Miller, 1986a). At times during the subsequent sampling and water-level measurements, the water levels indicated a slight downward gradient, while at other times, the water levels indicated a slight upward gradient. This would suggest that the Minford retards vertical flow and, therefore, downward movement of water in the clay is extremely slow. However, the two formations can be considered to act as one unconfined aquifer. The degree of connectiveness between the Gallia Sand and the underlying bedrock aquifers used by local residents is not known. Groundwater studies at the site have primarily been limited to the unconsolidated sediments of the Portsmouth River Valley. In addition, the relationship between groundwater in the Portsmouth River Valley and the Scioto River Valley is not known. Some nearby residents are using the deep, fractured bedrock as their domestic water supply, but most are using municipal water from wells along the Scioto River. On-site groundwater contamination appears to be confined to the unconsolidated sediments of the Portsmouth River Valley (the Gallia Sand in particular), but the risk of residential well contamination cannot be ruled out.

The unconsolidated sediments are the major source of water in Pike County. The alluvial material in the former Newark River Valley (presently occupied by the Scioto River) is the source of water for the County water system. The alluvium in the valley is 60 to 100 feet thick and consists of sand and gravel lying beneath more recent silts. The sand and gravel rest on shale bedrock. The thickness of the sand and gravel and the proximity to the Scioto River are the reasons for the large supply. Pumping wells near the river induces infiltration from the river to the sand and gravel. PUEC has the capability of pumping as many as 20 million gallons per day from 31 wells along the river. The Scioto River alluvium contains good quality water with a pH of about 7. Total dissolved solids are appro imately 350 mg/l, and hardness is about 300 mg/l (Law Engineering 1982). Although iron may be higher than the Secondary Drinking Water Standard of 0.3 mg/l, its presence would not be likely to cause adverse health effects in consumers. The geometric mean hydraulic conductivity for two wells in the area was reported as 8.2×10^{-2} cm/sec (Law Engineering, 1982).

3.4.2 General Description of Pollution Sources and Controls

PUEC staff have, over the years, identified a number of actual and potential sources of groundwater contamination. As a result of this identification, a number of monitoring wells were installed around various facilities. The major sources of actual and potential groundwater contamination are as follows:

- X-701B Holding Pond that receives trichloroethylene (TCE) contaminated water via direct discharges, pipeline leakage, and/or accidental spillage from unidentified sources.

- X-600A Coal Pile, X-231A and X-231B Oil Biodegradation Plots, and the X-749A Classified Material Burial Area, which may act as source areas for contaminated groundwater observed in a number of the monitoring wells in this area. Infiltration of precipitation will remove contaminants from the coal or the soil and transport them to the groundwater.

- X-749 Contaminated Material Disposal Facility, where wastes may be in contact with the groundwater.

- X-616 Chromate Sludge Lagoons and nearby, unidentified sources of organic compounds. These entities have contributed to groundwater contamination, via leaking process lines, leaching through the sludge, or some other (unidentified) avenue.

- X-734 and X-735 Sanitary Landfills, where buried wastes are the source of elevated total organic carbon (TOC) levels found in the groundwater.

- The X-705 Decontamination Building, where leaking pipelines and accidental spillage could be the avenue by which groundwater has become contaminated with TCE. The facility has no monitoring wells, but it is known that groundwater in this area is contaminated.

These areas and several other potential sources of groundwater contamination are discussed in greater detail in Section 4.5.

At present, there are neither institutional nor physical controls on most of the identified sources of groundwater contamination; hence these areas will continue to act as sources in the near-term. Surface-water diversion ditches at the coal pile function as a physical control by intercepting some of the contaminated runoff that would have otherwise percolated to groundwater. The diversion ditches are discussed in more detail in Section 3.3 and Section 4.1.

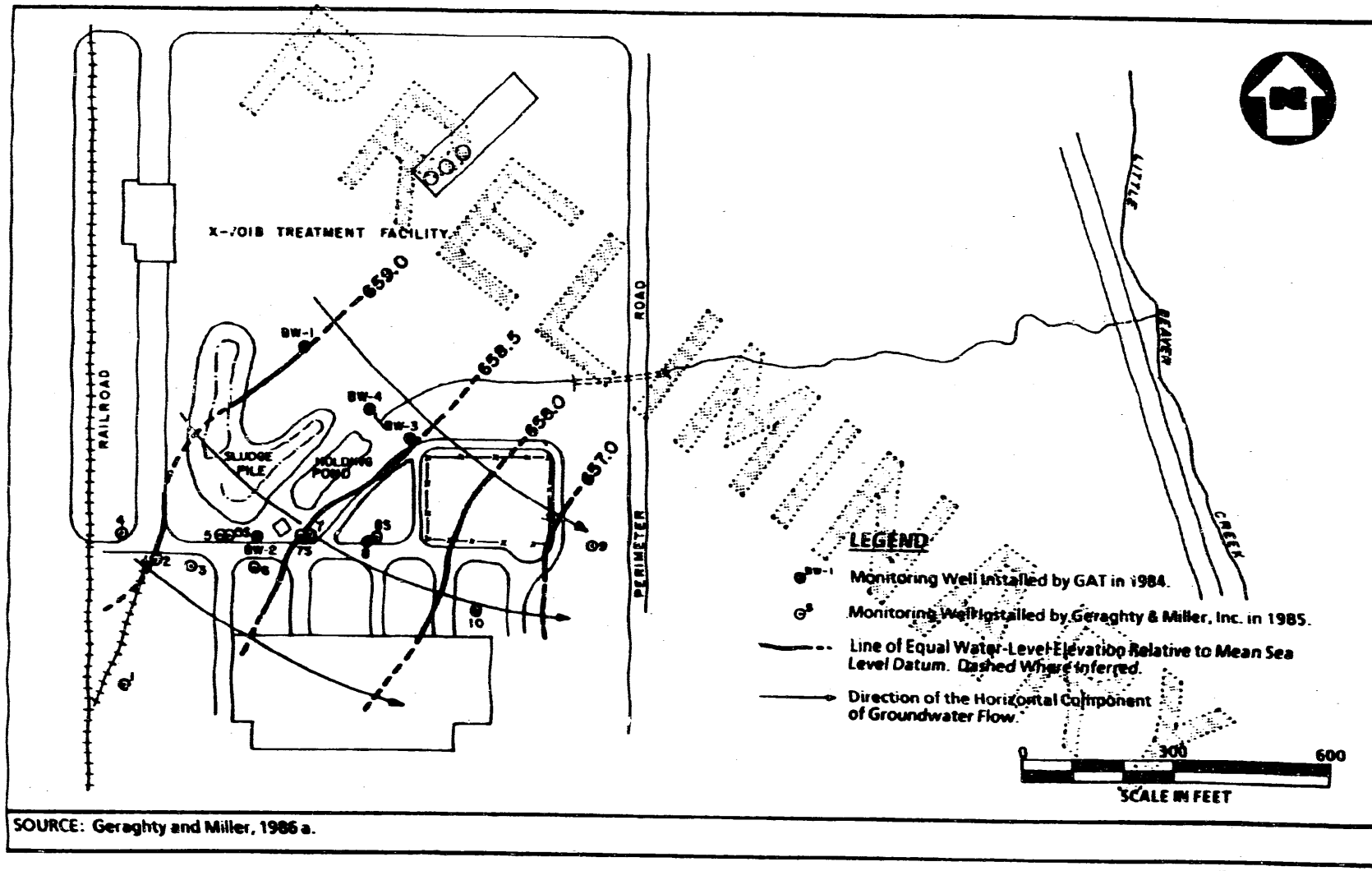
3.4.3 Environmental Monitoring Data

3.4.3.1 Well Installation

There are 67 active monitoring wells. They are identified and sampled as follows:

Facility	Number of Wells	Frequency	Facility	Number of Wells	Frequency
X-616	8	Quarterly	X-749A	7	Semiannually
X-231B	6	Quarterly	X-749C	7	Semiannually
X-701B	13	Quarterly	X-735	7	Semiannually
X-749	14	Quarterly	X-734	3	Semiannually
X-231A	5	Quarterly			

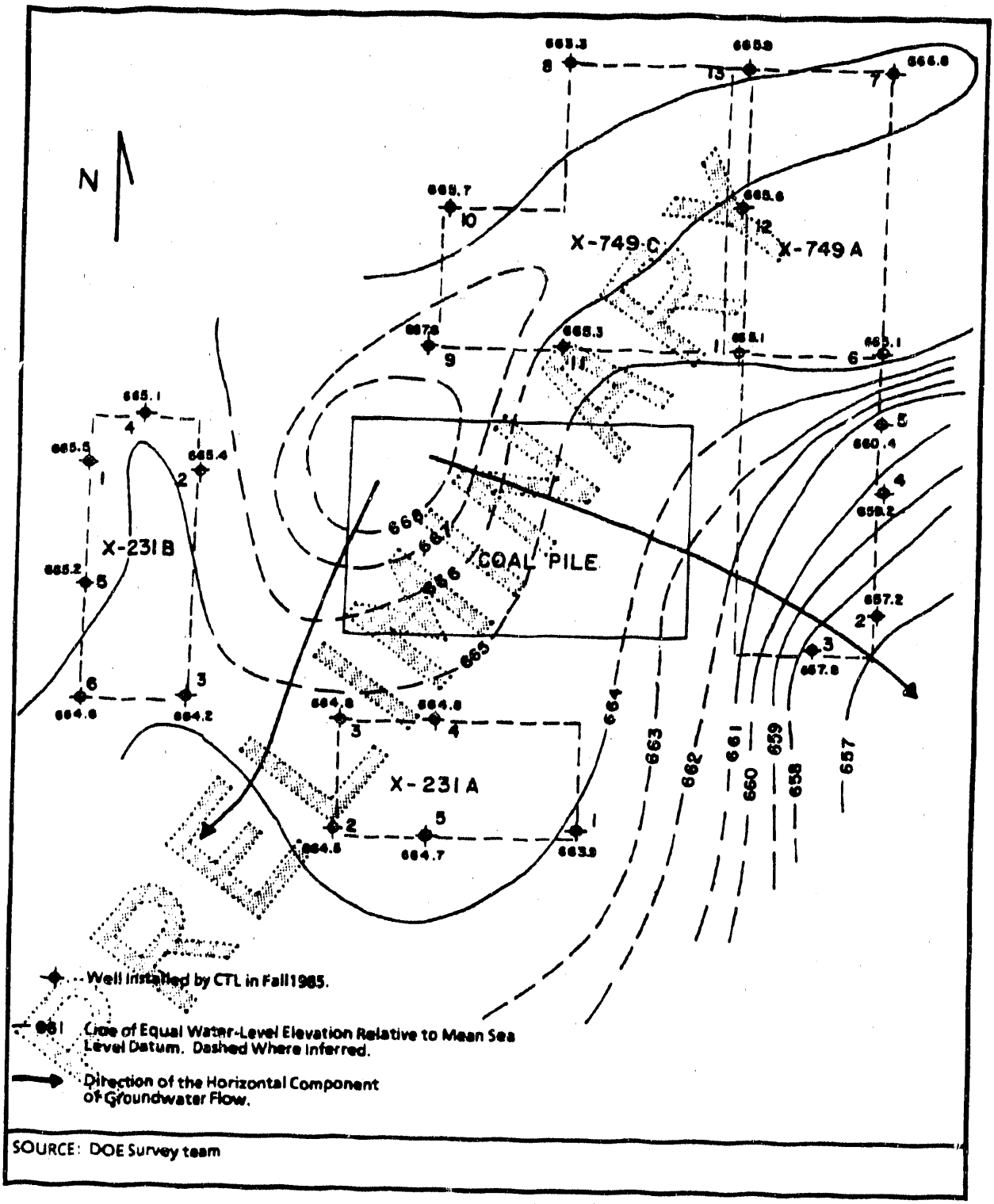
Figures 3-10 through 3-14 show approximate well locations. Each of the wells currently monitored at X-616, X-231A, X-231B, X-701B, X-749, X-749A, and X-749C is constructed of 2-inch-diameter stainless steel and outfitted with bladder pumps. The older wells at some of these facilities were constructed of 6-inch-diameter polyvinyl chloride plastic (PVC), sections of which were glued together. They



SOURCE: Geraghty and Miller, 1986 a.

FIGURE 3-10

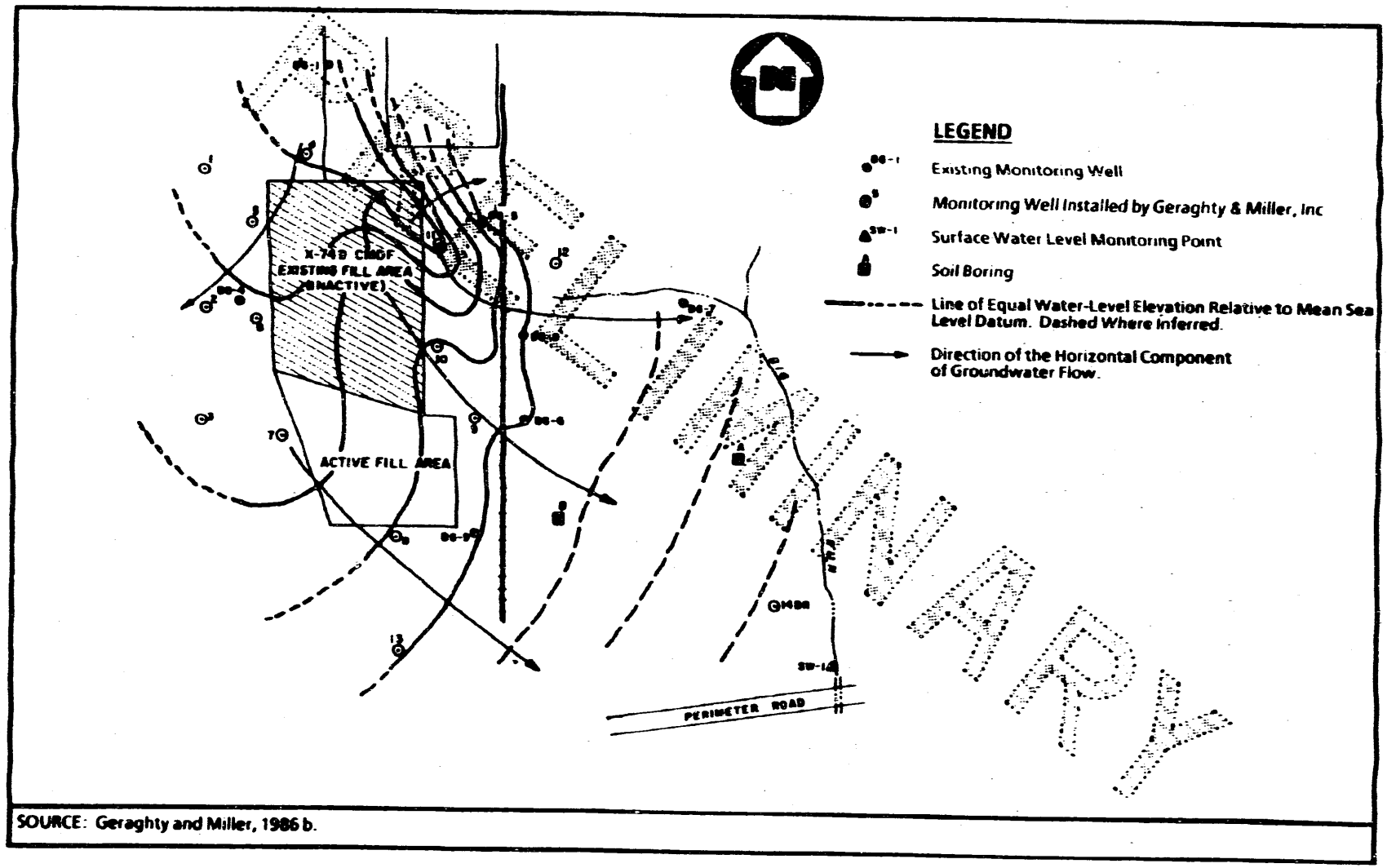
X – 701B
MONITORING WELL LOCATIONS & WATER TABLE CONTOURS
PUEC – PIKETON, OHIO



SOURCE: DOE Survey team

FIGURE 3-11

X-600A AREA
MONITORING WELL LOCATIONS & WATER TABLE CONTOURS
PUEC - PIKETON, OHIO



SOURCE: Geraghty and Miller, 1986 b.

FIGURE 3-12

X – 749
MONITORING WELL LOCATIONS & WATER TABLE CONTOURS
PUEC – PIKETON, OHIO

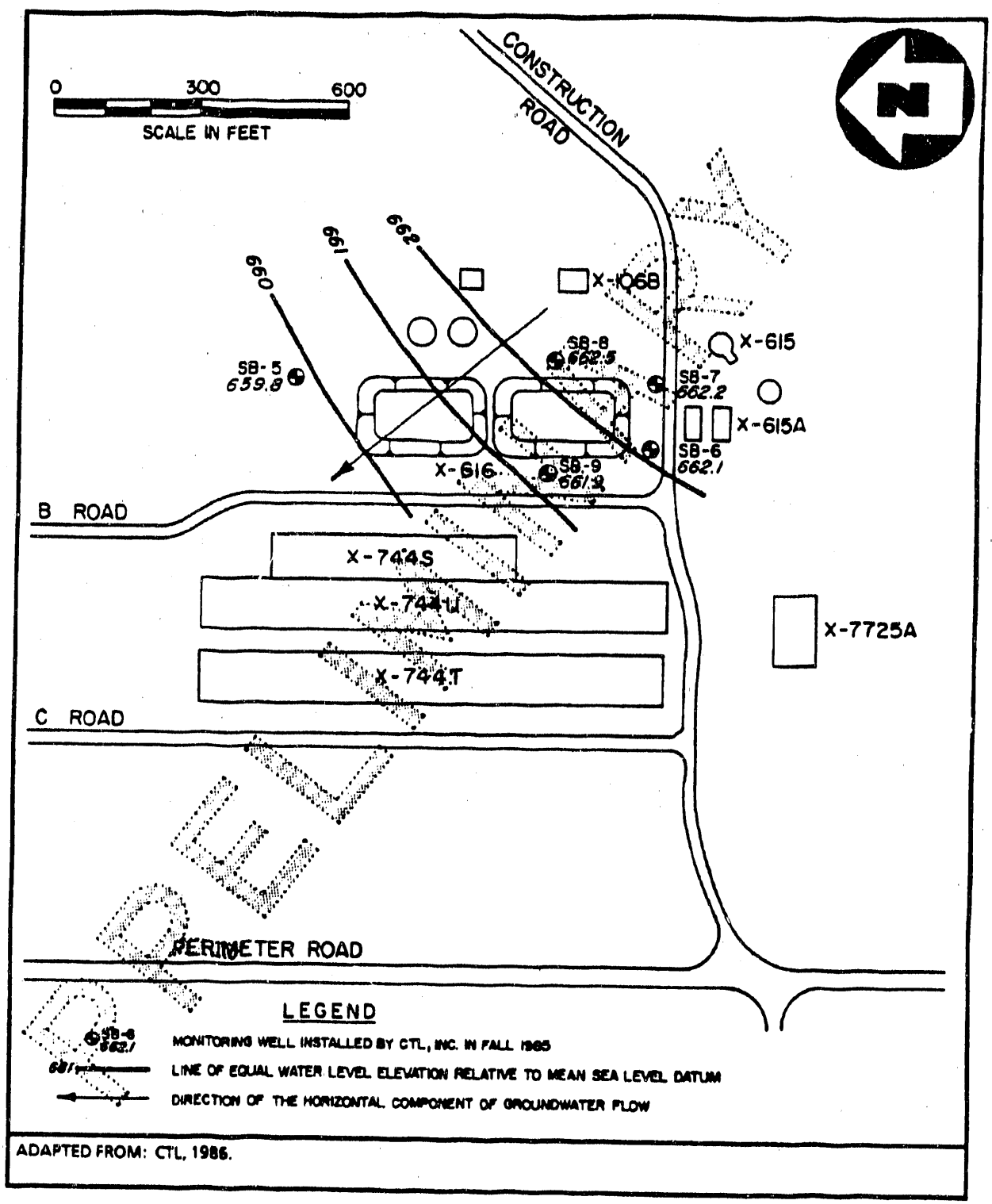


FIGURE 3-13

X-616 AREA
MONITORING WELL LOCATIONS & WATER TABLE CONTOURS
PUEC - PIKETON, OHIO

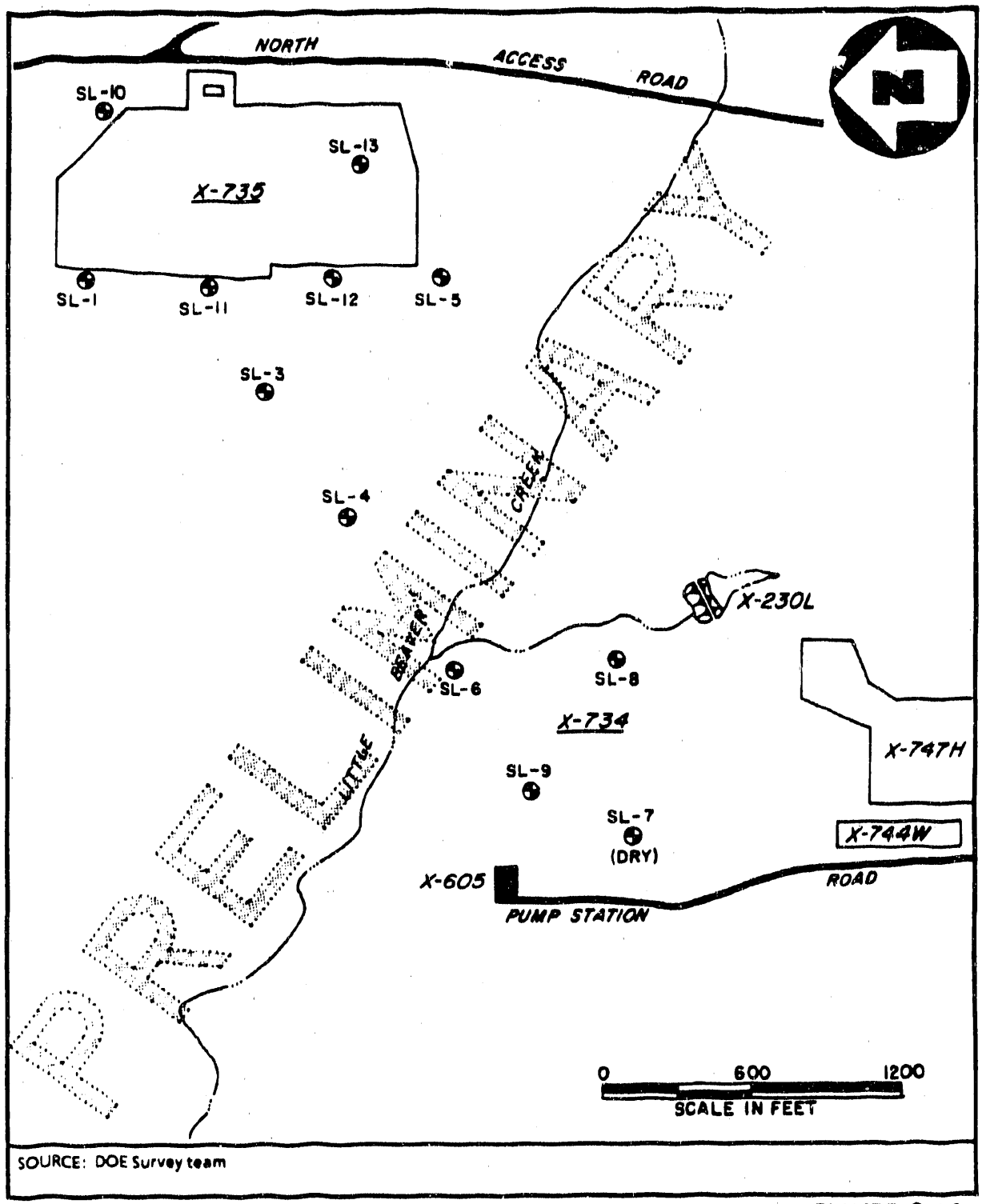


FIGURE 3-14

X-734 & X-735 AREAS
MONITORING WELL LOCATIONS
PUEC - PIKETON, OHIO

were also outfitted with submersible pumps. It was these factors which prompted EPA to request new wells that meet RCRA requirements. Construction (as-built) diagrams are available for the new wells built in 1985. However, the 6-inch-diameter PVC wells at X-734 and X-735 have not been replaced.

The following paragraphs describe in some detail the history of well construction at the nine facilities listed above.

X-701B

In 1953, one monitoring well was installed on the southeastern edge of the holding pond. For several years, it was analyzed for hexavalent chromium, nickel, fluoride, uranium, and gross alpha and beta activities. The well was sampled on numerous occasions, but most contaminants were found at or near the instrument detection limits. This original well has been grouted shut.

As part of the expansion of the groundwater monitoring network in 1984, four additional wells were installed. The four new wells were sampled after their completion in early 1985. At that time, a 1.65-foot-thick layer of separate phase TCE was found at the bottom of Well BW-2 (Geraghty and Miller, 1986a). The presence of this dense, non-aqueous phase liquid, coupled with inadequate well construction techniques (wells were made of 6-inch-diameter PVC that was glued together), prompted PUEC to hire Geraghty and Miller, Inc., for a detailed site investigation.

In the fall of 1985, Geraghty and Miller, Inc., installed 13 monitoring wells, including three sets of clustered wells.

X-600A Area (including X-231A, X-231B, X-749A, and X-749C)

The wells installed around these facilities were all completed in 1985 during single-effort investigations related to RCRA activities.

X-749

In 1953, four bedrock monitoring wells were installed. Through 1983, no appreciable differences in groundwater quality were seen between the upgradient and the downgradient wells. Five additional 6-inch PVC wells were installed during the fiscal 1984 effort. No analytical data are available for those five wells. All nine wells are presently inactive.

In the fall of 1985, Geraghty and Miller, Inc., installed 14 additional wells, all but one of which were screened at the base of the unconsolidated materials (in the Gallia Sand). The 14th well, located near Big Run, is screened in the bedrock. No additional wells are planned at this time.

X-616

Four 6-inch-diameter PVC wells were installed initially (1984) at this facility. These were replaced in 1985 by five wells meeting current guidance on well construction techniques.

X-734/X-735

In 1978, four 6-inch-diameter PVC wells were installed at X-734. In 1981, Johe et al., (1981) reported that the wells were about half silted in, a fact that makes their data on groundwater quality and flow less than reliable. In addition, the upgradient well (SL-7) is dry. None of these wells is scheduled for replacement.

In 1977, during an initial investigation for siting X-735, five 6-inch-diameter PVC wells were installed. When the new landfill opened in 1981, three additional wells were installed. As with the wells at X-734, most of these wells are partially silted-in. Thus, the data generated on them is unreliable.

3.4.3.2 Groundwater Sampling and Analysis

The on-site wells that are being sampled quarterly (X-616, X-231B, X-231A, X-701B, and X-749) are analyzed for the following parameters:

Indicator Parameters

Total organic halogens (TOX)	Total organic carbon (TOC)
Specific conductance	pH

Water Quality Parameters

chloride	iron	manganese	phenols
sodium	sulfate		

Interim Primary Drinking Water Standards

arsenic	barium	cadmium	chromium
lead	mercury	selenium	silver
endrin	lindane	methoxychlor	toxaphene
2,4-D	2,4,5-TP(Silvex)	radium	fluoride
gross alpha	gross beta	fecal coliform	nitrate

Additional Parameters

uranium	molybdenum

The wells being sampled semiannually (X-749A, X-749C, X-734, and X-735) are being analyzed for the following parameters:

- Chemical oxygen demand (COD)
- Total dissolved solids (TDS)
- TOC
- Chlorides
- Methylene blue active substances (e.g., detergents and other surfactants, and anionic substances)

Sample collection techniques, as observed during the Survey, are defined in the Sampling and Analysis Plan (GAT, undated a). Water levels in the wells are measured to the nearest tenth of a foot prior to removing any water from the wells. After all water levels are recorded, each well is purged using the bladder or submersible pumps until two well volumes are removed and the pH and conductivity have stabilized. First, coliform samples are collected from each well and delivered to the PUEC laboratory because of the time needed for sample preparation prior to analysis. The samplers then return to the wells to collect the remaining samples.

A 45-micron, high capacity, on-line filter is used to filter metals samples in the field. By filtering the samples, only dissolved metals can be analyzed. Suspended metals are not analyzed at the site, contradictory to the guidance presented in the PUEC sampling and analysis plan.

Each well is monitored for indicator parameters and water-quality parameters during a detection monitoring program as required by RCRA. Four replicate analyses are performed for each of the indicator parameters. At the time of the Survey, the facility had collected three sets of quarterly samples.

Residential wells are sampled semiannually and analyzed for uranium and gross alpha and beta activities, none of which have ever been found at levels that exceed the detection limits. Approximately eight wells are presently in the sampling network, but some of these wells are used for potable water supply. Water supply wells may be inappropriate for use as groundwater monitoring wells for several reasons. First, aeration caused by use of a submersible pump may strip volatile organics before they can be sampled and analyzed from the water. Second, since supply wells typically have extended screens reaching well below the water table, any contamination may be diluted by mixture with relatively clean water from other depths. Finally, potable water supplies may be treated by domestic water softeners that may cause some contaminants (e.g., metals) to precipitate before they can be sampled and analyzed. Hence, potable water supply wells cannot provide dependable groundwater monitoring information, but rather should be considered indicators of contamination from the tap at the time the sample is taken. PUEC has encountered difficulties in finding residential wells to sample because many of the residences are being hooked up to the municipal water supply. Most of the wells that the facility sampled in 1979 at the inception of its residential well sampling program have since been plugged as the owners change to public water. PUEC is attempting to identify additional residential wells in the area that are suitable for the sampling program.

3.4.4 Findings and Observations

3.4.4.1 Category I

None

3.4.4.2 Category II

1. Potential Radionuclide Contamination in Off-Site Wells. - There is a potential for undetected contamination of off-site wells with radionuclides.

The degree of connectivity between the Gallia Sand, which is contaminated on site, and the bedrock aquifer, which is the source of domestic water supplies in the area, is not known. In addition, sampling procedures in residential wells may mask any contamination that is present. Samples are collected from an outside tap, which may be filtered, rather than from a point in the line upstream of any water filters or softeners. The presence of

these devices could result in underestimation of radionuclide concentrations by removal of minerals or organics to which radionuclides may be complexed.

Although the nearest offsite well is more than 0.5 miles from the site and the levels of radionuclides in onsite wells are low, current information is inadequate to dismiss the potential for offsite transport of contaminants. PUEC indicated to the Survey team that it intended to note the presence of filters and softeners in future residential well sampling.

2. Underestimation of Volatile Organic Concentrations - Concentrations of volatile organic compounds in groundwater may be underestimated as the result of improper sampling procedures.

   Sample pump flow rates are not properly adjusted and cause excessive agitation, which may purge organics from the sample. In addition, sample containers were not completely filled, a factor which permitted volatile organics to diffuse from the water into the trapped air (see Finding 3.4.4.4.1).

3. Analysis of Groundwater for Pesticides - See Finding 3.3.4.2.3.

3.4.4.3 Category III

1. Known Groundwater Contamination - Groundwater in four areas of the site is known to be contaminated with radioactive and hazardous constituents as a result of both past and ongoing site activities.

   The full nature and extent of contamination at areas known to be contaminated is currently unknown but is under investigation. There are additional areas of potential groundwater contamination for which no groundwater sampling has been performed. The physical characteristics of both the actual and potential sources of groundwater contamination are discussed in detail in Section 4.5, whereas the known nature and extent of groundwater contamination is discussed below.

   - East Central Area

     The groundwater in the east-central portion of PUEC near the X-701B holding pond is known to contain TCE and radionuclides, but the existing monitoring well network

does not define the full extent of the contaminant plume. Even though a number of wells had been installed in this area prior to 1985 (see Section 3.4.3.1), little was known about water quality except for the existence of pure TCE (1.65-foot-thick layer) at the bottom of one well. Later well installation by Geraghty and Miller, Inc., has shown that the separate TCE layer is apparently limited to the area immediately adjacent to well BW-2. None of the other wells in the area of X-701B have been found to contain a separate phase of TCE, although it could be expected to appear in MW-6 (renamed "X-701-6" in 1987), based on local bedrock contours. The separate phase of TCE is an accumulation of the chemical at concentrations that exceed its water solubility. The movement of a pool of a heavier-than-water contaminant such as TCE is controlled primarily by gravity. The dense liquid will generally flow along an impermeable boundary (in this case, bedrock). PUEC stated that, "Present evidence indicates the groundwater flowing over the separate phase is being contaminated and is migrating, but that the separate phase is generally limited and not moving."

The TCE may have reached the base of the aquifer either through fractures in the Minford Clay or through a breach in the clay made during pond construction or process line installation (Geraghty and Miller, 1986a). This pool of separate phase TCE, as well as residual soil contamination, is probably acting as a continuous source of TCE to the plume. Other potential or actual sources of contamination at X-701B are discussed in more detail in Section 4.5.1.1.

According to Geraghty and Miller, (1986a), groundwater flows southeastward toward Little Beaver Creek, where it probably discharges. Additional wells are needed to confirm that groundwater discharges to the creek. Depending on the hydraulic gradient, contaminated groundwater may discharge to the East Drainage Ditch, and from there flow to Little Beaver Creek. This situation could also affect aquatic life in the creek. The Ambient Water Quality Criterion for TCE is 21,900 µg/l.

The available analytical data show that dissolved TCE was found at its highest concentration of 790,000 µg/l (which is about 70 percent of its theoretical solubility) in well MW-9 (renamed "X-701-9 in 1987), which is farthest from the pond (Geraghty and Miller, 1986a). These data indicate that the plume is probably much more extensive than was previously thought and has probably passed beyond the limits of the perimeter road. The plume also appears to be relatively narrow, perhaps because of

the high permeability and the thickness of the Gallia Sand, which together would limit dispersion. Table 3-8 presents the analytical results for samples collected at the facility.

TCE has been identified by the USEPA as a probable human carcinogen. The Maximum Contaminant Level for TCE is 5 µg/l, while the Maximum Contaminant Level Goal is zero (EPA, 1987). The TCE concentrations found in the wells in the X-701B area make this water unsuitable for consumption.

The wells containing the highest levels of TCE also showed the highest beta activities. Technetium-99 is very mobile in groundwater and might be expected to move more rapidly than the volatiles, based on a soil/sediment adsorption coefficient (log_{10}) of 1.3 in soil with about 45 percent clay (Hoeffner, 1985) and a Kd of 2.09 for TCE. The higher the number, the greater the affinity for organic carbon in soil or sediment. Hence, technetium will move approximately 10 times faster than TCE.

Geraghty and Miller, Inc., recommended the installation of 11 additional monitoring wells to define the extent of the plume, as well as the installation of a number of well points to investigate the limits of the TCE layer (Geraghty and Miller, 1986a). If the plume is not fully identified, the remedial actions selected for site closure may not fully remove groundwater contamination and may therefore not eliminate the potential for offsite migration and discharge. However, it is unlikely that any residential wells will be adversely affected by such migration because of their distance and depth.

Another potentially significant area of groundwater contamination at PUEC is near the X-705 Decontamination Building. There is indirect evidence to suggest that the groundwater beneath and around X-705 is contaminated by TCE, but sources are not identified. PUEC collected samples from each of two groundwater sumps. The analytical results indicate a potential groundwater contamination problem. According to PUEC personnel, the southern sump contained 13.5 mg/l TCE.

Groundwater sumps collect water from French drains beneath the building, and when the water reaches a certain level, the pumps are activated. The water from the southern sump is discharged either to the X-701B Holding Pond or to the D and E Storm Sewer, which empties to the East Drainage Ditch. At the time of the survey,

TABLE 3-8

SELECTED ANALYTICAL RESULTS
X-701B HOLDING POND MONITORING WELLS
MAXIMUM DETECTIONS BETWEEN NOVEMBER 1985 AND MAY 1986
PUEC - PIKETON, OHIO

Analyte	MW-1	MW-2	MW-3	MW-4	MW-5	MW-5S	MW-6	MW-7	MW-7S	MW-8	MW-8S	MW-9	MW-10
Total organic carbon (mg/l)	5.4	5.17	4.44	5.47	5.47	3.30	4.76	175	6.72	331	15.7	378	32.38
Gross alpha (pCi/l)	–	–	–	5.4 ± 2.6	7.5 ± 2.7	7.0 ± 2.6	7.7 ± 3.6	–	11 ± 3	–	17 ± 5	–	26 ± 5
Gross beta (pCi/l)	63 ± 8	5.6 ± 2.4	–	9.5 ± 2.5	11 ± 3	14 ± 3	11 ± 3	3,915	18 ± 3	1,152	190	298	31 ± 4
Trichloroethylene (mg/l)	–	0.003	0.003	0.027	0.005	0.018	0.057	320	0.022	750	44	790	7.6

Source: Adapted from Goodyear Atomic Corporation. Unpublished Quarterly Monitoring Data, (1986b). Geraghty and Miller, Inc., (1986a).

the water was discharging to X-701B. The water from the northern sump is discharged to the D Sewer.

Survey-related sampling is planned for the inflow to both sumps. The samples will be analyzed for TOX, TOC, gross alpha and gross beta activities, and nitrate to reflect the building processes.

- North Area

Based on the historic COD and TOC values exhibited by monitoring wells in the north area of PUEC, it is likely that groundwater in this area is contaminated by wastes buried in the landfills. In addition, there is a potential for contamination of Little Beaver Creek from discharge of groundwater to the stream. COD was as high as 345 mg/l (Well SL-6) and TOC was as high as 27.3 mg/l (Well SL-9) (Johe, et al., 1981). For comparison, TOC ranged from 3.3 mg/l to 378 mg/l at X-701B. These buried wastes will continue to act as a source of groundwater contamination generated by infiltrating precipitation. No specific organics analysis data was available for these wells. Survey-related sampling is planned.

Based on topography and geology, the survey team has determined that groundwater probably flows toward Little Beaver Creek from both landfills. However, the monitoring wells at both landfills are partially silted in making the data on groundwater quality and flow direction unreliable. In addition, the upgradient well at X-734 is dry; therefore there are no upgradient water-quality data at that facility.

- South Area

The groundwater in the south area of PUEC is known to be contaminated, primarily by the acidity associated with drainage from the coal pile. This low pH can readily mobilize metals and other hazardous constituents. Thus, the levels of contaminants would increase beyond that which would be expected from normal leaching processes.

Potential sources of contamination in this area include the X-600A coal storage area, the X-231A and B Oil Biodegradation Plots, the X-230K South Holding Pond, the Peter Kewitt & Sons Landfill, the X-749A classified materials disposed facility, and the

X-749 contaminated materials disposal facility. The X-600A coal pile is a likely source of acidic infiltration in the south area. These potential sources are described in more detail in Section 4.5.2.

Acidic leachate from the X-600A coal pile would be expected to contain high concentrations of iron, aluminum, and manganese. Excessive iron (up to 18.0 mg/l in MW-2 at X-231B versus a Secondary Drinking Water Standard of 0.3 mg/l) and low pH (between 5.6 and 6.4) are found in many of the surrounding wells.

Another potential source of groundwater contamination is associated with the nearby X-230K South Holding Pond (see Finding 3.3.4.2.1). Both the sediments in the pond and the sediments dredged from the pond, which are stored nearby, could be a source of acidic recharge to the groundwater beneath the pond or the spoil pile (see Finding 4.5.2.3.3). The X-230K South Holding Pond receives runoff from X-600A coal storage area, the X-231A and B Oil Biodegradation Plots, and the X-749A landfill as well as miscellaneous storm sewers in the southern section of PUEC. The sewers may have conveyed spills to X-230K. The X-231A and B oil plots and X-749A landfill may be direct source of groundwater contamination in addition to their contribution of contaminated runoff to X-230K, which may serve as a recharge basin. It is unknown, however, when or if the pond recharges the groundwater.

Because PUEC has conducted only detection monitoring at the wells near X-600A (see Section 3.4.3.2), it is unknown (but suspected) that contaminants found in the soils have reached the groundwater. TCE was found at concentrations up to 12,000 µg/kg, and 1,1-trichloroethane was found at concentrations up to 1,100 µg/kg in soil samples from X-231B. In addition, PCE (110 µg/kg) and Freon-113 (500 µg/kg) were also detected (Geraghty and Miller, 1986c). The presence of these organic compounds in the soils indicates that oily wastes containing solvents were probably land treated at this facility and that groundwater contamination is likely. In fact, these wastes may be contributing to the observed levels of TOC in the wells near X-231A and B.

Four facilities in the area (X-231A, X-231B, X-749A, and X-749) have their own monitoring well networks. Well locations are shown in Figure 3-11. Because each of the wells is currently being monitored for different parameters and on different schedules, the extent of contamination is difficult to determine. However, groundwater contours from the wells in the immediate vicinity indicate that the coal

pile may be a major source of groundwater recharge in the area. When PUEC's "X"-site boundaries of the five facilities are ignored, the contours shown in Figure 3-11 can be drawn. The contours beneath the coal pile itself are unknown, but the water levels measured in the fall of 1985 (not all were measured on the same day but they are still valid for drawing general conclusions) indicate that groundwater flows somewhat radially from the pile. This radial flow means that contamination problems can spread in all directions. However, contours in the northwestern corner of this area have not been determined because there are no wells in that area.

PUEC has performed more detailed monitoring around the groundwater surrounding the X-749 facility, which is contaminated with volatile organic compounds and radionuclides. The existing monitoring well network has shown that most groundwater contamination is confined to the wells nearest X-749 (see Figure 3-12 for well locations). More information on this source of contamination is contained in Finding 4.5.2.3.2. According to Geraghty and Miller, Inc. (1986b), groundwater flows generally southeastward toward Big Run, where it probably discharges. However, the low permeability of the shale bedrock in that area impedes groundwater flow to the stream. The plume has not been shown to have approached the stream as of January 1986.

Gross alpha activity in MW-10 (18 pCi/l) exceeded the drinking water standard of 15 pCi/l. Beta activities were as high as 288 pCi/l. The most recent guideline for technetium in drinking water is 5,000 pCi/l, which would yield a 4 mrem/year dose (EPA, September 30, 1986). Many of the wells immediately surrounding X-749 to the east, west, and south contained significant levels of volatile organic compounds. 1,1,1-trichloroethane was found at concentrations up to 9,400 µg/l in MW-10 (Maximum Contaminant Level Goal = 200 µg/l), TCE was found at concentrations up to 6,100 µg/l (MCLG = zero, proposed MCL = 5 µg/l), and 1,1-dichloroethylene was found at 2,300 µg/l (MCLG = 7 µg/l, proposed MCL = 7 µg/l). These levels of organic compounds may be reflected in the TOC concentrations found in these wells (up to 8.5 mg/l).

- Miscellaneous Areas

There are several areas at PUEC that are suspected of having contaminated groundwater. These area are described in more detail in Section 4.5.2. Of the areas,

only one, the X-616 Chromate Sludge Lagoons, have been studied for groundwater contamination.

Groundwater near the X-616 facility is contaminated with chromium and organics apparently as a result of waste disposal in the lagoons. The sludge in the lagoons may act as a source of groundwater contamination. This source of contamination is described in more detail in Finding 4.1.2.4 5 and Finding 4.5.2.3.4.

The five monitoring wells in this area contain TOC levels ranging from 3 to 8 mg/l. This indicates that there may be contamination with unidentified organics associated with past disposal practices. Chromium is infrequently detected, but was as high as 150 µg/l in well SB-5 on one occasion. This level is three times the National Primary Drinking Water Standard/MCL for chromium.

2. Comprehensive Groundwater Monitoring Plan. The groundwater monitoring activities at PUEC are inadequate to characterize the nature and extent of groundwater contamination because the wells are improperly located and many of the selected analytes are inappropriate or inadequate. Failure to analyze groundwater samples for the appropriate constituents could result in contamination going undetected.

The existing groundwater monitoring wells are essentially located as detection wells around specific, regulated or suspected sources of contamination. Wells are not consistently located to define the areal extent of contamination or to determine the groundwater flow patterns over the entire site. Failure to investigate groundwater contamination using aggregated groups of neighboring sources may result in undetected migration of contaminants. Identification of recharge and discharge areas will aid in determining the potential impacts of groundwater contamination.

In addition, PUEC's groundwater monitoring focuses narrowly on appropriate and/or technically irrelevant contaminants required for state and Federal regulatory compliance (e.g., metals and pesticides listed in 40 CFR 264.94) rather than on the particular contaminants known or suspected at a site. The facility staff were waiting to complete a full four-calendar quarters of analyses before running the Appendix IX scan; therefore, much of the chemical-specific information available is based on data collected by Geraghty and Miller, Inc., upon completion of their well installation.

3.4.4.4 Category IV

1. Groundwater Sampling QA/QC Problems. The accuracy and reliability of the data reported by the site laboratory may be suspect because of several QA/QC problems associated with PUEC sampling techniques. These problems could result in either the underestimation of some contaminant concentrations or possibly the misidentification of samples.

   - Underestimation of TOX and TOC concentrations may occur because the sample bottles were not completely filled. Volatiles in the water phase of the sample will diffuse into the air trapped in the sample bottle. Consequently, analysis of the water will give a volatile concentration less than that of the actual groundwater. In addition, the improper adjustment of the bladder pump flow rate or the use of submersible pumps in older wells (at X-734 and X-735) could purge the volatiles from the sample prior to closure of the sample bottles.

   - Use of insufficiently-insulated coolers with loose-fitting lids for sample transport will allow samples to warm and hence allow volatiles to escape the water. Levels of other contaminants could be similarly reduced.

   - Misidentification of samples could occur because non-waterproof labels are used on sample bottles and the sample bottles are not labeled with an indelible marker. Should more than one label fall off in the cooler, it would not be possible to properly identify the sample bottle unless it were marked.

4.0 NON-MEDIA-SPECIFIC SURVEY FINDINGS

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

4.1 Waste Management

4.1.1 General Description of Pollution Sources and Controls

4.1.1.1 Hazardous Wastes

Table 4-1 describes the overall sources, disposition and annual generation rates of waste at PUEC as described in Ohio EPA Disposal Questionnaires submitted by PUEC. The table was updated to reflect current conditions, practices, and generation rates based on available information and survey observations.

Resource Conservation and Recovery Act (RCRA) regulations define wastes as hazardous if they are specifically listed (e.g., chlorinated solvents) or if the waste fails one of the four characteristic tests: extraction procedure (EP) toxicity, ignitability, corrosivity, or reactivity.

PUEC generates a variety of liquid and solid hazardous wastes, including hazardous wastes contaminated with radionuclides. The hazardous wastes generated include solvent wastes generated from degreasing operations, laboratory hazardous wastes, waste acids from decontamination and maintenance operations, EP toxic sludges from the X-616 Chromium Reduction Plant, and EP toxic heavy metal sludges contaminated with uranium from the X-705 Uranium Recovery Operation. Table 4-2, adapted from the PUEC Hazardous Toxic and Mixed Waste Implementation Plan and Inventory of Wastes Requiring Incineration, describes the characteristics of hazardous, toxic, and mixed waste streams generated at Portsmouth. Potential mixed wastes not described on Table 4-2 include trap materials, uranium recovery table solids, and incinerator ash.

TABLE 4-1

WASTE DESCRIPTION
PUEC - PIKETON, OHIO

Waste Stream	Source(s)	Disposition	Annual Generation	Hazardous Waste	Radioactively Contaminated
Heavy metals sedimentation	Steam plant generation coal runoff	South Holding Pond	1,250 yd^3/year	No	No
Oils with PCB contamination >500 ppm	Maintenance activities spills from Askarel equipment	Diked storage pad	110 gallons/year	No	No
Oils with PCB contamination 50-500 ppm	Maintenance activities spills from lube oil systems	Diked storage pad	1,650 gallons/year	No	No
Oils with PCB contamination 5-49 ppm	Maintenance activities spills from lube oil systems	Diked storage pad	1,650 gallons/year	No	No
PCB-contaminated solids	Solids that have come into contact with PCB-contaminated lube oil	Diked storage pad	580 $feet^3$/year	No	No
PCB-contaminated solids	Solids that have come into contact with Askarel liquid	Diked storage pad	70 $feet^3$/year	No	No
Empty PCB-contaminated drums	Drums that originally stored Askarel	Diked storage pad	36 $feet^3$/year	No	No
Water treatment plant sludge	X-611 water treatment plant	X-611 A and B Lagoons	4.04 Mgal/year	No	No
Chromated sludge	X-616 chromate reduction facility	X-616 Lagoons	0.23 Mgal/year	Yes	Yes*
Mixed waste solvents	Laboratory areas	Hazardous waste storage facility X-752	220 gallons/year	Yes	No
Waste Solvents	X-720 paint shop	Hazardous waste storage facility	480 gallons/year	Yes	No
Kerosene/gasoline	X-750	X-752, Commercial disposal	240 gallons/year	Yes	No
Waste paint sludge	X-720 paint shop	Hazardous waste storage facility X-752	300 gallons/year	Yes	No

*Uranium content (< 10 ppm) may inhibit use of commercial treatment, storage, and disposal (TSD) facilities.

TABLE 4-1
WASTE DESCRIPTION
PUEC - PIKETON, OHIO
PAGE TWO

Waste Stream	Source(s)	Disposition	Annual Generation	Hazardous Waste	Radioactively Contaminated
Small quantities of waste chemicals	Laboratory areas	Hazardous waste storage facility	36 feet^3/year	Yes	No
Oils with PCB contamination <500 ppm	Seal exhaust vacuum pumps	Diked storage pad	275 gallons/year	No	Yes
Oils with PCB contamination >500 ppm	Seepage from contaminated expansion joints	Diked storage pad	110 gallons/year	No	Yes
Lime sludge with heavy metal contamination	X-705 recovery raffinate	Diked storage area X-7018 total containment	37,000 gallons/year	No	Yes
Cyanide solutions	X-720 silver plating operations	X-720 toxic locker	<30 gallons/year	Yes	Yes
Heavy metals sludge	X-705 raffinate treatment system	X-752	35,000 gallons/year	Yes	Yes
Ion exchange resin	X-705 raffinate treatment system	X-744-G	10 gallons/year	Unk	Yes
Degreaser sludges	X-700 and X-720 degreaser pits	X-752	720 gallons/year	Yes	Yes
Silver recovery solutions	X-100 reproduction, engineering records, X-710 laboratory, X-700 X-ray developer	NPDES outfall 003	445 gallons/year	No	No
Waste mineral oil	Process equipment and electrical equipment	Oil recycled back to equipment	2,690 gallons/year	No	No
Fluoride precipitation sludge	Electrolytic fluorine generation	X-735 sanitary landfill	3,000-17,000 kg/yr	No	No
Aqueous liquid		NPDES outfall 009A		N/A	
Chromated (Cr^{+6}) water	RCW blowdown	NPDES outfall 004/ Treated 61S Cr reduction	200 Mgal/year	N/A	No
Heavy metals liquid	Coal storage yard runoff	NPDES outfall 002A	1.9×10^7 gallons/yr.	N/A	No
Digested waste activated sludge	X-6619 sewage treatment plant	To be determined	350 lb/day	No	Yes

TABLE 4-1
WASTE DESCRIPTION
PUEC - PIKETON, OHIO
PAGE THREE

Waste Stream	Source(s)	Disposition	Annual Generation	Hazardous Waste	Radioactively Contaminated
Clariflocculation	X-705 recovery raffinate	NPDES outfall 003B	2.5×10^7 gallons/yr.	N/A	Yes
Radioactive aqueous liquid	X-705 recovery raffinate	X-6619 sewage treatment plant	1.6×10^7 gallons/yr.	N/A	Yes
Empty pesticide/herbicide containers	Weed and rodent control	X-735 sanitary landfill	Varies	No	No
Heavy metals sludge	X-621 coal pile runoff	X-735 sanitary landfill	25,000 feet^3/year	No	No
Friable asbestos	Demolition and renovation operations	X-735 sanitary landfill	1,000 feet^2/year	No	No
Grit and screenings	X-6619 sewage treatment plant	X-735 sanitary landfill	5,000 feet^3/year	No	No
Fluoride sludge	Electrolytic cell cleaning	X-735 sanitary landfill	3,000-17,000 kg/yr.	No	No
Fly and bottom ash	X-600 steam plant	Contruction spoils landfill	393,000 feet^3/year	No	No
Waste oil	Used motor oil, unreclaimable oil	Dust control[1]	3,910 gallons/year	No	No
Waste oil	Process vacuum pumps	Stored diffusion bldg.	2,900 gallons/ year	No	Yes
Trap material	Sodium fluoride or alumina traps - diffusion plant/X-705 uranium recovery	X-744G storage X-705 uranium recovery		Yes	Yes
X-701B pond sludge	X-701B Generated from treatment of miscellaneous X-705 flows including tunnel rinse and lab acids	X-701B total containment area	500 yards^3/year	Yes	Yes
Floor sweepings - PCB and oil contamination	Diffusion buildings	Storage in process buildings	108 yards^3/year	777	Yes
Burnable classified waste	Plant wide	X-705 incinerator	350 yards^3/year	No	No
Sanitary waste	Plant wide	X-735 landfill	70,000 yards^3/year	No	No
Radicator solids (incinerator)	X-705 incinerator	X-749 landfill	1,000 yards^3/year	Yes (?)	Yes

Source: 1984 Solid Waste Disposal Questionnaire (Fletcher 1984)
NA Not applicable
1 Practice ceased fourth quarter 1986.
Unk: Unknown

TABLE 4-2

CHARACTERISTICS OF HAZARDOUS, TOXIC, AND MIXED WASTE STREAMS
PUEC - PIKETON, OHIO

Name or Description	Chemical Composition	Annual Generation Rate	Treatment, Storage, or Disposal Method(s)
Chromium (+ 3) sludge	Calcium 10 wt% Magnesium 10 wt% Chromium 3 wt% Silicon 3 wt% Zinc 0.3 wt% Copper 0.06 wt% Iron 0.06 wt% Alumium 0.03 wt%	0.23 m gallons/year	Lagoon X-616 Chromium Sludge Lagoon Storage lagoon to be closed X-752
Waste solvents	Oil 50-75% Toluene 10-20% Methyl ethyl ketone 3-5% Acetone 0-5% Trichloroethylene 0-15% Xylene 0-20% Flashpoint <70°F	220 gallons/year	Storage; off-site incineration X-752
Paint waste solvents	Mineral oil 55-75% Xylene 2-15% Toluene 6-10% Methyl ethyl ketone 8-10% Trichloroethylene 1-7% Flashpoint <70°F	480 gallons/year	Storage; off-site incineration X-752
Paint shop sludge wastes	Pb 500 mg/l Flashpoint 75°F pH 6.3	300 gallons/year	Disposal at off-site landfill (ceased 11/8/86) Storage X-752
Laboratory chemicals	Varies - segregated by compatibility prior to packing into laboratory packs	36 feet^3/year	Storage; off-site landfill

TABLE 4-2
CHARACTERISTICS OF HAZARDOUS, TOXIC, AND MIXED WASTE STREAMS
PUEC - PIKETON, OHIO
PAGE TWO

Name or Description	Chemical Composition	Annual Generation Rate	Treatment, Storage, or Disposal Method(s)
Oils with PCB contamination and radionuclide contamination	PCBs 300 ppm Radioactivity, <44,000 ppm Uranium 300 ppm Solvents	2,900 gallons year	Storage
X-705 uranium recovery heavy metal sludge	Technetium, uranium, EP toxic cadmium and lead	200-300 yards^3/year	Storage X-752
X-705 resin	Uranium 10 ppm Technetium 20 ppm	4 yards^3/year	Storage
Kerosene/gasoline		240 gallons	Incineration
Hazardous liquids	Solvents/oils Solvents/aqueous	3,960 gallons	Incineration
Cyanide solution	Uranium 7.6 ppm Assay 1.15% pH 1.3 Cyanide 80-100 g/l	<30 gallons/year	Storage
Degreaser sludge	Uranium <500 ppm U-235 0.7-1.2% 1,1,1-trichloroethane Nickel <360 ppm Chromium <130 ppm PCBs <50 ppm pH 4-5	720 gallons/year	Storage
X-701B pond sludge	Uranium Technetium Metals	500 cubic yards	Disposal/X-701B

Source: Adapted from Blake, 1986.

Hazardous wastes are stored in an interim status storage facility located in Building X-752. The X-752 facility has concrete floors and berms with separate bermed areas to segregate incompatible wastes. Wastes are shipped to X-752 from generating facilities and the X-740 Waste Oil Storage area, when tests show drums of oil to contain hazardous wastes. Wastes such as solvents are shipped from X-752 to commercial facilities. Hazardous heavy metal sludges from X-705 Uranium Recovery Operations are also stored in one unpermitted area, X-752, next to the permitted storage area. PUEC has formally requested that OEPA expand the permitted hazardous waste storage area.

Figures 4-1 and 4-2 describe the overall handling procedures for sludges, solid wastes, and liquid wastes, respectively, including wastewaters at PUEC.

Underground Storage Tanks

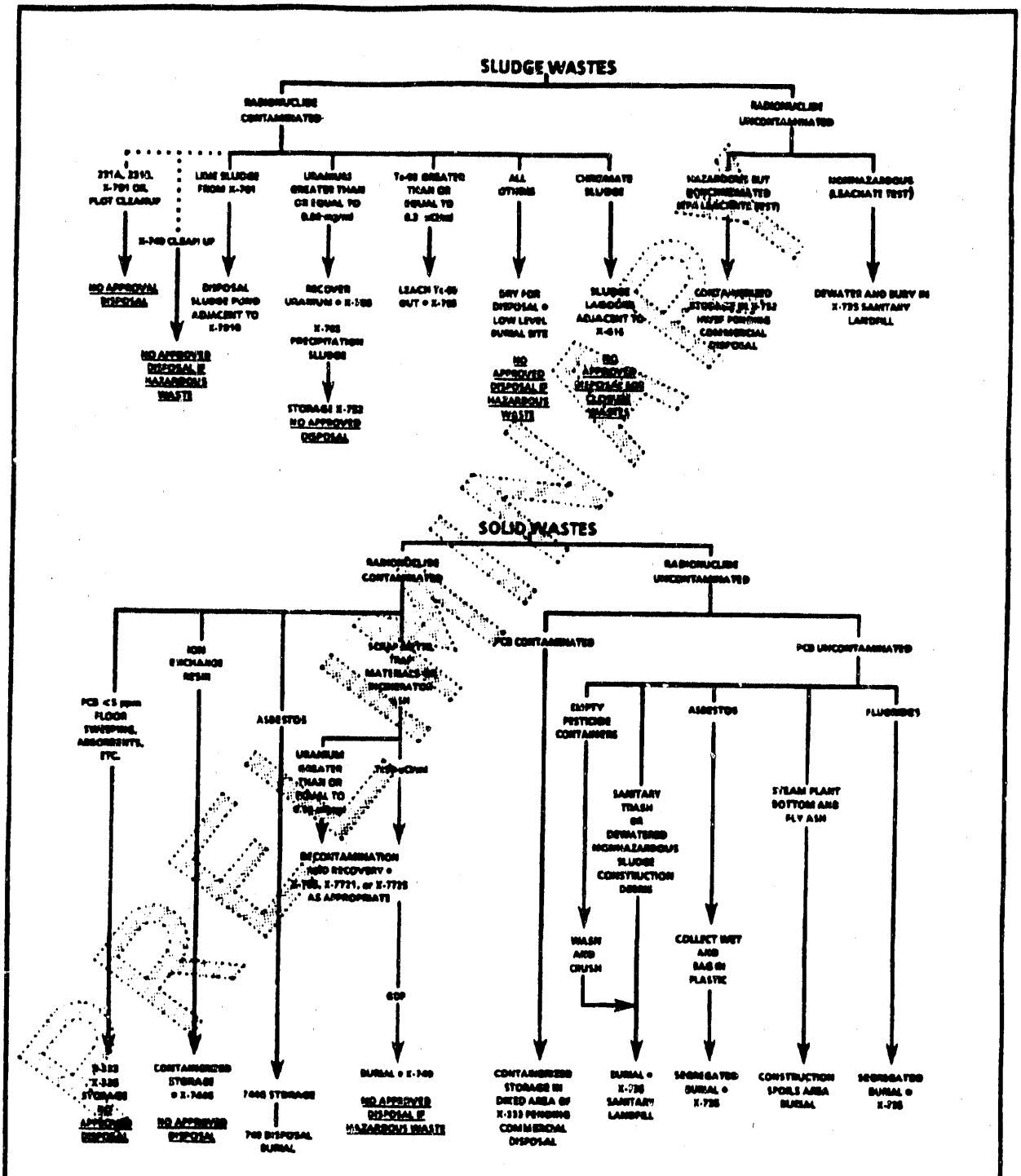
PUEC identified 48 underground storage tanks (USTs) subject to the RCRA Part 280 reporting requirements. These tanks range in size from 100 gallons to a 6,810,000-gallon cooling tower basin. The substances contained include oils, gasoline, wastewaters, and cooling waters containing hexavalent chromium. Most of the tanks were installed during the early to mid-1950s, when the plant was built. Table 4-3 gives information on USTs regulated by 40 CFR 280, including tank construction, capacity, material stored, and date installed for tanks listed in the PUEC Underground Storage Tank Notification. The USEPA has until November 1988 to promulgate tank regulations regarding leak testing, monitoring, and reporting leaks from tanks, taking corrective actions if leaks occur and preparing closure plans to prevent future contamination. Proposed regulations were issued April 17, 1987.

RCRA Permit - Part A

PUEC has submitted a RCRA Part A permit application for the following facilities:

- X-752 - Hazardous Waste Storage Facility
- X-616 Chromium Sludge Lagoon*
- X-701B Holding Pond (including Total Containment Area)*
- X-231B Oil Biodegradation Plots (currently undergoing closure)*
- X-749 Contaminated Materials Disposal Facility*

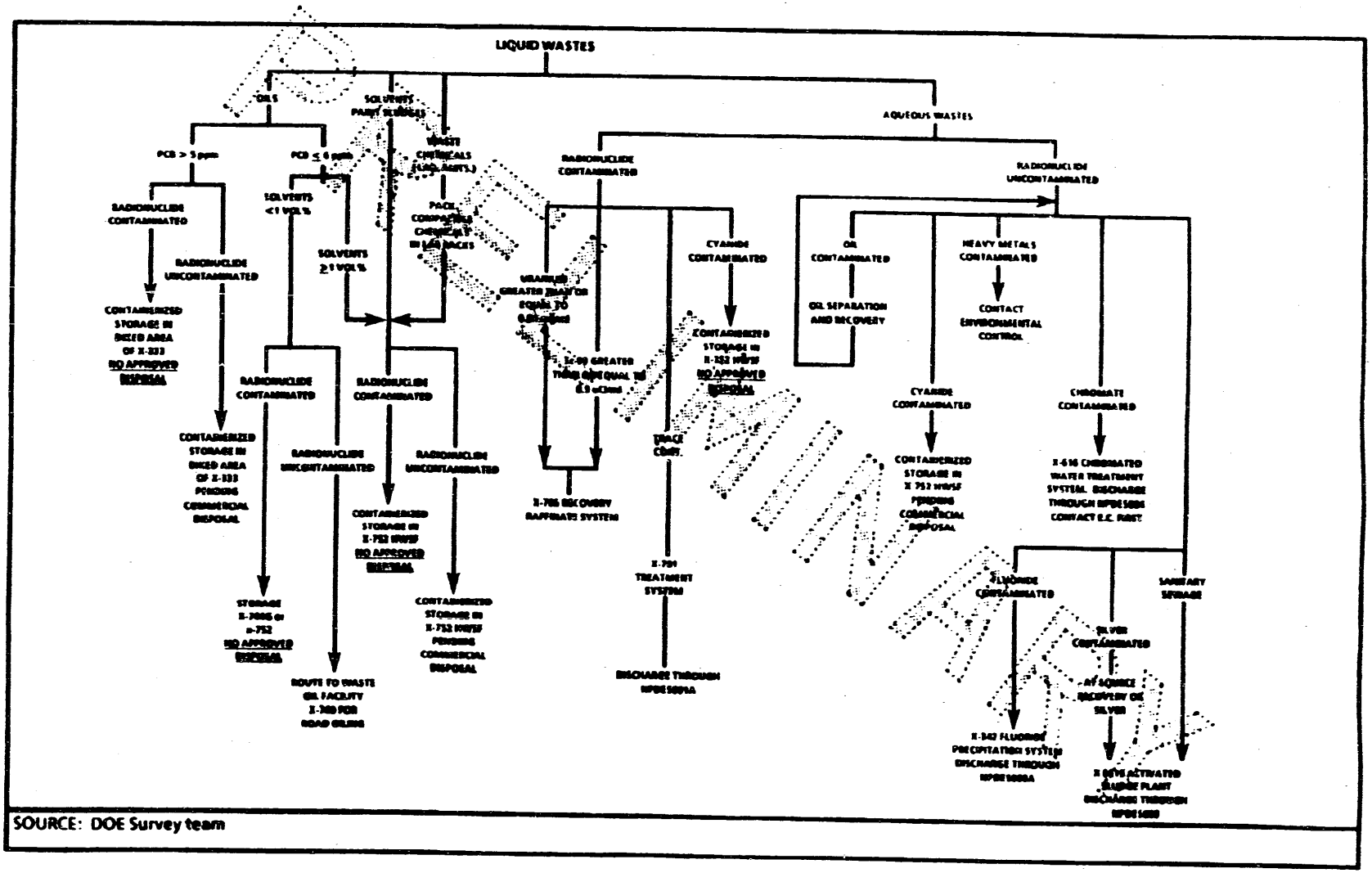
* Mixed Waste (Hazardous/Radioactive)



SOURCE: DOE Survey team.

FIGURE 4-1

WASTE HANDLING FLOW DIAGRAM
PUEC – PIKETON, OHIO



SOURCE: DOE Survey team

FIGURE 4-2

WASTE HANDLING FLOW DIAGRAM
PUEC – PIKETON, OHIO

TABLE 4-3

UNDERGROUND STORAGE TANKS REGULATED BY RCRA 40 CFR 280
PUEC - PIKETON, OHIO

Tank #	Facility	Tank Location	Tank Construction	Capacity (Gallons)	Material Stored	Date Installed	Date Abandoned
1	104	-	Steel	500	Diesel	5/54	NA
2	300	West	Fiberglass	2,000	Diesel	8/83	NA
3	326	Northeast	Steel	5,000	Diesel	7/66	NA
4	326	North	Steel	100	Diesel	-/81	NA
5	326	South	Steel	100	Diesel	-/81	NA
6	334	Southeast	Fiberglass	2,000	Diesel	-/85	NA
7	344	North	Steel	100	Diesel	-/81	NA
8	345	Under	Steel	250	Diesel	-/81	NA
9	605G	Southeast	Steel	500	Diesel	8/54	5/82(1)
10	611	North Side	Steel	6,000	Diesel	8/54	NA
11	611C	West	Steel	500	Gasoline	8/54	4/80(2)
12	611C	Northwest Corner	Fiberglass	550	Diesel	2/80	7/81(3)
NA	615	West	Steel	1,000	Propane	5/54	8/55(4)
13	640-1	West	Steel	500	Diesel	6/60	NA
14	710	Northwest	Steel	265	Diesel	-/55	NA
15	720	North	Fiberglass	4,000	Diesel	9/81	NA
16	735A	South	Fiberglass	4,000	Diesel	3/81	NA
17	750	-	Steel	501	Used Oil	1/62	NA
18	750	Southeast	Steel	18,000	Gasoline	5/54	NA
19	750	Southeast	Steel	18,000	Diesel	5/54	NA
20	750	Southeast	Fiberglass	10,000	Alcohol	6/82	5/83
21	751	North	Fiberglass	1,000	Used Oil	8/78	2/86
22	751	Southeast	Fiberglass	15,000	Gasoline	8/78	2/86
23	751	Southeast	Fiberglass	15,000	Gasoline	8/78	2/86
24	751	Southeast	Fiberglass	15,000	Gasoline	8/78	2/86
25	751	Southwest	Fiberglass	550	Diesel	8/78	NA

TABLE 4-3
UNDERGROUND STORAGE TANKS REGULATED BY RCRA 40 CFR 280
PAGE TWO

Tank #	Facility	Tank Location	Tank Construction	Capacity (Gallons)	Material Stored	Date Installed	Date Abandoned
26	1007	Northeast	Black Steel(5)	120	Diesel	-/79	NA
27	1010	Southwest	Fiberglass	550	Diesel	5/83	NA
28	1107AV	--	Fiberglass	280	Diesel	6/83	NA
29	1107DV	--	Fiberglass	280	Diesel	6/83	NA
30	1107EV	--	Fiberglass	280	Diesel	6/83	NA
31	3000	West	Fiberglass	840	Diesel	5/82	NA
32	3001	North	Fiberglass	1,500	Diesel	5/80	NA
33	3001	South	Fiberglass	1,500	Diesel	5/80	NA
34	3012	North	Fiberglass	840	Diesel	6/81	NA
35	3346	East	Fiberglass	1,500	Diesel	6/83	NA
36	6000	Southeast	Fiberglass	10,000	Diesel	5/82	NA
37	7721	South	Fiberglass	2,000	Diesel	7/83	Never Used
38	7721	South	Fiberglass	2,000	Gasoline	7/83	Never Used
39	7725	Southeast	Fiberglass	2,000	Diesel	3/83	NA
40	7726	West	Fiberglass	2,000	Diesel	3/83	NA
41A (55)	710	West	Concrete (Brick Lined)	5,000	Acidic Wastewater	-/53	NA
42A (86)	701-C	E. X-700	Concrete (Brick Lined)	50,000	Waste Cleaning Solutions	-/53	NA
43A (87)	626-2	S. X-626	Concrete	2,200,000	Recirculating Cooling Water	2/55	NA
44A (88)	630-2A	N.E. X-630	Concrete	4,600,000	Recirculating Cooling Water	8/54	NA
45A (89)	630-2B	S.W. X-630	Concrete	4,600,000	Recirculating Cooling Water	8/54	NA

TABLE 4-3
UNDERGROUND STORAGE TANKS REGULATED BY RCRA 40 CFR 280
PAGE THREE

Tank #	Facility	Tank Location	Tank Construction	Capacity (Gallons)	Material Stored	Date Installed	Date Abandoned
46A (90)	633-2A	N. 6332A	Concrete	6,810,000	Recirculating Cooling Water	3/55	NA
47A (91)	633-2B	E. 6332B	Concrete	6,810,000	Recirculating Cooling Water	3/55	NA
48A (92)	6001	E. 6000	Concrete	286,000	TCE	6/83	NA

Source: Portsmouth Uranium Enrichment Plant, (undated).

(1) Water inleakage.
(2) Replaced by tank listed below.
(3) Replaced with above-ground diesel tank because of a vent line breakage, which caused water inleakage.
(4) Dug up and installed above ground.
(5) Two coats of Koppers #50.

RCRA Permit - Part B

PUEC is presently negotiating the RCRA Part B permit conditions. As part of the negotiating process, USEPA has issued a "Notice of Deficiency" (NOD), which is a request for additional information to address permitting issues. Among the areas addressed in the NOD was the X-749 landfill, which had improperly received hazardous wastes in the past, and the X-701B surface impoundment, which had received chromic acid wastes in the past and is still an active hazardous waste facility. Neither facility is now an active hazardous waste facility, and EPA wants them closed. PUEC is requesting continued use of X-701B until November 1988, and full or partial in-place closure of X-749 instead of excavation of wastes. Near-term initiation of closure would immediately require storage and/or disposal of a large quantity of excavated wastes in an on-site, RCRA-permitted facility.

The USEPA is also considering requiring closure of the X-231A and X-701B North Oil Biodegradation Plots as RCRA facilities, in addition to the X-231B Plot, for which PUEC has already submitted a RCRA closure plan. Cleanup of wastes and contaminated dirt would generate a large quantity of solvent and radionuclide-contaminated material requiring on-site storage and/or disposal in a RCRA-permitted facility. In-place closure as a landfill may be allowed because of the anticipated problems in handling the large quantities of contaminated material that would be generated by cleaning to background levels.

The NOD from USEPA also states that the X-749A Classified Materials Burial Ground and the Northern Impoundment should be listed as solid waste management units on the RCRA Part B Permit application. If either unit were shown to be releasing hazardous wastes or constituents as a result of a RCRA facility assessment, the continuing release provisions of Section 3004(u) of RCRA would require cleanup of any releases before PUEC could obtain a RCRA permit. This could generate additional remedial action wastes.

X-616 Chromium Sludge Lagoons

Sludge generated by the X-616 chromium reduction plant, which treats chromium-contaminated recirculating cooling-water system blowdown, is discharged to the X-616 sludge lagoons. Section 3005(j) of the Resource Conservation and Recovery Act requires closure of surface impoundments such as the X-616 chromium sludge lagoons by November 8, 1988, if they do not meet the technical standards for new facilities. PUEC intends to close the lagoons since they do not contain any liners as required by RCRA regulations. The sludge in the lagoons failed the EP toxicity test for chromium and contains uranium ($\approx$ 10 ppm), which may make the sludge a mixed waste.

Tests of the X-616 sludge showed that lime addition reduces the leachable chromium to a level that passes the EP test. Region 5 of USEPA concurred on a one-time basis in January 1986 to allow lime addition to be used to detoxify 2,700 cubic yards of sludge and subsequent disposal in a nonhazardous waste landfill.

Three closure methods are under consideration. Clean closure would require that the sludge and the chromium-contaminated clay liner be removed, dewatered, mixed with lime, and b ed in the sanitary landfill. The second method is identical to clean closure, except that lime would be disked into the clay liner in place of removal. A third method would require in-place sludge treatment and installation of a cap.

After closure of the lagoon, any new sludge that is generated would be treated with lime for detoxification. An alternative solution to the problem would be the substitution of a phosphate-based (chrome-free) corrosion inhibitor for chromium-based inhibitors. Lime-stabilized sludges may not pass the new Toxic Concentration Leaching Procedure (TCLP), which will be in effect in 1987. Substitution of phosphate-based corrosion inhibitors places the facility at risk of increased corrosion rates in the various diffusion process buildings' cooling water systems. In addition, discharge of treated phosphates from treated recirculating cooling water into surface waters may be restricted. Pilot plant studies of phosphate-based inhibitors as substitutes for chromium-based corrosion inhibitors are under way.

4.1.1.2 Mixed (Radioactive and Hazardous) Wastes

PUEC generates mixed wastes (hazardous/radioactive) from a variety of sources. Trap materials, with varying uranium-235 assays that recent tests have shown to be EP toxic, are generated within the three process buildings (X-326, X-333, and X-330). The materials (sodium fluoride, alumina, and magnesium fluoride) are removed from traps and placed into metal cylinders by Chemical Operations, and the cylinders stored in Building X-744G for uranium recovery (where economical) or, until 1986, disposed of in the X-749 landfill. The backlog of trap wastes stored at X-744G is increasing since uranium recovery is proceeding at only one-third capacity until construction of the full-scale biodenitrification plant is completed. This plant will treat wastewaters to meet NPDES permit conditions. Uneconomically recoverable trap materials are accumulating for disposal for several reasons. First, there is no hazardous waste disposal facility on-site suitable for disposal of these wastes and, second, off-site disposal is precluded by the presence of radioactive constituents. Third, if traps are changed more frequently in an effort to improve air emission controls, the quantity of trap materials that therefore is destined for disposal will increase. Relatively large areas

are required for storage of these cylinders of uneconomically recoverable trap materials, since their high uranium content results in the need to keep the cylinders in an "always safe" configuration and thus eliminate the potential for a criticality event.

EP toxic heavy metal precipitation sludges containing uranium generated at the X-705 uranium recovery operation are presently stored next to, but technically outside, the permitted area in the X-752 hazardous waste storage facility. The generation rate of one bin per week will triple when the recovery operation returns to full operation in 1987 with completion of construction and shakedown of the full-scale biodenitrification plant. Full-time operation of the uranium recovery operation will eliminate the back-log of recoverable trap materials while increasing the storage area requirements for long-term storage of the resulting sludges. Spray table solids (both EP toxic and radioactively contaminated) from the X-705 Decontamination Building are also stored at X-744G.

The X-701B Holding Pond, which treats radioactive wastewaters, produces a heavy metal uranium and technetium-contaminated sludge that is disposed of in the X-701B Total Containment Area. Prior to July 1984, the holding pond received liquid radioactive wastes from the X-705 decontamination and uranium recovery operations. Liquid wastes from the X-700 building cleaning operations also were received prior to June 1982.

The sludge is stored in the Total Containment Area in the event that uranium recovery becomes economically feasible. However, USEPA will require that the sludge be treated as a waste, since uranium recovery is not now feasible. Approximately 500 cubic feet of sludge is generated annually.

Disposal and/or treatment of any mixed wastes at commercial facilities is precluded by the refusal of commercial hazardous waste facilities to handle any hazardous wastes contaminated with radionuclides, and by PUEC policy prohibiting shipment of radioactive wastes to off-site facilities other than DOE facilities.

The growing accumulation of mixed wastes is common to DOE facilities. One option to alleviate this growing problem is the planned construction of the K-25 Incinerator at Oak Ridge. This incinerator would serve PUEC as well as other DOE facilities.

Wastes identified at Portsmouth for which the K-25 Incinerator can be used include process oils containing uranium that were formerly land disposed, organic hazardous wastes, PCB/radioactive floor sweepings, absorbent material and oils from the process buildings, X-705 resins, X-615 and east ditch PCB cleanup wastes, and mixed organic wastes. Table 4-4 summarizes annual generation rates

TABLE 4-4

ANNUALLY GENERATED WASTES REQUIRING INCINERATION
PUEC - PIKETON, OHIO

Waste Identification	Annual Rate	Uranium	Solvents	PCBs	Other
Hazardous, TSCA, or Oil Wastes with Uranium Concentrations Less than 5 ppm					
Kerosene/Gasoline	240 gal	none	none	none	none
Oil-Lube	2,400 gal	<3 ppm	none	≥50 ppm	----
Paint Solvent	480 gal	<1 mg/l	yes	none	----
Waste Solvents (haz.)	800 gal	<1 mg/l	99 + %	none	oil,MEK,acetone
Used Oil (motor oil)	660 gal	none	none	none	none
Machine Coolant	450 gal	none	none	none	water
PCB Liquids	120 gal	<1 ppm	slight	570 ppm	estimate
Paint Sludge	300 gal	none	yes	none	mercury
Hazardous Liquids	3,960 gal	none	haz	none	----
Waste Oils	13,000 gal	<3 ppm	none	<50 ppm	----
SUBTOTAL	22,410 gal				
Highly Contaminated, High Assay, Hazardous and/or TSCA Wastes					
Oil-Seal Exhaust	2,900 gal	300 ppm	yes	<70 ppm	U range <7000 ppm
Degreaser Sludge	720 gal	<500 mg/l	haz?	none	----
Hazardous Solids	8 cu. yd.	Unknown	yes	none	----
Sorbents (Zorball, etc.)	108 cu. yd.	<450 ppm	none	<500 ppm	----
SUBTOTAL LIQUID	3,620 gal				
SUBTOTAL SOLID	116 cu. yd.				

TABLE 4-5

PCB WASTES IN INVENTORY
REQUIRING INCINERATION
PUEC - PIKETON, OHIO

PCB WASTES IN 55-GALLON DRUMS, 12/31/85

Manifest Number	Weight (Lb.)	Contents*	Category*	Analytical Results		
				U(ppm)	U-235(%)	PCB(ppm)
LO-85-33	463	CC Oil	3	9,560?	0.67	30
LO-85-37	456.5	CC Oil	3	340	0.77	55
LO-85-38	462	CC Oil	3	150	0.5	10
LO-85-41	539	CC Oil	3	345	0.77	120
LO-85-59	335	CC Oil	3	4	NA	120
LO-85-68	617	R, G, A	1	--	--	--
LO-85-69	520	R, GL, A	1	--	--	--
LO-85-70	495	A, R	1	--	--	--
LO-85-71	446	R, A	1	--	--	--
LO-85-73	434	CC Oil	3	<2	--	140
LO-85-91	451	CC Oil	3	4	NA	10
LO-85-92	478	CC Oil	3	120	NA	5
LO-85-126	416	R, A, FS	1	--	--	--
LO-85-127	390	R, A, FS	1	--	--	--
LO-85-128	260	A, PA, R	1	--	--	--
LO-85-129	249	Waste Oil	3	<1	--	25
LO-85-130	280.5	A, R	1	--	--	--
LO-85-131	252	A, R	1	--	--	--
LO-85-132	296	A, R	1	--	--	--
LO-85-133	258.5	A, R	1	--	--	--
LO-85-134	233	A, R	1	--	--	--
LO-85-135	265	A, MH, R	1	--	--	--
LO-85-136	260.5	A, R	1	--	--	--

TABLE 4-5
PCB WASTES IN INVENTORY
REQUIRING INCINERATION
PUEC - PIKETON, OHIO
PAGE TWO

PCB WASTES IN 55-GALLON DRUMS, 12/31/85

Manifest Number	Weight (Lb.)	Contents*	Category*	Analytical Results		
				U(ppm)	U-235(%)	PCB(ppm)
LO-85-137	261.5	A, R	1	--	--	--
LO-85-138	250	A, R	1	--	--	--
LO-85-139	297	A, R	1	--	--	--
LO-85-140	250	A, R	1	--	--	--
LO-85-141	196	MH	1	--	--	--
LO-85-142	190	MH, R	1	--	--	--
LO-85-143	217	MH	1	--	--	--
LO-85-144	254.5	A, MH	1	--	--	--
LO-85-145	292	A, MH	1	--	--	--
LO-85-146	282.5	A, MH	1	--	--	--
LO-85-147	190.5	A	1	--	--	--
LO-85-148	423	Waste Oil	3	<2	--	70
LO-85-149	419	Waste Oil	3	<2	--	110
LO-85-150	288	A, C, PA, R, SM.	1	35	NA	90
LO-85-151	464	Lube Oil	2	--	--	--
LO-85-152	484	Lube Oil	2	--	--	--
LO-85-153	482	Lube Oil	2	--	--	--
LO-85-154	435	Lube Oil	2	--	--	--
LO-85-155	489	Lube Oil	2	--	--	--
LO-85-156	490	Lube Oil	2	--	--	--
LO-85-157	386	Lube Oil	2	--	--	--
LO-85-158	473	Lube Oil	2	--	--	--

TABLE 4-5
PCB WASTES IN INVENTORY
REQUIRING INCINERATION
PUEC - PIKETON, OHIO
PAGE THREE

PCB WASTES IN 55-GALLON DRUMS, 12/31/85

Manifest Number	Weight (Lb.)	Contents*	Category*	Analytical Results		
				U(ppm)	U-235(%)	PCB(ppm)
LO-85-159	461	Lube Oil	2	--	--	--
LO-85-160	394	Lube Oil	2	--	--	--
LO-85-161	453	Lube Oil	2	--	--	--
LO-85-162	484	Lube Oil	2	--	--	--
LO-85-163	230	A	1	--	--	--
LO-85-164	210	A, R	1	--	--	--
LO-85-165	211	A, R	1	--	--	--
LO-85-166	261	A, R	1	--	--	--
LO-85-167	222	A, R	1	--	--	--
LO-85-168	211	A, R	1	--	--	--
LO-85-169	201	A, MH, R	1	--	--	--
LO-85-170	276	A, MH, R	1	--	--	--
LO-85-171	271	A, MH, R	1	--	--	--
LO-85-172	210	A	1	--	--	--
LO-85-173	215	A, MH	1	--	--	--
LO-85-174	236	A, R	1	--	--	--
LO-85-175	250	A	1	--	--	--
LO-85-176	227	A	1	--	--	--
LO-85-177	273	A	1	--	--	--
LO-85-178	227	A	1	--	--	--
LO-85-179	240	A, MH	1	--	--	--

TABLE 4-5
PCB WASTES IN INVENTORY
REQUIRING INCINERATION
PUEC - PIKETON, OHIO
PAGE FOUR

PCB WASTES IN 55-GALLON DRUMS, 12/31/85

Manifest Number	Weight (Lb.)	Contents*	Category*	Analytical Results		
				U(ppm)	U-235(%)	PCB(ppm)
LO-85-180	216	A, R	1	--	--	--
LO-85-181	494	Lube Oil	2	--	--	--
LO-85-182	270	A, G, PA, R	1	--	--	--
LO-85-183	445	A, G, PA, R, SM	1	35	NA	90
LO-85-184	599	A, PA, W	1	35	NA	90
LO-85-185	694	A, PA, Soil	1	35	NA	90
LO-85-186	530	A, G, PA, R, SM, W	1	35	NA	90
LO-85-187	485	Soil, Rock	1	35	NA	90
LO-85-188	810	Soil, Rock	1	35	NA	90
LO-85-189	464	A, PA, R, Soil	1	35	NA	90
LO-85-190	484	Waste Oil	3	35	NA	90
LO-85-191	489	Waste Oil	3	35	NA	90
LO-85-192	225	PA, PL, A, C	1	--	--	--
LO-85-193	207	A, PL	1	--	--	--
LO-85-195	470	Mineral Oil	2	--	--	--
LO-85-196	468	Mineral Oil	2	--	--	--
LO-85-197	465	Mineral Oil	2	--	--	--
LO-85-198	468	Mineral Oil	2	--	--	--
LO-85-199	462	Mineral Oil	2	--	--	--

TABLE 4-5
PCB WASTES IN INVENTORY
REQUIRING INCINERATION
PUEC - PIKETON, OHIO
PAGE FIVE

PCB WASTES IN 55-GALLON DRUMS, 12/31/85

Manifest Number	Weight (Lb.)	Contents*	Category*	Analytical Results		
				U(ppm)	U-235(%)	PCB(ppm)
LO-85-200	469	Mineral Oil	2	--	--	--
LO-85-201	464	Mineral Oil	2	--	--	--
LO-85-202	470	Mineral Oil	2	--	--	--
LO-85-203	466	Mineral Oil	2	--	--	--
LO-85-204	387	Mineral Oil	2	--	--	--
LO-85-205	200	C, G, PA, PL, R, S	1	--	--	--
LO-85-206	396	Waste Oil	3	7.3	1.8	30
LO-85-207	115	A, PA	1	7.3	1.8	30
LO-85-208	432	A, PA	1	7.3	1.8	30
LO-85-209	352	Waste Oil	3	<2	--	10
LO-85-210	479	Oil (82% Water)	3	<2	--	5
LO-85-211	555	Oil (62% Water)	3	<2	--	5
LO-85-212	479.5	Waste Oil	3	<2	--	10
LO-85-213	439	Waste Oil	3	<2	--	5
LO-85-214	436	Waste Oil	3	<2	--	5
LO-85-215	255.5	Waste Oil	3	<2	--	5
LO-85-216	435	Waste Oil	3	<2	--	10

PYRANOL WASTE

P-85-11	447	A, C	1	--	--	--
P-85-12	491	A, 3 CAP.	1	--	--	--
P-85-14	568.5	A, 3 CAP.	1	--	--	--

TABLE 4-5
PCB WASTES IN INVENTORY
REQUIRING INCINERATION
PUEC - PIKETON, OHIO
PAGE SIX

X-760 NEUTRALIZATION PIT WASTE

Manifest Number	Weight (Lb.)	Contents*	Category*	Analytical Results		
				U(ppm)	U-235(%)	PCB(ppm)
760-UP-85-1	650	4	5	1,300	0.723	85
760-UP-85-2	490	4	5	1,300	0.723	85
760-UP-85-3	625	4	5	1,300	0.723	85
760-UP-85-4	800	4	5	1,300	0.723	85
760-UP-85-5	835	4	5	1,300	0.723	85
760-UP-85-6	800	4	5	1,300	0.723	85
760-UP-85-7	825	4	5	1,300	0.723	85
760-UP-85-8	850	4	5	1,300	0.723	85
760-UP-85-9	835	4	5	1,300	0.723	85
760-UP-85-10	600	4	5	1,300	0.723	85
760-UP-85-11	720	4	5	1,300	0.723	85
760-UP-85-12	700	4	5	1,300	0.723	85
760-UP-85-13	640	4	5	1,300	0.723	85
760-UP-85-14	750	4	5	1,300	0.723	85
760-UP-85-15	725	4	5	1,300	0.723	85
760-UP-85-16	850	4	5	1,300	0.723	85
760-UP-85-17	825	4	5	1,300	0.723	85
760-UP-85-18	720	4	5	1,300	0.723	85
760-UP-85-19	820	4	5	1,300	0.723	85
760-UP-85-20	725	4	5	1,300	0.723	85

TABLE 4-5
PCB WASTES IN INVENTORY
REQUIRING INCINERATION
PUEC - PIKETON, OHIO
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X-760 NEUTRALIZATION PIT WASTE

Manifest Number	Weight (Lb.)	Contents	Category	Analytical Results		
				U(ppm)	U-235(%)	PCB(ppm)
760-UP-85-21	820	4	5	1,300	0.723	85
760-UP-85-22	635	4	5	1,300	0.723	85
760-UP-85-23	800	4	5	1,300	0.723	85
760-UP-85-24	860	4	5	1,300	0.723	85
760-UP-85-25	750	4	5	1,300	0.723	85
760-UP-85-26	860	4	5	1,300	0.723	85
760-UP-85-27	800	4	5	1,300	0.723	85

Source: Blake, 1986.

* Contents and Category Designations:

A	absorbent	PA	paper
C	coveralls	PL	plastic
CAP.	capacitor	R	rags
CC	co-contaminated	S	shoe covers
E	empty drum	SM	scrap metal
F	filters	W	electric wire
FS	floor sweeping	1	co-contaminated solids waste
G	gloves	2	sample analysis pending
GL	glass	3	co-contaminated liquid waste
H	hoses	4	mostly slag and limestone, some liquid
MH	mop head	5	analysis given is approximate for pit prior to drumming

TABLE 4-6

X-615 SLUDGE CONTAINING PCBS IN INVENTORY REQUIRING INCINERATION PUEC - PIKETON, OHIO

X-615 SEWAGE TREATMENT PLANT SLUDGE IN 55 GALLON DRUMS, 12/31/85

Drum Quantity	Manifest Numbers	Total Weight
906	615-UP-84-1 -- 615-UP-84-714 and 615-UP-85-715 -- 615-UP-85-906	478,804 lbs.

PCB ANALYSIS OF GRAB SAMPLES, PPM BY WEIGHT

Sample Number	Aroclor 1260	Aroclor 1254
1098	440	110
1099	420	120
1100	300	80
1101	220	70
1102	110	30
1103	220	60
1104	100	40
1105	130	30
1106	160	50

LEACH EXTRACT ANALYSES, DETECTED MATERIALS CONCENTRATIONS

Class	Compound or Element	Analysis (mg/l)
Metals	Barium	0.14
	Copper	0.06
	Iron	0.13
	Lead	0.1
	Manganese	3.15
	Zinc	6.8
Inorganics	Chlorides	63
	Fluorides	3.4
	Nitrate	1
	Sulfate	128
	Total Dissolved Solids	710
Organic Herbicides	2,4-D	150 ppb
	2,4,5-TP (Silvex)	15 ppb

TABLE 4-6
X-615 SLUDGE CONTAINING PCBS IN INVENTORY
REQUIRING INCINERATION
PUEC - PIKETON, OHIO
PAGE TWO

SLUDGE GRAB SAMPLE RESULTS

Sample Number	Uranium µg/g	U-235 (%)	Alpha d/m/g	Beta & Gamma d/m/g**	Mercury µg/g	pH	Fluoride µg/g
913	540	NA	3100	890	11	6.1	2220
1058	246	6.1	1587	550	110	5.88	2020

Source: Blake, 1986.

** Disintegrations per minute per gram

TABLE 4-7

HAZARDOUS WASTES IN INVENTORY
REQUIRING INCINERATION
PUEC - PIKETON, OHIO

MISCELLANEOUS HAZARDOUS WASTES IN 55-GALLON DRUMS, 07/01/85*

Drum Quantity	Contents	Footnote	Sample Analyses				
			U	U-235(%)	Tc (mg/l)	PCB (ppm)	CN (gm/l)
13	Degreaser Sludge	1 2 3	46 ppm 37 ppm 58 ppm 310 ppm	1.0 0.7 -- --	-- -- 0.02 0.03	10 40 -- --	-- -- -- --
4	Cyanide Liquids	4	1.8 mg/l	<2%	--	--	83
2	Cyanide** Liquids						
10	Hazardous & PCB Liquids	5	1,823 ppm	--	--	45	--
29	Flammable Liquids	--	--	--	--	--	--
8	Flammable Solid	--	--	--	--	--	--
15	Laboratory Chemicals	--	--	--	--	--	--
15	Waste Resin Solution	--	--	--	--	--	--
4	Soil, Mercury Contaminated	--	--	--	--	--	--

Source: Blake, 1986

1-Four different batch analyses given.
First two for sludge generated June 1981.
Second two for sludge generated December 1981.
2- Alpha indicated 44,000 dpm.
3- Alpha indicated 74,000 dpm.
4- Assay is estimate; no analysis available.
5- Alpha indicated 1,160 d/m/gm. Beta indicated 1,580 d/m/gm.
Hazardous constituents in various drums include trichloroethylene, fuel oil, diesel fuel, kerosene, and xylene.

*Uranium-contaminated waste inventory updated to 12/31/85.
Remaining inventory as of 07/01/85. There have been few additions and no shipments since.
**Analysis pending. Probably similar to four drums above.

TABLE 4-8

CONTAMINATED OILS IN INVENTORY REQUIRING INCINERATION
PUEC - PIKETON, OHIO

Source	Location	Quantity (gallon)	U (mg/l) Average*	U-235 (%) Average*
GCEP	GCEP	331.3	120.6	0.8
GDP	GDP PB'S	440.7	322.8	5.84
GDP	X-740	7975.	Analysis Pending	Analysis Pending

Source: Blake, 1986.

* The uranium and U-235 concentrations are averages, based on laboratory analyses of contents of 10-liter, 20-liter, and 5-gallon polybottles prior to batching into 55-gallon drums. Batching information identifying which polybottles filled which drums is not available. Contents of individual drums can differ significantly from the averages. Composite samples of the drums will be required to determine contents. It is known that less than 200 grams of uranium are in any 55-gallon drum.

Some quantity estimates are based on weights of polybottle contents, assuming 6 pounds per gallon of contents. Quantities in X-740 are based on the number of 55-gallon drums, assuming 55 gallons per drum.

Note: Materials have not been sampled for PCBs or hazardous constituents.
GCEP = Gaseous Centrifuge Enrichment Plant
GDP = Gaseous Diffusion Plant

procedures, oils containing hazardous and radioactive constituents are stored in X-752, oils that are PCB and radioactively contaminated are stored in the PCB facilities, oils that are PCB, hazardous and radioactively contaminated are stored in X-752, and oils that are radioactivity contaminated only are stored in X-744G. However, waste oil shipped to X-740 for storage on occasion show the presence of radioactive, hazardous, and/or PCB constituents and must be reshipped to other storage facilities.

Burnable radioactive and classified wastes such as paper, plastic, wood, rags, and classified computer tape are incinerated at the "Radicator." The "Radicator" is a controlled air, dual-chamber incinerator. The upper chamber is propane-fired to remove smoke, odors, and combustible particulate emissions from the flue gas. Drums of burnable feed material are stored outside on a concrete pad. The ash from wastes burned in the X-705 incinerator is not disposed of in the X-735 Landfill because of radioactive constituents and currently is not disposed of in the X-749 Contaminated Materials Disposal Facility to preserve disposal capacity. Ashes are considered security items and stored when not reprocessed for uranium. The ashes and nonburnable metallics are removed manually from the incinerator by personnel in protective clothing.

Contaminated scrap with fixed contamination is buried either at X-749, or if classified, at X-749A. Table 4-9 provides data on 39 burials of contaminated waste since 1976 at X-749. As of February 1985, a total of 32,100 to 42,800 cubic yards of radioactively-contaminated material had been buried. The materials buried include:

- Trapping materials, i.e., alumina and sodium fluoride, and ash from contaminated burnables (6%).
- Miscellaneous metallic scrap, i.e., copper, steel (92%).
- Building and/or construction scrap (1.5%).
- Heavy metals sludge (0.5%) mixed with soil to form a solid

Trap materials and incinerator ash are buried in 5-inch-diameter steel cans and 55-gallon drums. Material buried in 5-inch cans contains sufficient uranium to be of concern with regard to concentrations. The cans are buried in plywood coffins that are lined with plastic and filled with lime. Incinerator ash and alumina and sodium fluoride trap materials, which have been leached to remove uranium, are buried in 55-gallon drums. The trench bottom is covered with lime, and lime is spread over the coffins and 55 gallon drums. The trap materials were found to be EP toxic for metals in 1986.

TABLE 4-9

X-749 BURIAL INDEX
PUEC - PIKETON, OHIO

Burial #	Contents
1	A through D - 5" Cans - Al, NaF, etc. E and below - 33-55 gal. drums buried 07/06-09/76.
2	231 - 5" Cans - Boxed, 24-55 gal. drums buried 09/22/77.
3	X-705 Roof Material.
4	X-344 Construction Scrap.
5	X-344 Scrap.
6	Misc. Contaminated Scrap Buried 09/15/77.
7 through 13	Misc. Contaminated Scrap.
14	88 - 5" Cans in 5 Coffins, 9 - 55-Gal. Drums Buried 1978.
15	55 - 55-Gal. Drums Buried 09/12/78.
16	7 Coffins, 35 - 55-Gal. Drums Buried 10/28-30/78.
17	17 Coffins, 5 - 55-Gal. Drums Buried 06/12/79.
18	1 Coffin, 64 - 55-Gal. Drums (1 Redrum), Buried 09/12/79.
19	Aboveground Misc. Equipment Buried April 25, 1980.
20	Aboveground Misc. Equipment Buried June 1, 1980.
21	12 Coffins, 15 - 55-Gal. Drums FA 79-2, FA 79-22, FA 80-8.
22	Aboveground Misc. Equipment Buried 08/14/80.
23	8 Coffins, 24 - 55-Gal. Drums (1-Redrum) Buried 01/08/81.
24	11 Coffins, 15 - 55-Gal. Drums, 7 - 55-Gal Drums of Absorbent Pads from Oil Plots Buried 09/17/81.
25	Aboveground Misc. Equipment Plus Pickup Truck 4222 + Fork Lift 16-2437 + Drum Life 16-02385 Buried 09/24/82.
26	10 Coffins (206 - 5" Containers) 7 - 55-Gal Drums.
27	9 Coffins (203 - 5" Containers), 10 - 55-Gal. Drums, 3 - 55-Gal. Drums of Lightly Contaminated Waste Buried 12/03/82.
28	Converter Shells, Filled Compressor Blades, and Misc. Scrap Buried 03/11/83.
29	10 Coffins (232 - 5" Containers), 19 - 55-Gal. Drums Buried 04/26/83.
30	3 Coffins (157 - 5" Containers) Buried 06/01/83.
31	4 Coffins, 3 - 55-Gal. Drums.

TABLE 4-9
X-749 BURIAL INDEX
PUEC - PIKETON, OHIO
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Burial #	Contents
32	8 Coffins, 13 - 55-Gal. Drums Buried 05/18/84.
33	20 Containers of Sludge from Heavy Metals Buried 08/09/84.
34	Misc. Scrap and Equipment Buried 11/02/84.
35	Burial 85 of 16 Tubs of Sludge from Heavy Metals Buried 11/06/84.
36	8 Coffins, 29 - 55-Gal. Drums Buried 12/12/84.
37	27 Tons of Sludge from Heavy Metals Burial 85-02 Buried 02/12/85.
38	Heavy Metal Sludge, Asbestos X-6619 Sludge.
39	210 PSPs, Asbestos, Heavy Metal Sludge.

Source: PUEC, 1980.

Heavy metals sludge was mixed with dirt or buried to provide a material that was less than 1 percent liquid.

Contaminated asbestos is disposed of by wetting the asbestos and placing it in a bag, prior to disposal.

Low-level contaminated equipment and materials are stored in four open lots, two fenced (X-747H and X-747G) and two unfenced (X-747J and X-705B). The lots are used for temporary storage of materials awaiting decontamination (X-747J), burning (X-705B), burial (X-747G), or transfer to other sites (X-747H).

4.1.1.4 Mixed (Radioactive and Nonhazardous) PCB Waste

Wastes containing both PCBs and radioactive constituents are generated in the three process buildings. Floor sweepings, absorbent material, and oils from X-330 and X-333 are stored in the X-333 PCB storage area. The same wastes generated in X-326 are accumulated in various points within X-326, although a central storage area within X-326 is being planned.

Floor sweepings from all three process buildings were disposed of on-site in the Old Sanitary Landfill until 1979. In 1980 when new PCB regulations became effective, they were shipped off site to an authorized PCB landfill. In early 1984 these sweepings and absorbent materials were found to be contaminated with uranium, and offsite disposal was stopped. Since then, these wastes have been accumulating in the X-333 PCB storage area and in X-326.

Contaminated (radioactive) PCB oils from the process buildings are also accumulated in the X-333 PCB storage area and within X-326. The accumulating radioactive PCB wastes are being stored for eventual disposal in the K-25 Incinerator (see Section 4.1.1.2).

4.1.1.5 Nonhazardous Waste

Nonhazardous wastes (no PCB, radioactive, or hazardous constituents) are disposed of at the X-735 Sanitary Landfill, Construction Spoils Area, and the X-749A Classified Materials Burial Area. The X-735 Sanitary Landfill receives 25,000 to 30,000 cubic yards of sanitary waste yearly, including asbestos wastes, which are disposed of in a dedicated cell. Nonhazardous treatment plant sludges, such as those from the X-621 Coal Pile Leachate Treatment Plant, are also disposed of at X-735.

The only waste currently disposed of at the Construction Spoils Area is fly ash (7,000 to 9,000 cubic yards/year). Since July, 1985, construction debris is disposed of at X-735.

Nonradioactive scrap metal (250 to 300 tons/year) is stored in outdoor storage yards, including the X-247H Northwest Surplus and Scrap Yard.

Classified wastes are buried in the X-749A Classified Materials Burial Area. Classified wastes are generally equipment which, due to material composition, size, or shape, is classified. Wastes buried in X-749A may contain radioactive and/or hazardous constituents.

Between 8,500 and 13,600 cubic yards of materials have been disposed of in the facility as of December 1984. These materials include (1) miscellaneous aluminum, nickel, and steel process scrap, which is radioactively contaminated and (2) uncontaminated metallic and polymeric materials. The exact use and composition of nearly all materials buried in the facility is considered restricted data by DOE.

4.1.2 Findings and Observations

4.1.2.1 Category I

None

4.1.2.2 Category II

1. Waste Treatment/Storage/Disposal (TSD) Capacity. Releases of hazardous/radioactive waste constituents may result from the lack of sufficient TSD capacity for mixed radioactive waste oil, hazardous, radioactive, and radioactive/PCB wastes. All of the waste streams discussed under this finding will continue to accumulate on-site until TSD options are made available.

   There are a variety of factors, which are not entirely unique to PUEC, that contribute to the waste TSD capacity problem. The factors identified by the survey team include

   - Shortage of storage capacity at X-752, the only permitted on-site hazardous waste storage facility.

- Lack of permitted on-site hazardous waste treatment or disposal facilities.

- PUEC's policy of not allowing shipments of radionuclide-contaminated wastes (i.e., waste that contains greater than 2 ppm of uranium) to off-site facilities (other than DOE facilities).

- Reluctance of off-site commercial hazardous waste treatment, storage, and disposal facilities (HWSDFs) to accept waste containing radioactive constituents.

- Lack of off-site DOE hazardous waste treatment, storage, or disposal facilities.

- Expected increase in volume of hazardous, mixed, and radioactive wastes being generated as a result of remedial actions, and better characterization of waste streams.

Following are specific examples of the treatment/storage/disposal capacity problems observed by the Survey team at PUEC:

- Mixed Radioactive/Hazardous Waste Storage - Unpermitted Facilities

  Release of hazardous and/or radioactive constituents may result from the storage of mixed wastes in unpermitted hazardous waste storage areas in the X-740 waste oil storage facility and the X-744G contaminated materials warehouse. Neither facility is permitted as a hazardous waste storage area or operated in accordance with the operational practices required by RCRA regulations to prevent the release of hazardous constituents. DOE Order 5480.2 on Hazardous and Mixed Waste Management states the following: "The procedures (for management) will follow to the extent practicable regulations issued by the Environmental Protection Agency (EPA) pursuant to the Resource Conservation and Recovery Act (RCRA) of 1976."

  Inorganic sodium fluoride and alumina trap materials from the process buildings, which recent tests have shown to be EP toxic for cadmium, and spray table solids from uranium recovery operations in X-705 are stored in X-744G in 5-inch-diameter metal cylinders. These wastes, if they did not contain economically recoverable amounts of uranium, were disposed of, until 1985, in the X-749 contaminated materials landfill. The X-749 landfill is not a permitted hazardous waste facility and has been temporarily

closed (see Finding 4.5.2.3.1). Consequently, these wastes are accumulating in X-746. Many cylinders in which the waste is stored are deteriorating because of the corrosive nature of the wastes, and on occasion, material from deteriorated cylinders must be repacked into new containers. Storage area requirements for these trap materials are greatly increased because of the spacing requirements needed to store the cylinders in an "always safe" configuration, i.e., the storage of potentially fissile material in a configuration that prevents a critical mass, hence a criticality event, from occurring accidentally. A spill from a deteriorated cylinder could compromise the always safe configuration.

Exhaustion of capacity in the permitted hazardous waste storage facility in X-752 has resulted in the storage of hazardous waste in nonpermitted areas in other buildings with the attendant potential for release of hazardous constituents through mishandling of wastes. Hazardous wastes are being stored for periods longer than 90 days in X-744G and X-740. Neither facility has a hazardous waste storage permit. Drums in X-740 that have been shown by analytical results to contain hazardous wastes remain in X-740 because of a lack of storage space in X-752.

Mixed-waste heavy metal precipitation sludges from the X-705 uranium recovery operations are accumulating in X-752 outside the permitted hazardous waste storage area. Treatment technology to reduce the volume of the wastes and immobilize hazardous and radioactive constituents in an unleachable form is being investigated by PUEC. This technology will not be available for a minimum of 2 to 4 years, assuming that it can be successfully demonstrated and that hazardous waste treatment permits can be obtained.

The amount of heavy metal sludge from X-705 that would require storage in X-752 until a detoxification treatment method is tested and permitted is expected to be at least 500 tubs (1 cubic yard/tub). This waste alone would exhaust much of the potential storage area in X-752, which must also be used for storage of organic hazardous wastes and nonradioactive, PCB-containing wastes.

- Radioactive/Waste Oil Storage

Exhaustion of capacity in X-744G has resulted in accumulation of radioactive waste oil in the X-740 "Clean" Waste Oil storage facility. PUEC procedures specify that drums of

waste oil containing radioactive constituents should be transferred and stored at X-744G to prevent mishandling and inappropriate use or disposal. See Section 4.1.2.2.4.

- Radioactive/PCB Waste Storage

Exhaustion of storage capacity in the PCB storage area in X-333 may result in the release of radioactive/PCB wastes by inappropriate treatment or disposal in facilities not designed for handling radioactive/PCB wastes.

The PCB storage area in X-333 is being filled to capacity with contaminated (radioactive) floor sweepings, absorbent material, and oils containing PCBs. The remaining capacity in X-333 does not allow sufficient storage area for additional quantities of these wastes, which are expected to continue accumulating until disposal options become available. The processing of noncontaminated PCB wastes, which are also handled in this area, is impeded by the lack of adequate work space and storage area.

Contaminated PCB wastes generated within the high-assay process building (X-326) are accumulating in areas not formally designated for PCB storage. These floor sweepings, absorbent material, and oils from X-326 are not always properly manifested, labeled, and inventoried as required by PUEC procedures. Tightened security considerations require absolute certainty that drums of material removed from X-326 do not contain any high-assay uranium. The resulting reluctance of security personnel to allow drums of waste to leave the building without a thorough check has inhibited the removal of wastes from the building. The planned solution for the disposal of radioactive/PCB floor sweepings, oils, and absorbent materials from the process buildings is incineration at the K-25 Incinerator now under construction (see Section 4.1.1.2).

- Contaminated Sites - Cleanup Waste Disposal/Treatment

Lack of storage and/or disposal capacity for wastes resulting from the cleanup of contaminated land treatment facilities and surface impoundments may result in releases or continuing releases to the environment of hazardous wastes or constituents as a result of inappropriate storage or postponement of remedial actions.

Storage and/or disposal capacity does not exist for cleanup of mixed (hazardous/radioactive) wastes and mixed contaminated dirt from potential remedial actions at the X-701B Total Containment pond; the X-749 Contaminated Materials Disposal Facility; and the X-231A, X-231B, and X-701B Oil Biodegradation Plots. EPA will require closure of these facilities in accordance with RCRA regulations. Closure may involve removal and disposal of wastes and waste-contaminated soil in a permitted facility, or treatment to destroy or immobilize hazardous wastes and constituents. Treatment technologies to detoxify these wastes and contaminated soils have not been tested and must be considered speculative at this time. On-site demonstration of treatment equipment from vendors is difficult to arrange because of the presence of radionuclides in the wastes. Vendors are asking that PUEC purchase demonstration equipment that would be in contact with radionuclide-containing wastes.

PUEC has estimated that cleanup of X-701B would generate 16,000 to 70,000 cubic yards of sludge/oil contaminated with uranium, technetium, and solvents. Cleanup of X-231A and X-231B Oil Biodegradation Plots would generate 9,000 and 6,500 cubic yards respectively of uranium- and solvent-contaminated oil. Similar estimates were not available for other potential remedial actions.

High-Assay Waste Disposal

High-assay (U-235 isotope concentration greater than 1 percent of uranium content) wastes being stored for disposal are accumulating in various areas in the plant, principally X-326 and X-744G. These wastes include X-326 floor sweepings and absorbent material, X-326 lube oils and seal exhaust oils, X-326 alumina and sodium fluoride trap materials (mixed wastes), and some similar materials also periodically generated in X-333 and X-330. On occasion, X-705 Uranium Recovery resins are high assay. Disposal options do not exist at this time, and additional storage will be required until disposal options become available. The need for storage space is increased by the requirement to keep many high-assay waste containers in an "always safe" configuration to satisfy criticality concerns. The future disposal plan is incineration at the K-25 Incinerator (see Section 4.1.1.2). Long-term storage will be required until procedures for incinerating these wastes can be developed and tested.

- X-616 Chromium Sludge Lagoons

Treatment/disposal alternatives may not exist for the EP toxic chromium sludge waste generated after November 8, 1988. Sludge generated in the treatment of chromium-containing cooling water blowdown is currently released to the X-616 Chromium Sludge Lagoons. Section 3005(j) of RCRA requires closure of all surface impoundments by November 8, 1988, if they do not meet RCRA standards. PUEC intends to close the X-616 lagoons, since they do not meet the standards for liners and since retrofitting is impractical.

Sludge and contaminated liners and any waste-contaminated soil would be detoxified by lime addition, which would produce a waste that passes the EP test for chromium and could be disposed of in X-735. USEPA apparently is willing to accept this procedure for closure. After November 1988, PUEC plans either to continue to detoxify newly-generated sludge with lime, or to switch to non-chromium cooling-water corrosion inhibitors such as phosphates.

Reliance upon lime stabilization to detoxify the X-616 chromium sludge may fail if USEPA promulgates, as expected, new leaching procedures (TCLP); i.e., lime-stabilized waste may fail the test for toxicity. In this case PUEC would have no treatment alternative and no disposal alternative, since the X-611 sludge lagoons would be closed.

Substitution of phosphate-based corrosion inhibitors for chromium could lead to increased rates of corrosion of heat exchangers in the process buildings. In addition, discharges of treated cooling water blowdown to surface waters may be limited by NPDES permit conditions. Pilot plant studies of substituted, phosphate-based inhibitors for chromium corrosion inhibitors are under way.

Survey-related sampling is planned.

2. Waste Characterization. Inadequate characterization of solid wastes could result in unidentified hazardous wastes being handled as nonhazardous wastes, with the potential for subsequent release of hazardous constituents to the environment.

The Survey team identified the following waste streams as needing further characterization:

- Sandblasting residues for EP metals
- Glass blasting residues for EP metals
- Wood slats from the cooling towers for chromium
- X-6619 (sewage treatment plant) grit and screenings for EP metals
- X-326, X-330, and X-333 sodium fluoride and alumina trap materials for EP metals
- Incinerator ash for EP metals

In general, PUEC has not tested its waste streams to determine whether they were hazardous wastes unless the wastes were specifically listed as hazardous waste by the USEPA. The survey team observed that at least one waste stream, presumed to be nonhazardous by PUEC, may be proved hazardous (EP toxic), based on recent tests by PUEC. This waste stream consists of the sodium fluoride and alumina trap materials from the process buildings.

In addition, the areas where unidentified hazardous wastes are currently generated, treated, stored, or disposed of may become subject to hazardous waste regulations. In particular, if such wastes are disposed of at nonhazardous waste disposal sites (e.g., X-735), these sites may possibly be considered RCRA disposal sites. PUEC has established a waste characterization task force.

Survey-related sampling of selected waste streams is planned.

3. Contaminated Burnable Waste Incinerator. Incineration of hazardous wastes (chlorinated solvents) and oils in the X-705 Incinerator (which is not permitted for incineration of hazardous waste and oils) may result in the release of hazardous constituents to the environment.

A review of the incinerator burn record by the Survey team showed that in January and April 1986, hazardous solvents and oils were burned. PUEC policy specifies that the X-705 Incinerator should be used only for the incineration of burnable, uranium-contaminated trash and classified material such as documents. The incinerator is not designed to burn hazardous waste and lacks emission controls such as a scrubber or precipitator (see Finding 3.1.4.2.1).

PUEC management immediately shut down the incinerator upon being informed that those materials were burned and conducted an investigation to ensure that these practices stopped. The incinerator is currently not operating, and burnable wastes are being accumulated on-site in convertor shells near X-744G.

4. Uranium-Contaminated Oils. Improper tracking and lack of a central area for storing uranium-contaminated oils can result in mishandling or inappropriate use of the oils and a subsequent release of uranium to the environment.

   Uranium-contaminated oils from the process buildings are accumulating within the process buildings at several locations. These oils are not stored in a central area, and documentation regarding the quantity and location of these oils was not available during the Survey.

   Process oils containing uranium were formerly disposed of at the X-231A, X-231B, and X-701B Oil Biodegradation Plots. This practice was halted, and now there are no available treatment or disposal options and the oils continue to accumulate. The future disposal plan is incineration at the K-25 incinerator (see Section 4.1.1.2). Long-term storage will be required until these wastes can be incinerated.

5. X-700 Chromate Tank Solution and Sludge - Treatment/Disposal. The chromic acid tank in X-700 may be serving as an unpermitted hazardous waste storage tank. In addition the tank may be leaking chromic acid into the ground and contaminating groundwater.

   The 18,000-gallon chromic acid tank was reported as being active on the Underground Storage Tank inventory filed by PUEC in 1986. This information was contradicted by X-700 personnel, who stated during the survey that the tank is no longer used. Consequently, the tank contents--highly concentrated hexavalent chromium solution and sludges--would now be considered hazardous wastes. This tank is, in effect, serving as an unpermitted hazardous waste storage tank (see Finding 5, Category IV, Section 4.1.2.4). The tank does not have drains and its integrity has not been tested. The level of solution has dropped even though no solution has been removed. Evaporation is not likely to be the explanation, since the solution is highly concentrated and should have a low evaporation rate.

Off-site disposal of the tank contents is virtually precluded, since the solution contains uranium. The most practical disposal method, treatment at the X-616 Liquid Effluent Control Facility, would require obtaining a hazardous waste treatment permit for X-616, which is presently permitted only as an NPDES treatment facility.

6. Waste Oil Storage. There is a potential for mishandling, through inappropriate use or disposal, of waste oils containing hazardous, PCB, or radioactive constituents, because of improper storage (resulting from waste characterization lag time) and incomplete labeling of drums. The following examples were observed by the Survey team:

   - Drums of hazardous waste and potentially hazardous waste are stored for periods exceeding 90 days in X-740 (Waste Oil Storage Facility). This is necessitated by the lag time between sampling and reporting of analytical results. Frequently, 6 months or more elapse before it is determined whether the waste is hazardous. X-740 is not permitted for hazardous waste storage. Even after the waste oil is determined to be a hazardous or mixed waste, it is not moved to X-752 because of the lack of storage space (see Finding 4.1.2.2.1).

   - Drums of waste oil contaminated, or potentially contaminated, with uranium are stored in X-740 for extended periods of time because of the lag time (6 months or more) between sampling for radionuclides and the reporting of analytical results. PUEC procedures specify that drums of oil containing radioactive constituents should be transferred and stored a X-744G. Even after the waste oil is found to contain radionuclides it is not moved to X-744G because of a lack of storage space (see Finding 4.1.2.2.1).

4.1.2.3 Category III

1. Integrity of Underground Storage Tanks. Hazardous wastes or materials could be released into the soil and/or groundwater from underground tanks and associated piping that have not been tested for structural integrity.

Forty-eight underground storage tanks are regulated by the hazardous waste underground storage tank regulations and were subject to the RCRA Part 280 reporting requirements (see Table 4-3). Many of these tanks and associated piping, including those with chromium-containing cooling water, the 18,000-gallon gasoline and diesel fuel tanks

at the X-740 garage, and the underground wastewater pits at X-710 and X-701C, are at least 30 years old. It is possible that, because of their age, not all of these tanks have retained their structural integrity. Therefore, some may be leaking and contaminating the groundwater and/or soil.

The cooling tower basins and associated piping are of particular concern because of the extreme mobility in groundwater of hexavalent chromium (a corrosion inhibitor in the cooling water), the age of the basins, the depth of the basins, and the quantity of cooling water (five basins containing 2.2 to 6.8 million gallons). Most of the basins are near, if not actually within, the water table. A cooling water basin of similar design and construction at the Paducah Gaseous Diffusion Plant (Paducah, Kentucky) drained into the ground when it was isolated from the recirculating cooling water systems.

Waste-holding tanks and associated piping of concern include the X-701C pit, which receives acidic waste from X-705, and the X-710 laboratory pit, which receives acidic wastes and some solvents from the X-710 laboratory operations.

USEPA will promulgate underground storage tank regulations, which will require leak testing, monitoring, and reporting releases from tanks, taking corrective actions if leaks occur, and preparing closure plans to prevent future contamination. States such as California and New York have already promulgated such regulations.

Survey-related sampling is planned.

4.1.2.4 Category IV

1. Hazardous Waste Training. Since building personnel in X-740 and X-744G, as well as in other facilities where hazardous waste is handled, are not trained in hazardous-waste-handling procedures, a release of hazardous waste constituents to the environment may result. Hazardous constituents could be released through improper disposal in a nonhazardous waste disposal facility or inappropriate use, such as use of hazardous waste oil as a road-oiling compound.

2. X-752 Hazardous Waste Storage. There are no measures (such as grates) to prevent hazardous waste containers from coming into contact with water or released wastes in the event of a spill. The floors of the waste storage area are not sloped to allow liquids to

drain away from waste containers, nor in the absence of sloping, are there pallets or grates to keep waste containers off the floor. The pending RCRA permit will address this problem.

3. Organic Hazardous Waste Disposal. Organic hazardous wastes, primarily those containing sludges, are accumulating because the off-site disposal facility (CECOS) used by PUEC for disposal of hazardous solvents and paint sludges can no longer accept these wastes. Land disposal, which was used in the past, is prohibited by the RCRA Land Disposal Ban after November 8, 1986. Although these organic wastes can be incinerated, they are not accepted for incineration because they do not pass the 60-mesh screen size limit imposed by the CECOS incinerator. Filtering of these sludges to pass a 60-mesh screen would require a hazardous waste treatment permit. Although other incinerator operators may take drum quantities of waste not passing the 60-mesh screen test, PUEC is limited in its choice of commercial incinerators, since only CECOS has been willing to accept U.S. Government terms and conditions of contract.

4. Applicability of RCRA to Trap Materials Prior to Uranium Recovery. Storage of wastes (spray table solids, trap materials, etc.) prior to uranium recovery may be subject to RCRA regulations, since these wastes recently failed the EP toxicity test. If further testing confirms that the wastes are EP toxic, X-744G may need a RCRA storage permit even if no wastes destined for disposal are stored at the facility. (See Findings 4.1.2.2.1 and 4.1.2.2.2). Survey-related sampling is planned.

5. Solid Waste Management Unit List - RCRA Part B Permit Application. The RCRA Part B Permit Application did not list all solid waste management units as required. USEPA stated in the NOD previously discussed (see Section 4.1.1) that the X-749A Classified Materials Burial Ground and the northern X-611 impoundment should be listed as solid waste management units. The chromate tank in X-700W is not listed even though X-700 personnel informed the survey team that the tank is no longer used (see Finding 4.1.2.2.5).

4.2 Toxic and Chemical Materials

4.2.1 General Description of Pollution Sources and Controls

At PUEC, the toxic and chemical materials survey covered PCBs, asbestos, fully halogenated chlorofluoroalkanes, tetrachlorodibenzo-p-dioxin (TCDD), and pesticides/herbicides. Additionally,

chemical storage and handling at the X-720 stores area and bulk storage of chemicals at various buildings was also covered.

PCB Sources

A total of 160 transformers and 11,261 capacitors are in service at PUEC. In all, a total of 1,171,545 kg of PCBs are present in transformers and capacitors on site. The PCBs are located throughout the facility; however, the majority of sources are in process buildings X-330 and X-333. In addition, Building X-333 also houses the storage areas for liquid and solid PCB waste, such as from wipes and sweepings from the lubricating oil system (see Section 4.1.1.4). The co-contaminated soils from the X-615 cleanup are also stored in X-333. Additionally, approximately 10,000 gallons of Pyranol are stored in the PCB storage area in X-333. These areas are all diked to control escapes into the environment. Another source of PCBs is the ventilation duct work that drips PCB-contaminated oils from its gasket material onto the floor of the process buildings. PCBs were introduced into the system when, during installation, the gasket material to be used was soaked with oil to help form a better seal. The oils contained PCBs, although this was not known at the time. A collection system captures many of the drips but is not in place at all locations.

Asbestos Sources

Asbestos materials are used throughout PUEC. These materials are used for insulation, packing, gaskets, shingles, cement, and transit.

A quarterly report is issued dealing with removal of friable asbestos. Asbestos removal projects are conducted according to NESHAPs regulations. Asbestos wastes are handled as either uncontaminated or contaminated with radioactive materials. Contaminated asbestos wastes are staged at X-744G in discarded reaction vessels before disposal at X-749. Uncontaminated wastes are collected in assigned dumpsters throughout the plant and staged at X-700 before disposal at the designated asbestos disposal area of the X-735 Sanitary Landfill.

Several of the larger cooling towers at PUEC (630 and 633) contain a "fill" that contains asbestos. The material, called "Munter's Fill" was chosen to provide an improved surface for evaporation and thereby improve cooling. As this material aged it became more friable. PUEC has determined that the recirculating water contains asbestos particles well above the detectable limit. Levels as high as 1.0×10^6 fibers per liter have been found. To limit employee exposure, PUEC now requires

respirators when working in this area. Replacement of this fill with non-asbestos materials is planned by 1990.

Pesticides/Herbicide Sources

Four herbicides are currently in use at PUEC. These are SPIKE TREFLAN GG, Roundup, SIMAZINE 80W, and WEEdone 170. Although these herbicides are applied throughout PUEC, there is no monitoring of groundwater or surface water for these chemicals (see groundwater and surface water sections). Building X-342B is the storage area for these chemicals. Strychnine corn (for pigeon control) and Hubsco 147 (rat poison) are stored in X-720C. Both storage areas are secured and well maintained. These chemicals are used on an "as needed" basis, and no estimate of quantities used was available during the Survey.

Although applicators attend regular training sessions, the need for formalized written procedures to cover spills and applications near surface water was observed during the Survey. PUEC has since implemented these procedures.

Chlorofluoroalkane Sources

Refer to Section 3.1 for a discussion of chemicals in this category.

TCDD (Dioxin) Sources

There is no evidence of dioxin use on site. However, because the on-site incinerator has burned unauthorized wastes, there is the potential that PCB wastes could have been burned, a process which could produce TCDD as a result of inefficient combustion (see Finding 3.1.4.2.1).

Other Sources

The Spill Prevention, Control and Countermeasure Plan (SPCC) (GAT, 1985d) identified at least eight liquid chemical storage tanks with capacities between 140 and 10,000 gallons. Chemicals stored in these tanks include sodium hydroxide and chromic, hydrochloric, nitric, and sulfuric acids.

4.2.2 Findings and Observations

4.2.2.1 Category I

None

4.2.2.2 Category II

1. PCB Releases from Transformer Areas. Accumulation of oily wastes and trash in several diked transformer areas on the ground floor of X-333 could lead to potentially unsafe conditions and releases of PCBs to the environment.

   Allowing PCB oils to accumulate could potentially lead to larger cleanups and the attendant problems associated with handling and disposal (see Finding 4.2.2.4.1). Allowing trash to accumulate in diked areas may lead to the spread of PCB oil and contribute to a potential fire situation. TSCA regulations require cleanup of PCB-oil leaks within 48 hours, and the removal of all flammable materials stored near PCB transformer.

2. Leaking Seals Lack Collection Systems. The lack of collection systems on all leaking seals in the ventilation duct-work system of the process buildings results in the spread of PCB oils.

   Oils were introduced into the duct-work system during installation, when they were applied to the duct-work seals. It was later discovered that these oils contained PCBs. At present, PCB oils fall to the floor from seals without collection systems and remain there until the Chemical Operations Group is notified to clean up the oils. While awaiting cleanup, the oils can be tracked throughout the process buildings by pedestrian and vehicular traffic (see Finding 4.2.2.4.1).

4.2.2.3 Category III

1. Spills from Above-Ground Tanks. Spills from above-ground tanks could result in the release of transformer oils, fuels, and chemical products to surface water, groundwater, and soils.

The PUEC Spill Prevention, Control and Countermeasure (SPCC) Plan (D'Antonio, 1985) identifies a number of tanks as having no spill containment structures. The tanks identified include the following:

- 24 fuel tanks ranging in size from 80 to 10,000 gallons.
- 8 chemical storage tanks ranging from 140 to 10,000 gallons.
- 183 transformers with oil capacities of 400 to 34,000 gallons.

The Survey team identified a 25,000-gallon sodium hydroxide tank as having inadequate secondary containment. The tank was in an unlined depression that did not have sufficient volume to contain a spill of the entire contents of a full tank.

Based on survey observations, the methods PUEC relies on to contain spills from undiked and/or inadequately diked tanks can be categorized as one of the following types:

- The methods do not exist.
- They involve cleanup of the area affected by a spill.
- They involve containment at a holding pond (that may be of some distance from the tank) and cleanup of the pond and the pathway of the spill to the pond.

In the latter method there is still a potential for a release to the environment because of failure of the holding pond to contain the spill; e.g., the holding pond that is relied upon to contain an oil spill from the X-533 switchyard is filled with sediment and is incapable of containing a major spill. According to PUEC personnel, the pond successfully contained a spill from X-533 in 1978; however, the Survey team does not believe the pond could contain a similar spill today.

4.2.2.4 Category IV

1. Written PCB Cleanup and Inspection Procedures Needed. No written procedures are in place at PUEC to cover the following situations:

   - Cleanup of PCB oil leaks from transformers in the process buildings. TSCA requires that PCB leaks be cleaned up within 48 hours. There is no formal procedure in place to

ensure that diked areas in the three process buildings are inspected on a routine basis and that leaks are reported and cleaned up within 48 hours. Prior to completion of the Survey, the building custodian of the X-333 process building informed the Survey team that he initiated a procedure for routine inspections and prompt reporting and cleanup of PCB leaks.

- Cleanup of the PCB oil drips from the process building ventilation duct-work system. There currently are no formalized procedures to provide for a more frequent inspection of oil drips and the timely notification of the Chemical Operations Group for cleanup. PCB leaks should be cleaned up within 48 hours according to TCSA (see Finding 4.2.2.2.2).

- Inspection of co-contaminated (radioactive and non-radioactive) PCB waste storage area in X-333. During the Survey, there was no formalized procedure outlining a regular inspection of the co-contaminated drums stored on the ground floor of X-333. The Environmental Control Group has prepared a written guidance outlining a regular inspection procedure to ensure the integrity of the drums in storage.

2. Pesticide Application Procedures. There is the potential for contamination of surface waters with pesticides because of the lack of a formalized procedure for application of pesticides near such waters. The existing practice, communicated by word-of-mouth, directs the operator not to apply pesticides within 15 feet of a stream. New or untrained personnel could unknowingly violate this directive.

   The Environmental Control Group has prepared a procedure giving specific direction regarding the application of pesticides near streams.

3. Uncontrolled Herbicide Releases. There is the potential for uncontrolled releases of herbicides to the environment from an accidental spill or release in the X-342B storage area. There were no formalized emergency procedures in place for addressing these kinds of releases. A procedure has been prepared by the Environmental Control Group to outline what should be done in these cases.

4. Asbestos Wastes. Although not currently an environmental problem, the present PUEC practice of single-bagging asbestos waste has more recently been replaced by

double-bagging at many Federal and non-Federal facilities. This practice reduces the potential for accidental exposure to airborne materials.

5. Identification of PCB Transformers. There is the potential for mishandling PCB transformers in process buildings during emergencies such as fires. No labels are in place on the doors to the process buildings to indicate the presence of PCB transformers inside. Door identifications are required by the 1985 TSCA fire regulations.

6. Reporting PCB Quantities. PCB quantities were incorrectly reported in the 1984 and 1985 PCB annual reports. The annual reports are an administrative requirement of TSCA. A review of the annual reports by the Survey team revealed the following:

   - PCB quantities in the 1984 and 1985 annual reports were reported in pounds instead of kilograms, as required.

   - PCB quantities in the 1985 annual report were summed for all sources; PCB quantities for transformers are required to be reported separately.

4.3 Direct Radiation

4.3.1 Background Environmental Information

The radiation-site setting can be described as a subset of each of the previous media settings (e.g., air, soils, hydrogeology, and surface waters). Each of these primary pathways is responsible for radionuclide transport and ultimate contamination of vegetation, food, ambient air, drinking water, and soils.

Off-site radionuclide contamination as a result of PUEC operations is, generally speaking, only slightly above natural background concentrations. Maximum measured radiation levels for 1985 revealed an air pathway dose of only 6 percent of the most stringent applicable EPA limit. Ambient air monitoring stations located downwind measure only slight increases above concentrations measured at the background station located upwind from the plant.

All surface water effluent streams from the plant eventually drain into the Scioto River. During 1985, no significant difference was measured in the averages of alpha activity concentrations ($<0.91 \times 10^{-8}$ µCi/ml upstream versus $<0.93 \times 10^{-8}$ µCi/ml downstream) or beta-gamma activity

concentrations ($<4.54 \times 10^{-8}$ µCi/ml upstream versus $<4.81 \times 10^{-8}$ µCi/ml downstream) (GAT, May 1986). Uranium concentrations upstream and downstream also showed no significant difference.

Most of the other offsite media radionuclide concentrations are either at background levels or only slightly above. Additional details regarding radionuclide concentrations on-site and off-site are discussed in each of the media sections in Chapter 3.

4.3.2 General Description of Pollution Sources and Controls

Aerial radiation surveys (see Figures 4-3 through 4-5) conducted in 1976 indicate, as expected, that the primary sources of radiation are the X-745B and C UF_6 feed and tails storage yards, and the feed vaporization storage yard. Another aerial survey has been conducted since GCEP was constructed; however, the results and contours have not been prepared at the time of this writing. It is not anticipated that this updated aerial survey will have results significantly different from the 1976 survey.

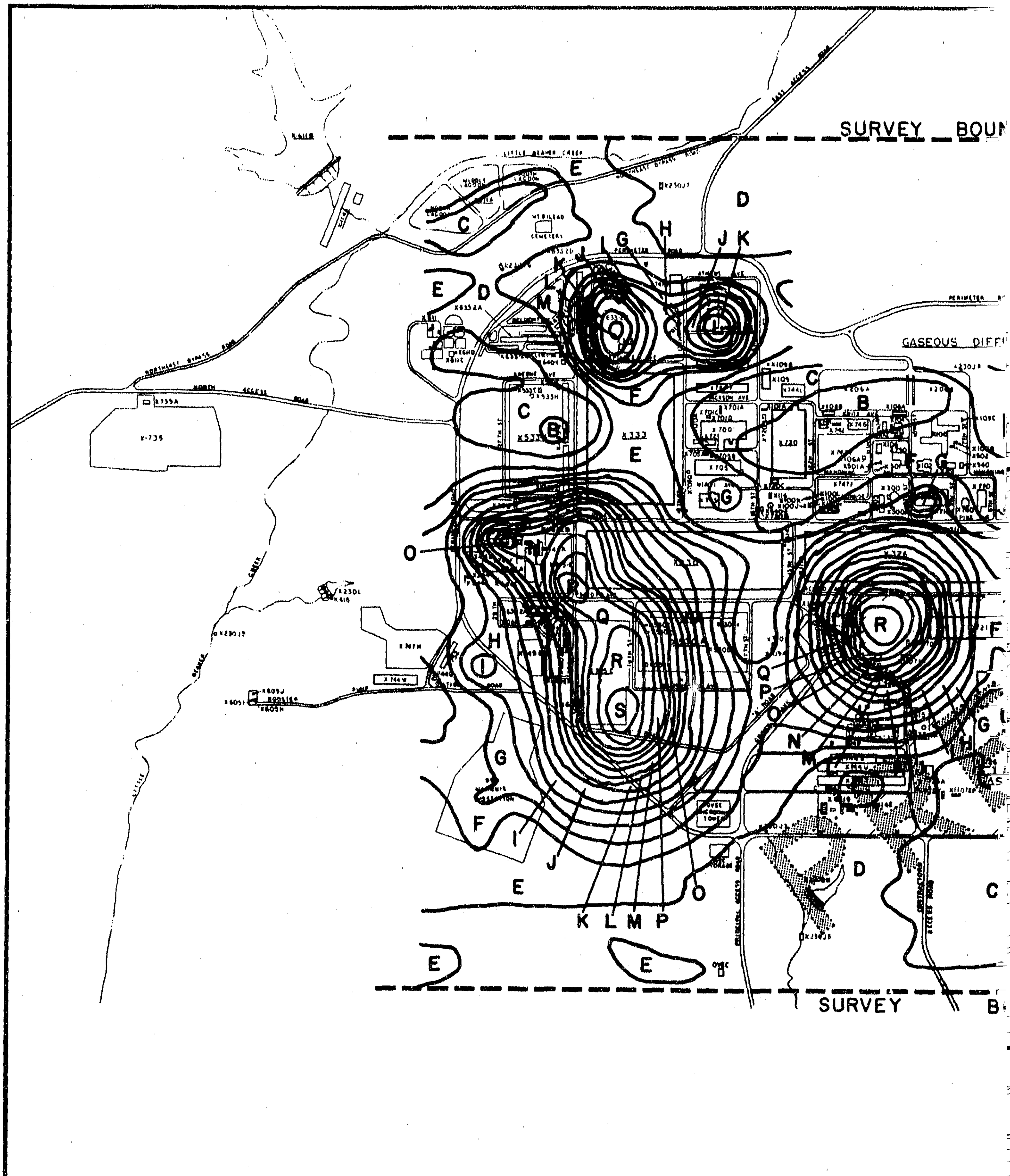
The primary control used to limit direct radiation exposure to members of the public is site perimeter fencing. Once inside the security fence surrounding process areas, employees and visitors may then have unrestricted access to all storage areas.

4.3.3 Environmental Monitoring Program

Direct radiation is measured by site contractor personnel at 28 locations surrounding the site using thermoluminescent dosimeters (TLDs). A set of 28 field TLDs and 4 control TLDs (used for calibration) is exposed for 3 months at a time. At the end of this time, a fresh set of TLDs is set out and the exposed TLDs collected for reading in accordance with environmental control procedure MSE-E-508 (Goslow, 1986).

TLD sampling points are categorized into three groups. Group I consists of eight locations around the perimeter road that represent the closest the general public can approach the plant. Group II consists of six locations around the DOE property line, which range from 1.5 to 3 km (1 to 2 miles) from the plant center and are situated in the closest general public residential area. Group III consists of 14 locations that represent residential and agricultural areas around the site and range from 3 to 8 km (2 to 5 miles) from plant center.

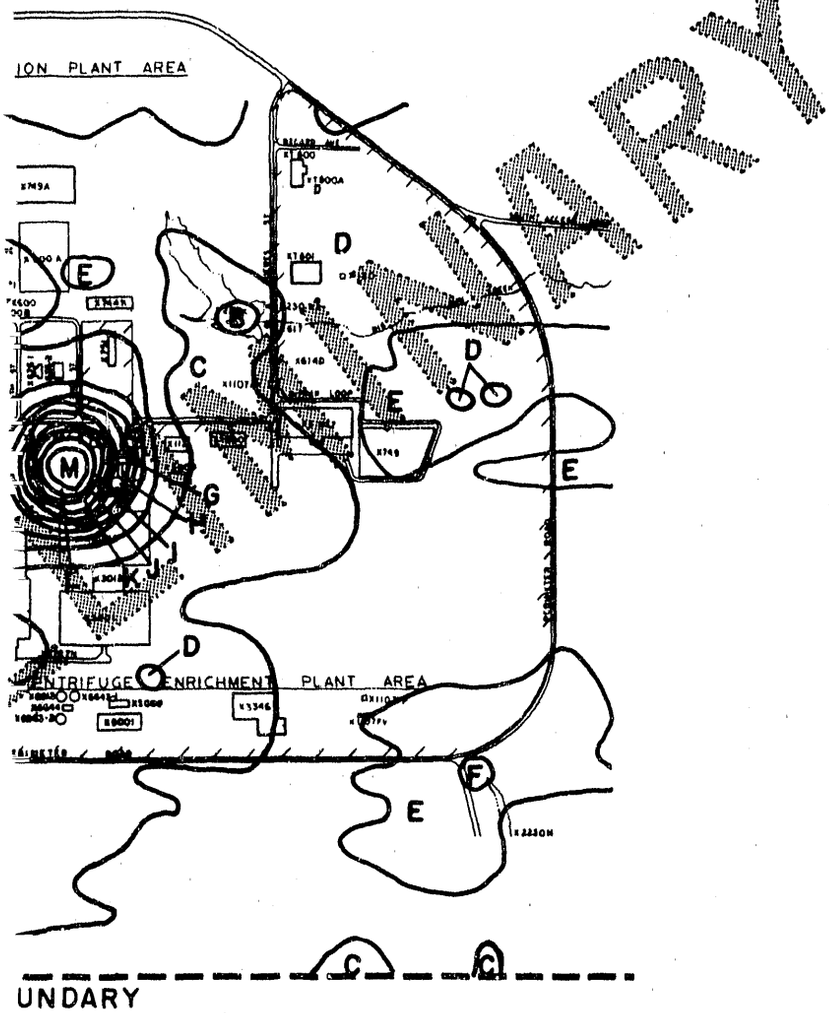
2



SOURCE: EG & G, 1981

TOTAL EXPOSURE RATE
PUEC-F

DARY



CONVERSION SCALE	
LETTER LABEL	TOTAL GAMMA EXPOSURE RATE (μR/h) AT 1 METER LEVEL*
A	<5
B	5-6
C	6-7
D	7-8
E	8-10
F	10-11
G	11-12
H	12-15
I	15-20
J	20-25
K	25-30
L	30-40
M	40-55
N	55-75
O	75-100
P	100-150
Q	150-200
R	200-300
S	>300

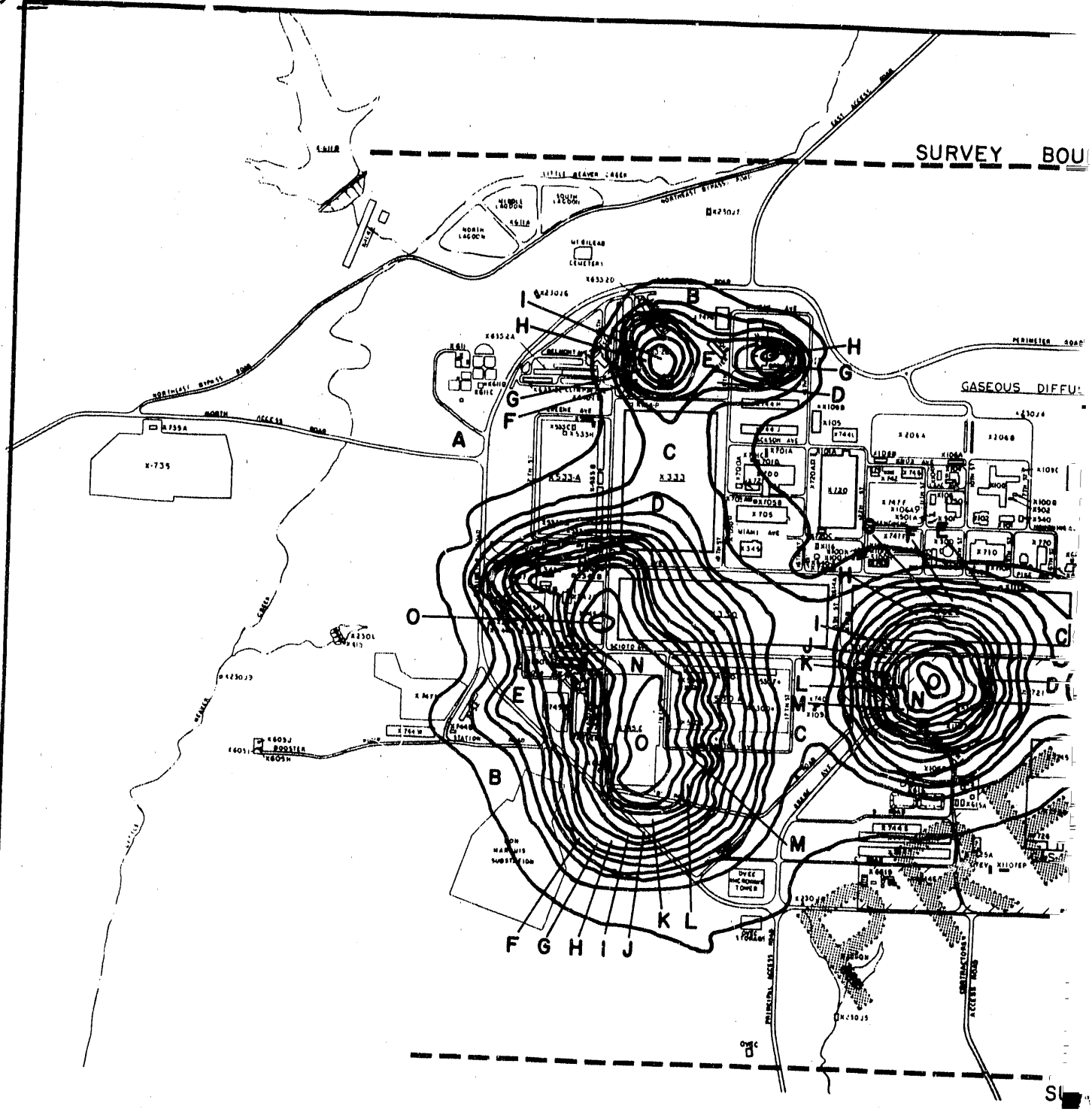
* At 1 meter above ground averaged over the detector field-of-view (approximately 200m in diameter). Includes cosmic ray contribution of 4μR/h.

0 1500 3000
SCALE IN FEET

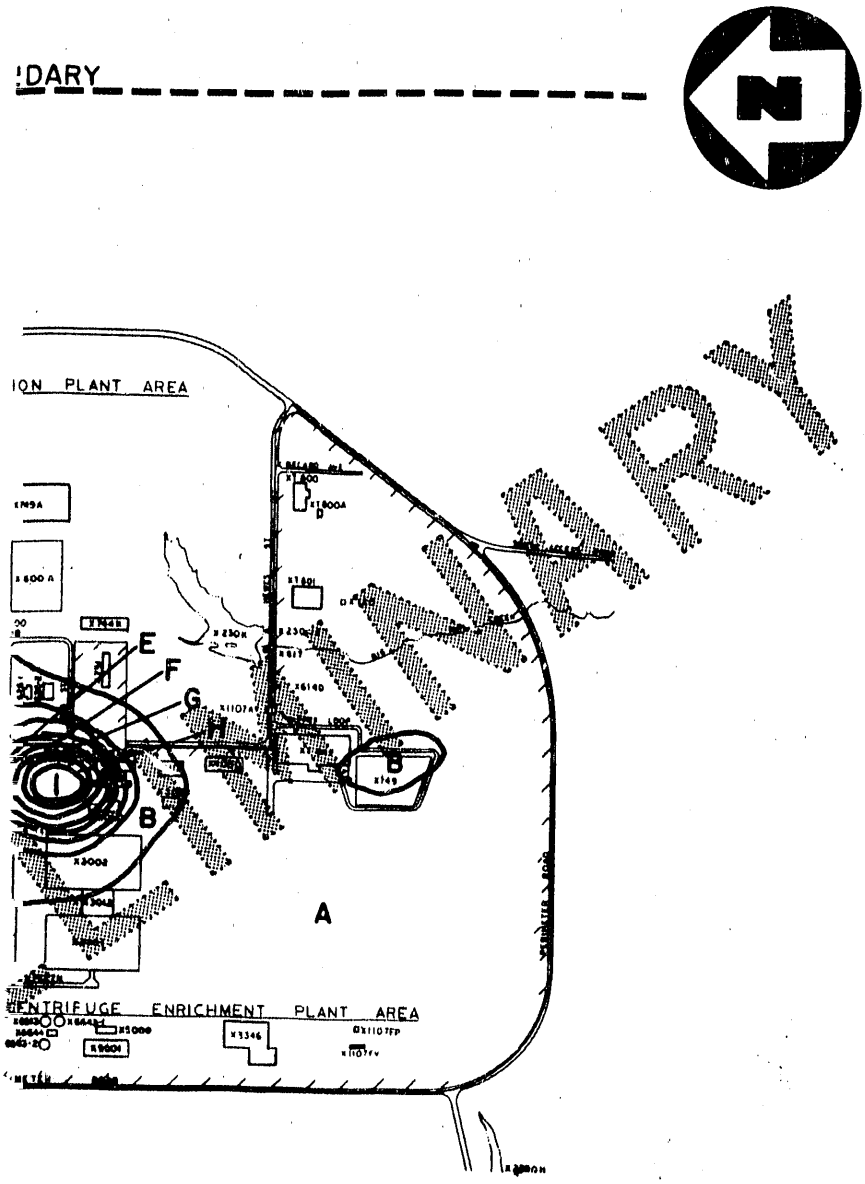
FIGURE 4-3

:-AERIAL SURVEY-1976
IKETON, OHIO

2



MAN-MADE CONTAMINANT
PUEC-P



CONVERSION SCALE	
LETTER LABEL	GAMMA EXPOSURE RATE (μR/h) FROM MAN-MADE ISOTOPES AT 1 METER LEVEL*
A	< 1
B	1-4
C	4-5
D	5-7
E	7-10
F	10-15
G	15-20
H	20-30
I	30-40
J	40-50
K	50-70
L	70-100
M	100-150
N	150-200
O	> 200

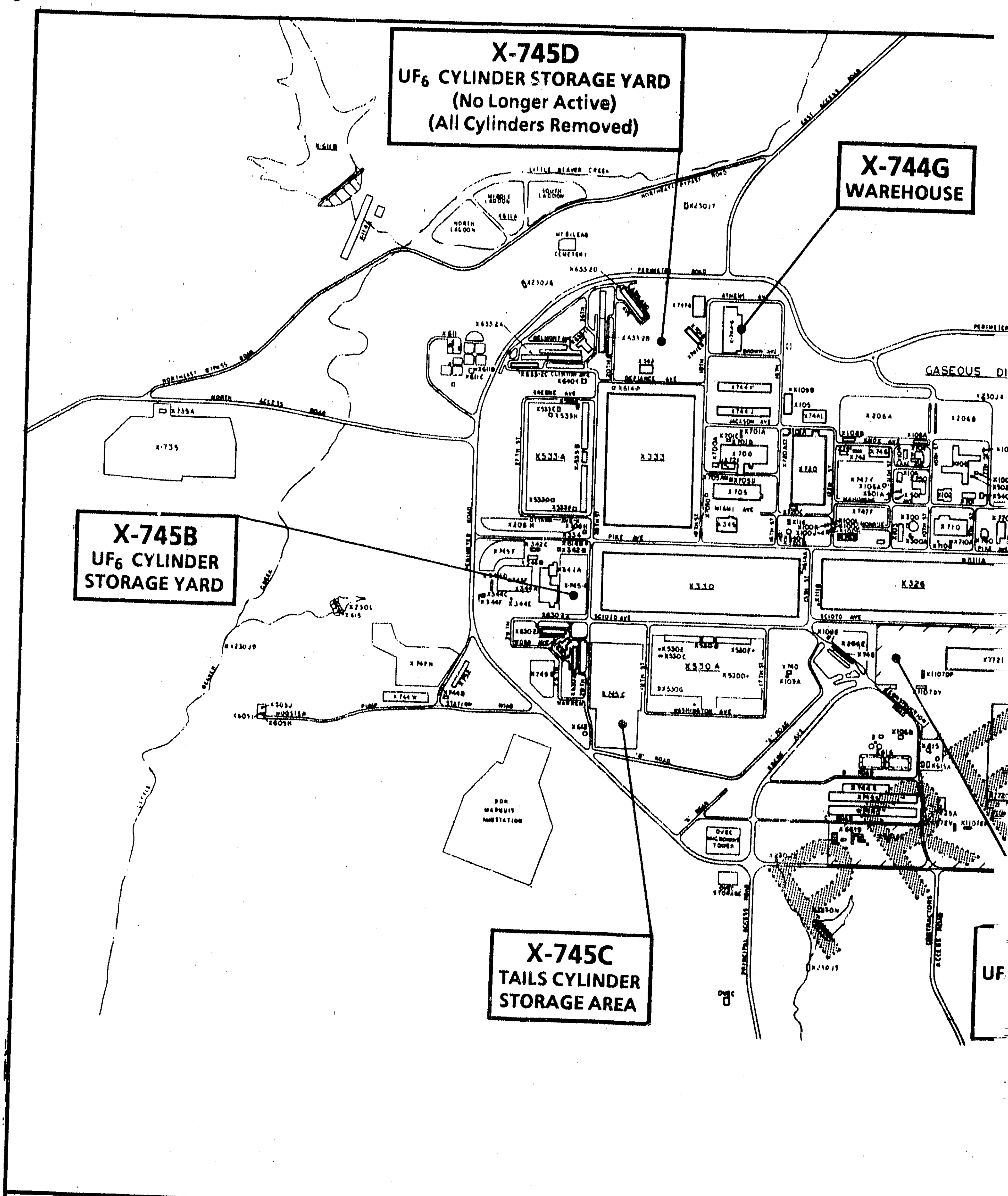
* Assuming 1000 cps at 90m altitude equals 1 μR/h at 1m above ground, averaged over the detector field-of-view (approximately 200m in diameter).

0 1500 3000
SCALE IN FEET

-AERIAL SURVEY- JULY 1976
KETON, OHIO

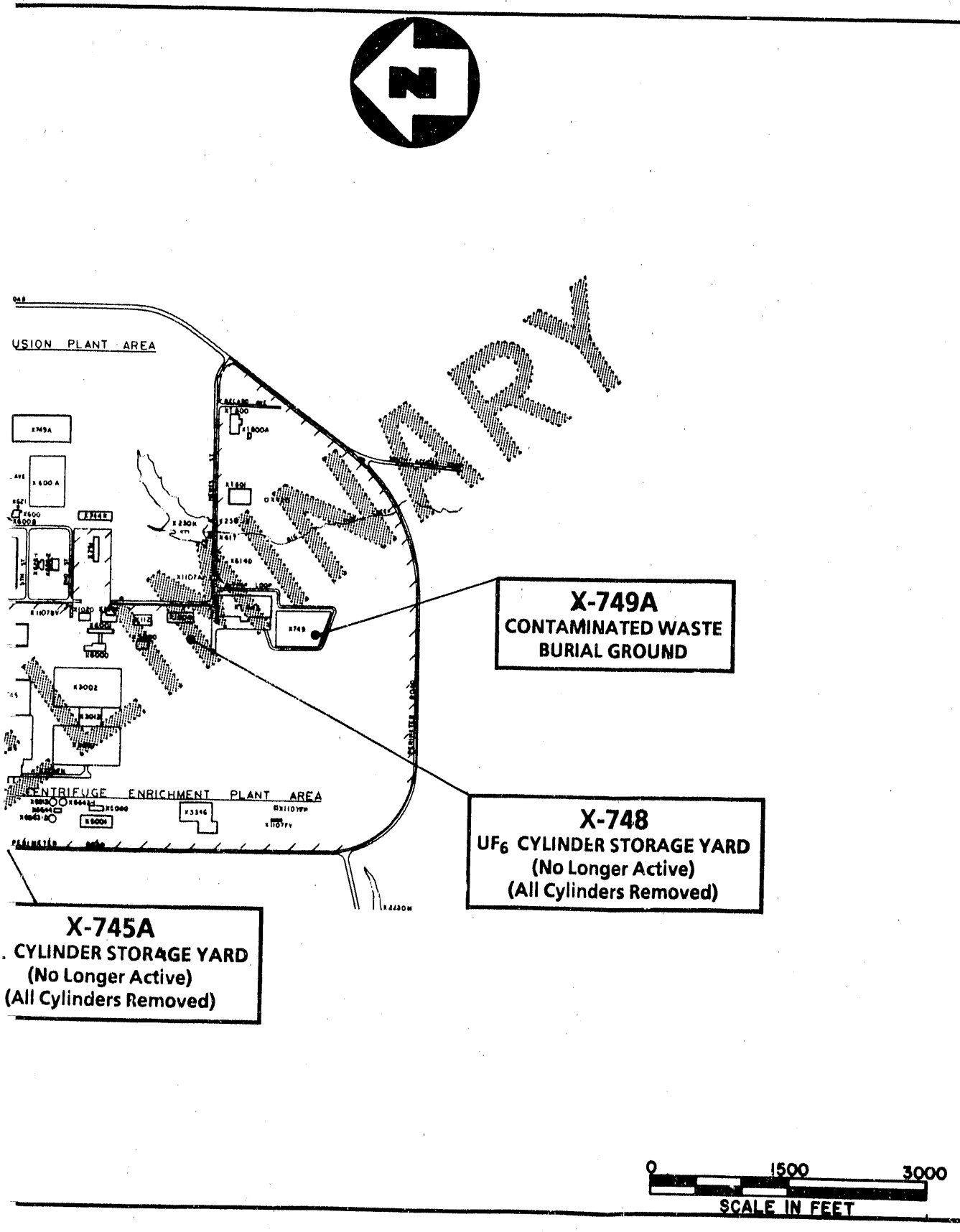
FIGURE 4-4

2



SOURCE: EG & G, 1981

PRIMARY SO
PUEC-



RCES OF RADIATION
IKETON, OHIO

FIGURE 4-5

Group I results indicated a 1985 average of 6.9 microrem/hour, which is equivalent to a 60.4 millirem/year dose. Group II results average at 6.8 microrem/hour (59.6 millirem/year), and Group III results are 8.0 microrem/hour (70.1 millirem/year) respectively. These results are not significantly different from background and aerial radiation survey data discussed below.

TLD results, which are more accurate for a specific location, generally are in good agreement with the categories indicated on the aerial surveys. TLD station 29 is in the direction of the residence closest to the largest concentration of direct radiation sources, the X-745C tails cylinder storage area. Results for the first and second quarter of 1985 average 7.35 microrem/hour (64 millirem/year) at station 29 compared to an average of 7.4 microrem/hour (65 millirem/year) at the background station (No. 28) for the same period. Ambient gamma monitoring data reported by the EPA for April to June 1985 indicate an average of 7.2 microrem/hour (63 millirem/year) at the Columbus, Ohio, station (EPA, 1986b).

4.3.4 Findings and Observations

4.3.4.1 Category I

None

4.3.4.2 Category II

None

4.3.4.3 Category III

None

4.3.4.4 Category IV

None

4.4 Quality Assurance/Quality Control

4.4.1 General Description of Data-Handling Procedures

The PUEC Technical Division Analytical Laboratories (TDAL) QA activities are administered by a coordinator who reports directly to the division manager. The TDAL consists of numerous laboratories that provide services which include support to environmental, industrial hygiene, uranium accountability, process control, and research and development activities.

The Laboratory Controls and Standards Group (LCSG) prepares and administers standards and controls for the TDAL. LCSG also operates the Central Sample Receiving and Storage facility, prepares the chain-of-custody protocols, administers the laboratory information system, and performs statistical analyses of TDAL data.

A measurement control program is in effect that includes internal controls, external controls, working standards, spike samples, and duplicate samples.

Other measures in place at PUEC that supplement the QA program include certification of personnel, calibration of equipment, provision of laboratory security, use of approved procedures, and conduct of internal audits.

4.4.2 Findings and Observations

4.4.2.1 Category I

None

4.4.2.2 Category II

None

4.4.2.3 Category III

None

4.4.2.4 Category IV

1. D a May be Suspect. The following findings at the organic, inorganic, and/or radiological laboratories at PUEC could result in imprecise and/or inaccurate environmental monitoring data being generated:

   - Organic Laboratory. Formalized QC checks, such as calibration checks, transcription errors, calculation checks, and written laboratory procedures (adapting EPA SW 846 procedures to the PUEC laboratory) were not in use. These deficiencies are recognized by the organic laboratory staff and will be addressed after the backlog of samples from the East Ditch Drainage Project is depleted.

   - Inorganic Laboratory. No written QA sign-off procedures were in place in the PUEC inorganic laboratory notebooks. The function of a QA check of results was routinely carried out, but the laboratory did not have a mechanism for a QA sign-off in the notebooks. The laboratory initiated a formal QA sign-off procedure during August 1986.

     No action was taken when a control sample result was not within specifications. The laboratory has initiated a procedure to alert the supervisor so that appropriate action can be taken. In addition, a new Laboratory Information Management System (LIMS) is being implemented that will also alert the supervisor when such anomalies occur.

   - Radiological Laboratory. Laboratory analysts were not signing-off in their laboratory notebooks at the time of the survey. Proper QA procedures specify that the analyst sign off by initialing each page of the analysts's notebook. The radiological laboratory supervisor implemented a sign-off mechanism during August 1986.

4.5 Inactive Waste Sites and Releases

4.5.1 General Description of Pollution Sources and Controls

This section provides an overview of the sources and potential sources of releases of hazardous substances into the environment at PUEC. Because the precise source of contamination is often unclear, the sources have been aggregated into geographic areas (see Table 4-10) on the facility, and a miscellaneous category has been established for site-wide or isolated sources. The locations of the

TABLE 4-10

KNOWN OR SUSPECTED SOURCES OF GROUNDWATER CONTAMINATION

- EAST CENTRAL AREA (SECTION 4.5.1.1)

  1. X-701B Holding Pond
  2. Process Lines from X-700 and X-705
  3. North Oil Biodegradation Plot (X-701B)
  4. "Total Containment" Ponds
  5. X-701C Neutralization Pit
  6. X-700 Chemical Cleaning Building
  7. East Drainage Ditch
  8. Recirculating cooling water system
  9. X-744G Building

- NORTH AREA (SECTION 4.5.1.2)

  10. Old Landfill (Ruby Hollow)
  11. Construction Spoils Disposal Area

- SOUTH AREA (SECTION 4.5.1.3)

  12. X-231A,B Oil Biodegradation Plots
  13. X-749A Classified Materials Burial Area
  14. X-749 Contaminated Material Disposal Facility
  15. Peter Kewitt and Sons Landfill
  16. X-230k South Holding Pond

TABLE 4-10
KNOWN OR SUSPECTED SOURCES
OF GROUNDWATER CONTAMINATION
PAGE TWO

- MISCELLANEOUS AREAS (SECTION 4.5.1.4)

17. X-615 Old Sewage Treatment Plant
18. Miscellaneous Drums and Spills
19. GCEP Building Area
20. West X-705 Pad Area
21. Process Building (X-333, 330, and 326) Disposal of Solvent
22. West Ditch Disposal Area (March 1978)
23. Chromium Sludge Lagoons (X-616)
24. "East Spot"
25. Road Oiling
26. X-342C Neutralization Pit

Source: DOE Survey team

specific sites are noted on Figure 4-6. The numbers given on the location map (Figure 4-6) correspond to the numbers used to designate the sites in Table 4-10. Further information on each of these sites is given in the Findings section (4.5.2).

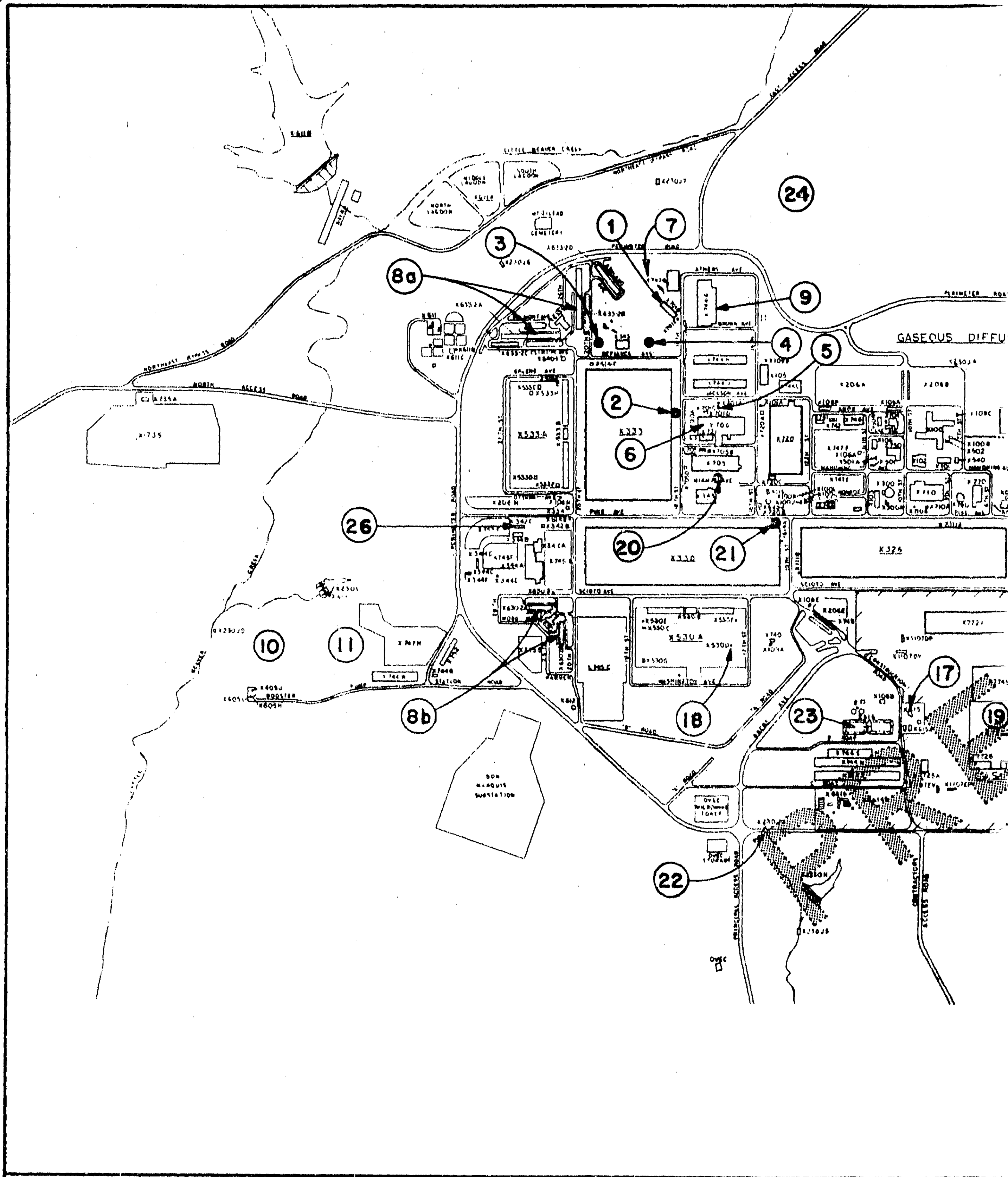
4.5.1.1 East Central Area

There are nine potential sources of soil, surface water, or groundwater contamination in the East-Central Area of PUEC. Each of these actual or potential sources is detailed in Section 4.5.2.

1. X-701B: Unlined holding pond
2. Process Lines from X-700 and X-705: leaky 4-inch and 8-inch piping.
3. North Oil Biodegradation Plot: PCB-, uranium-, and solvent-contaminated oil plot.
4. "Total Containment" Ponds: Disposal areas for X-701B sludge.
5. X-701C Neutralization Pit: Brick-lined treatment pit.
6. X-700 Chemical Cleaning Building: Contains 8 large dip tanks and a degreaser.
7. East Drainage Ditch: PCB-contaminated ditch.
8. Recirculating Cooling Water System: Towers and appurtenances contain chromate-contamined water.
9. X-744G Building: Formerly housed pipe shop; currently shows evidence of spills.

The sources located in the East-Central Area of PUEC may be contributing to the groundwater contamination that is discussed in Section 3.4. In addition to being located in the same area of PUEC, several sources are functionally related. For example, effluents to the X-701B Holding Pond drain from the X-700 and X-705 process lines. These process lines drain the X-701C Neutralization Pit and, indirectly, Building X-700. Sludge dredged from X-701B has been disposed of in the "total containment ponds." The X-701B Holding Pond drains to the East Drainage Ditch. The North Oil Biodegradation Plots are located only about 100 yards north of X-701B. The X-744G building is located only about 100 yards southeast of X-701B. The recirculating cooling water system flows throughout the plant area, but the largest sumps, the cooling towers, are located in the northern section of the plant area. Hence, a thorough understanding of the contamination requires an examination of each individual source as well as the relationship between the sources. More information on these sources is given in Section 4.5.2.

2



SOURCE: DOE Survey team

LOCATION OF
PUEC - P

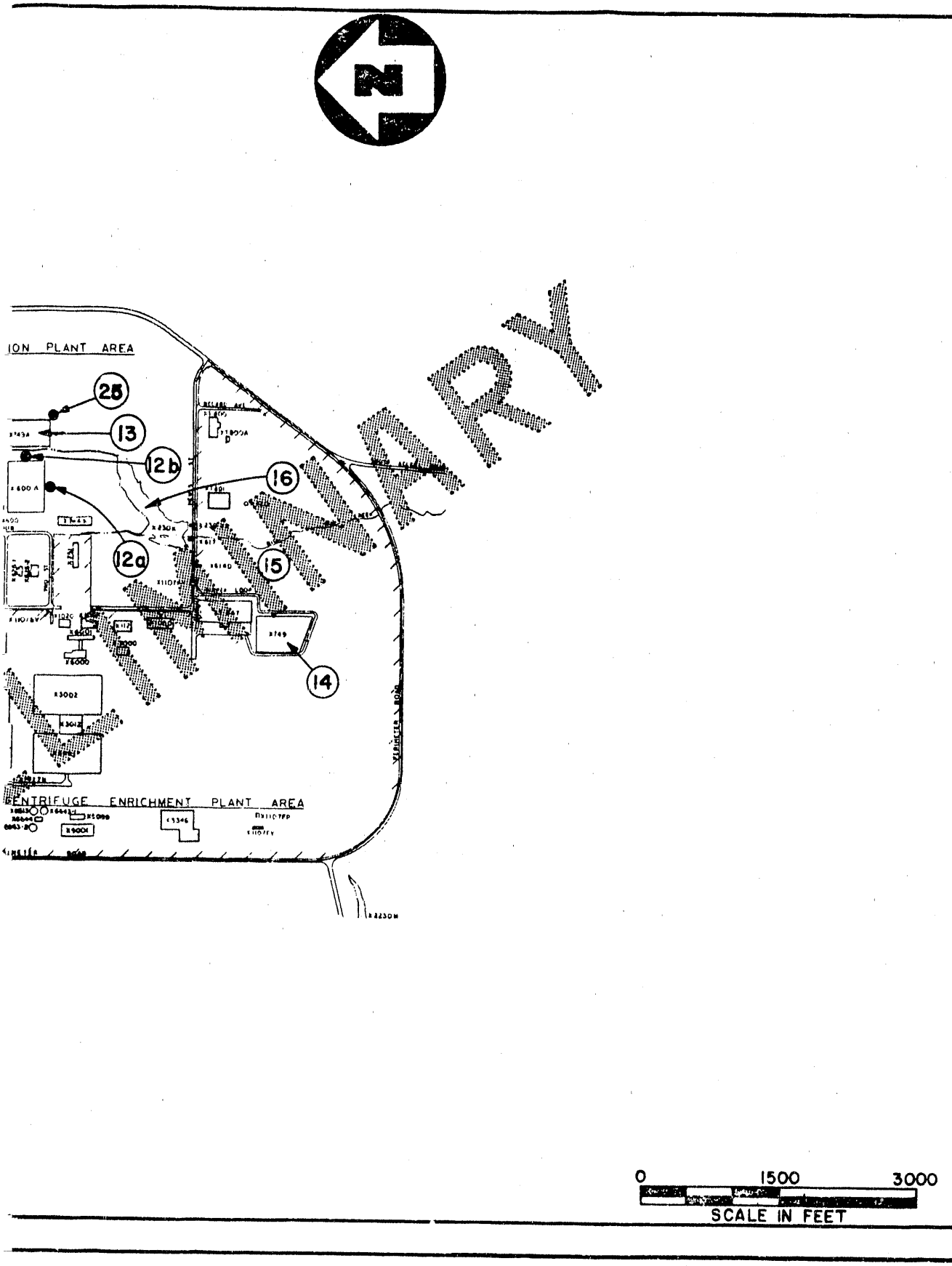


FIGURE 4-6

CERCLA SITES
KETON, OHIO

4.5.1.2 North Area

There are two potential sources of soil, groundwater, and surface water contamination in the North Area of PUEC:

1. Old Landfill (Ruby Hollow): 4-acre landfill used from 1968 to 1981 received primarily mixed refuse but some undetermined amount of hazardous waste.

2. Construction Spoils Disposal Area: 8-acre landfill received construction spoils and coal ash since 1978.

Both of these actual or potential sources are detailed in Section 4.5.2.

The amount of hazardous waste disposed of in these two landfills is uncertain. Because they were used primarily during a period when hazardous waste disposal was less regulated than at present, some hazardous waste is suspected of having been disposed of in them. For example, floor sweepings from the process buildings, now known to be contaminated with 3,000 mg/kg PCBs, were routinely handled like mixed municipal waste and placed in the old landfill.

4.5.1.3 South Area

There are five potentially significant sources of soil, groundwater, or surface water contamination in the southern section of PUEC:

1. X-231A and B Oil Biodegradation Plots: Two land treatment areas which received waste oil contaminated with solvents, PCBs, and uranium.

2. X-749A Classified Materials Disposal Facility: Landfill where majority of waste was contaminated classified tapes, papers, and parts. Some material was contaminated with nickel carbonyl.

3. X-749 Contaminated Material Disposal Facility: Low-level radioactive waste and hazardous waste landfill.

4. Peter Kewitt and Sons Landfill: Landfill primarily used for construction rubble for nearly 30 years (1952 to 1968), but probably received some hazardous wastes.

5. X-230K South Holding Pond: Man-made pond receiving runoff and discharges from most of south area of PUEC, before flowing into Big Run Creek.

Each of these sources is detailed in Section 4.5.2.

4.5.1.4 Miscellaneous Areas

There are 10 areas at PUEC, located throughout the facility or in isolated locations, that are potential sources of soil, groundwater, or surface-water contamination.

1. X-615 Sewage Treatment Plant: Former sewage treatment plant where sludge drying beds were contaminated with PCBs.

2. Miscellaneous Drums and Spills: Several abandoned drums and spill sites are listed in Section 4.5.2.3.

3. GCEP: Area of recent plant construction may have been a former dumping and spill site.

4. West X-705 Pad: Storage pad on west side of X-705 was found to be contaminated with uranium and technetium.

5. Process Building (X-333, 330, 326) Disposal of Solvents: Buckets of TCE were routinely poured onto the ground outside the doors of the process building (according to PUEC personnel).

6. West Ditch Disposal Area: Uranium fallout from a 1978 release settled in a ditch and was later pumped onto the slope leading to the ditch.

7. X-616 Sludge Chromium Lagoons: The two unlined X-616 lagoons hold wastewater and sludge containing trivalent and hexavalent chromium.

8. East Spot: Area inside of eastern fence has been bare since at least 1966, and has a greyish-green layer approximately 4 inches thick located about 1 foot below the ground surface.

9. Road Oiling: Used oil (possibly contaminated with solvents, PCBs, and lead) was applied to unpaved roads throughout PUEC.

10. X-342C Neutralization Pit: Cracked concrete treatment pit possibly leaked solvents, acids, and fluoride.

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. East-central Area - Actual and Potential Sources of Groundwater Contamination

Groundwater in the East Central Area of the site is contaminated with a wide variety of solvents and radionuclides--primarily tricholoroethylene (TCE) and technetium.

As discussed in detail in Section 3.4.4.3, the East-Central Area is the location of the highest known levels of groundwater contamination at PUEC. TCE was found in 13 of 15 monitoring wells at concentrations ranging from 7 to 790 ppm (approximately the limit of solubility of TCE in water). In addition, a 1.65-foot thick layer of pure TCE was found in monitoring well BW-2 in March 1985. There are at least nine actual and potential sources of this contamination. The Survey team, in conjunction with information provided by PUEC, has identified the following actual or potential sources of hazardous substance contamination of the environment in the East-Central Area.

X-701B Holding Pond (Map Site 1). The X-701B Holding Pond is one of at least nine actual and potential sources of groundwater contamination in the East-Central Area of PUEC (see Figure 4-6).

X-701B is a rectangular, unlined holding pond, approximately 30 yards long by 20 yards wide and 15 feet deep, that retains wastewaters prior to discharge to the East Drainage Ditch (NPDES 001). It was designed as a settling basin for suspended solids. For approximately 30 years, thousands of gallons (based on survey team's estimate) of hazardous substances (organic, inorganic, and radioactive) have been discharged annually to X-701B from the X-700 and X-705 cleaning and decontamination buildings. The nature of these wastes has changed over time, but has included spent trichloroethylene (TCE) from the vapor degreasers, chromate wastes, and raffinate (uranium- and technetium-contaminated nitric acid), usually diluted with water and neutralized with lime. Some wastewaters continue to be discharged to X-701B. No information is available on the exact quantity of wastes discharged to X-701B. A complete historical record search of discharges to X-701B has not yet been performed.

There are three apparent contamination sources that contribute to the problems at X-701B. First, the lines from X-700 and X-705 directly discharge to X-701B and thus cause the pond to be a source of groundwater contamination. Second, generalized groundwater contamination from spills and disposal in the area may leach into X-701B (unless groundwater mounding is occurring). Finally, contamination from these spills and disposal may be transported through the gravel/sand-filled utility trench in which the discharge lines were laid. This trench may function in a manner similar to a French drain. The X-701B pond serves as both a source and a conduit for contamination. Because it is unlined, it may contaminate groundwater (see Section 3.4) through slow percolation. In addition, X-701B is emptied by annual dredging of the sediments and sludges and a continuous discharge of effluent to Little Beaver Creek via the East Drainage Ditch.

Wastewaters and contaminants continue to be discharged into X-701B from three pipelines ("process lines" in PUEC's terms) from the X-700 and X-705 cleaning and decontamination buildings (a 4-inch Duriron pressure line, a 5-inch stainless steel line, and an 8-inch line, all referred to as "acid waste" lines, according to PUEC Drawing X-705-11-M). Several lines from the X-705 building merge into two (the 5- and 8-inch lines) while the 4-inch line drains the X-701C neutralization pit. These pipelines are discussed further in the following section (Map Site 2). Discharges to X-701B were studied

in detail by PUEC Chemical Operations Department from February 1983 to February 1984. During that period 1,704,102 liters (450,225 gallons) of wastewater per week (622 million liters [164 million gallons] per year) was metered with an average uranium concentration of 2 ppm. The disposal rate represents an average of 13.63 kg (33 pounds) of uranium per month or 163.59 kg (360 pounds) per year piped into the X-701B Holding Pond. Sludge from the X-701B Holding Pond has been dredged annually into the two "containment ponds" (Middle-East and West) discussed below (Map Site 4). Hence, the sludge discharged into X-701B does not simply accumulate there. At the time of the 1983-1984 Chemical Operations study, there were approximately 578,611 liters (2,190,043 gallons) containing 230 kg (506 pounds) of uranium in X-701B. Concentrations of inorganic constituents in X-701B sludge are given in Table 4-11. No organic contaminant parameters were analyzed in the X-701B sludge because the primary purpose of the Chemical Operations study was to evaluate the loss of potentially recoverable total uranium and U-235, rather than to evaluate potential environmental risk.

Based on other records, Chemical Operations estimated that an average of 277 kg (609 pounds) of uranium have been discharged monthly to X-701B. During the 10 years for which some record of X-701B and "containment pond" usage is available, approximately 3,324 kg (7,313 pounds) of uranium have been discharged to X-701B. There is no information available on the explanation for the discrepancy between the estimated total 3,324 kg (7,313 pounds) of uranium and the 1,232 kg (2,711 pounds) combined total estimated to be contained in the (1) X-701B Holding Pond (230 kg; 506 pounds), (2) the Middle (East) "containment pond (617 kg; 1,357 pounds), and (3) the West "containment" pond (385 kg; 847 pounds). The 2,092 kg (4,602 pounds) discrepancy represents more than 60 percent of the uranium estimated to have been discharged to X-701B. The Chemical Operations Department estimated the efficiency of the X-701B Holding Pond, in precipitating uranium from the influent, at approximately 40 percent. If this efficiency estimate is accurate, then about 1,329 kg (2,923 pounds) of uranium would have been precipitated in X-701B, and 1,995 kg (4,389 pounds) discharged through NPDES 001 to the Little Beaver Creek from 1973 to 1984. If the same discharge rate is assumed for the 30-year period, 1945 to 1984, then approximately 9,972 kg (21,938 pounds) of uranium may have been discharged to the X-701B Holding Pond, and 5,983 kg (13,163 pounds) of uranium may have been discharged to the East Drainage Ditch, which leads to Little Beaver Creek.

TABLE 4-11

INORGANIC SLUDGE CONSTITUENTS IN X-701B PUEC - PIKETON, OHIO

Element	Percent (ppm)	
Aluminum	>10	(>100,000)
Barium	0.01	(100)
Calcium	6.0	(60,000)
Chromium	0.2	(2,000)
Copper	0.2	(2,000)
Iron	3.0	(30,000)
Lead	0.01	(100)
Magnesium	1.0	(10,000)
Molybdenum	0.003	(30)
Nickel	0.06	(600)
Silicon	>10	(>100,000)
Sodium	0.3	(3,000)
Tin	0.01	(100)
Titanium	1.5	(15,000)
Vanadium	0.03	(300)
Zinc	0.1	(1,000)

Source: PUEC Chemical Operations Department (1985).

Although X-701B is scheduled to be closed out as a disposal site, the soil and groundwater contamination resulting from X-701B and related sources will not be eliminated by cessation of disposal and backfilling of the area, which has been proposed as the closure plan by PUEC. No specific remedial actions are yet planned for X-701B, but a hydrogeological study is under way and is scheduled to be completed by mid-1987. The existing groundwater contamination near X-701B is described further in the hydrogeology and waste management sections (3.4 and 4.1, respectively).

Process Lines from X-700 and X-705 (Map Site 2). Leakage from the "process" lines leading from buildings X-700 and X-705 to X-701B has contributed to the groundwater contamination in that area.

The "process" lines from the X-700 and X-705 cleaning and decontamination (D&C) buildings serve as a source and a pathway for both local and area-wide contamination. These lines are termed "process" lines by PUEC personnel (despite the fact that they convey waste) because they provide drainage to the processes in the X-700 and X-705 buildings. Designed and built to convey wastewaters from the D&C buildings (raffinate waste, solvents, lime slurry, metals, and chromate), the process lines are suspected, by PUEC personnel, to have leaked into the ground. Also, the trench for these lines discharges into the unlined X-701B Holding Pond and thus provides a French-drain-type pathway for migration of groundwater contamination to surface water.

There are three lines made of "Duriron" that drain processes in X-705 and X-700 (via X-701C). Four 4-inch lines drain from X-705 northward into a connecting 5-inch line, which runs under 18th Street to X-701B. One of these four lines has no flow. Another has a monthly flow of 1,532,183 liters (404,803 gallons). The average monthly flow of the three flowing lines was 525,704 liters (138,891 gallons). Also, an 8-inch line drains the tunnel rinse booth to X-701B with an average monthly flow of 608,000 liters (160,634 gallons). Finally, another 4-inch Duriron pressure line previously connected the X-701C neutralization pit to X-701B. In June 1982, the X-701C neutralization pit drainage line was rerouted to the X-616 chromium treatment facility. Although no precise information is available on the volume of leakage, these flow rates indicate that leakage of even a small percentage of the total flow rate could be significant.

The 4-inch lines from X-705 drain evaporator condensate, cylinder cleaning rinse water, decontamination pit solutions, and water from the bundle destruction and detubing

booth. Prior to June 1984, PUEC drained raffinate recovery wastes through these lines. These raffinate wastes were about 25 percent (by weight) nitric acid (pH less than 1.0). In addition, they contained uranium, technetium, iron, aluminum, nickel, copper, and zinc. The 8-inch-diameter line drains the X-705 tunnel rinse booth and drains the water used to rinse equipment following decontamination. In addition, approximately 917,456 liters (242,416 gallons) per month of wastewater pumped from the sumps under the tunnel were sent through this line. This water, which is actually groundwater, flows into the sump from the building foundation. Groundwater in this area is known to be contaminated with solvents. In 1985, PUEC found 13.5 ppm TCE in the water in the X-705 tunnel sump. Survey-related sampling of the sump is planned.

Sections of the pipes have been replaced several times at various locations along 18th Street because they were corroded. Some corroded pipe was not conveying corrosive wastes, which suggested that the source of the corrosion was from the surrounding trench and not exclusively from the materials (e.g., raffinate) flowing through the pipe. It is possible that corrosive waste breached one pipe, leaked into the trench, and corroded other lines running through the trench.

The exact amount of wastes discharged from X-700 and X-705 buildings through these lines is uncertain, but some rough estimates can be made from readily available historical records. Based on monthly usage reports compiled from the Chemical Operations Department by the survey team, between 0.5 and 1.0 million gallons of TCE were used in X-705 since the facility began operating. Part of this volume was evaporated from the vapor degreasers (see Section 3.1), and a significant but unknown amount was pumped to the X-701B Holding Pond. A smaller amount may have leaked out of the process lines from X-705 and X-700.

Several bore holes were drilled in 1985 to determine the location and nature of the process line leakage. PUEC considered the results of this investigation to be ambiguous, but they were not directly reviewed by the Survey team. No remedial action was planned as of late 1986.

North Oil Biodegradation Plot (Map Site 3). Landfarmed oil contaminated with PCBs, solvents, and uranium may cause continued or future groundwater, surface water, and soil contamination.

An area northwest of X-701B was used for less than 2 years (1973 to 1974) as a land-farming area. As with other biodegradation areas (X-231A and X-231B), the waste applied here was contaminated with PCBs, solvents, and radionuclides (uranium).

The CERCLA Phase I Installation Assessment report includes a list of the wastes believed to have been applied to the site. Generally, the waste included uranium-contaminated waste oil, fuller's earth, and sludge (contaminated with PCBs) from the X-615 Old Sewage Treatment Plant.

PUEC estimated that the following waste quantities were applied at the north plot:

Waste	Quantity
waste oil (uranium contaminated)	1,768 gallons
waste fuller's earth	6,000 gallons
waste trichloroethylene	30 gallons
Miller's fluorinated lubricant	37.5 gallons
mixture: Carbitol & tributyl phosphate	12.5 gallons
X-615 Sewage Treatment Plant Sludge (radio-nuclide and PCB contaminated)	4 drying beds

Waste oil typically was contaminated with enriched uranium at an estimated average concentration of 5,000 mg/l at an estimated average assay of 3.5 percent U-235. Some solvents used to remove oils from pumps were mixed with waste oils disposed on the plot. Total estimated uranium present is 33.4 kg. There may be 0.074 Curies of uranium present, based on a PUEC estimate.

PUEC did not have any remedial plans for this area in August 1986 (see 4.1.1.1). Groundwater contamination from the North Oil Biodegradation Plot may be caused by rain water infiltration through the area, which generates leachate. A gravel cover was placed on or near the former oil plot. The location is uncertain. Percolation may presently be enhanced by the gravel cover that discourages runoff from the area. Prior to the addition of the gravel surface, runoff from the oil plot may have caused surface-water contamination and the spread of contaminated sediments. Finally, failure to address the residual soil contamination may result in the inadvertent exhumation of the contaminated material and the subsequent distribution of surface contamination on trucks, equipment, and personnel.

"Total Containment" Ponds (Map Site 4). The two former sludge disposal pits, known as the "total containment ponds," may be the source of continuing and future groundwater contamination at PUEC (see Figure 3-10).

Two shallow depressions northwest of and adjacent to X-701B (south of the biodegradation plot), known as the "total containment ponds," have been used intermittently for more than 20 years to dispose of dredge material from X-701B. The nature of the wastes is similar to X-701B because the wastes came from X-701B. Precipitation tends to collect in the ponds and facilitates the migration of contaminants into the groundwater. In addition, the pond closest to X-701B holds standing water and may overflow into the East Ditch and X-701B. These ponds are about 30 to 40 yards long and about 10 to 15 yards wide.

The Middle (East) containment pond, located adjacent to X-701B, received significantly more sludge than the West pond. The Middle (East) pond contained approximately 849,804 liters (324,519 gallons) of sludge, containing about 617 kg (1,357 pounds) of uranium when Chemical Operations studied the ponds in 1983-1984. The West containment pond held approximately 472,395 liters (124,807 gallons) of sludge with about 385 kg (847 pounds) of uranium.

X-701C Neutralization Pit (Map Site 5). The X-701C Neutralization Pit may be a source of continuing or future groundwater contamination at PUEC. The integrity of the pit has not been tested. Cracks in the pit lining would provide a route for contaminants to enter the groundwater.

The X-701C Neutralization Pit is a 50,000-gallon capacity, brick-lined dry well located below ground level, between buildings X-700 and X-705. It is used to adjust the pH of spent cleaning solutions from the X-700 and X-705 cleaning and decontamination buildings. Acidic wastes are discharged to the pit from X-700. Slaked lime is added to the solution until it meets the PUEC pH limits (pH 6 to 8) for discharge to X-701B.

The nature of discharges to the X-701C Neutralization Pit may be better understood by considering the source of those discharges, the X-700 Chemical Cleaning Buildings, in the following section. No specific information on the constituents in the wastes sent to X-701C are available. The X-700 Chemical Cleaning Building has been and still is the

source of all discharges to X-701C. As discussed in Finding 4.1.2.2.5, eight large dip tanks in X-700 are drained to X-701C. Based on the contents of the dip tanks and the equipment that was cleaned, the Survey Team suspects that the waste that went to X-701C may have included uranium, sodium bisulfate ($NaHSO_4$), sodium hydroxide, sodium carbonate, TCE, and chromic acid. No information is available on the total volume discharged to X-701C (Map Site 6) or on the volume that may have leaked from the pit.

X-700 Chemical Cleaning Building (Map Site 6). Several indoor cleaning solution tanks in the X-700 Chemical Cleaning Building may be a source of continuing or future groundwater contamination.

The integrity of these tanks has never been tested. Leaks and spills from the tanks could reach the groundwater through cracks in the foundation and slab of this 35-year-old building.

The X-700 Chemical Cleaning Building contains eight large dip tanks.

- Two 18,000-gallon sodium bisulfate ($NaHSO_4$) acid tanks.
- Two 24,000-gallon and one 18,000-gallon alkali tanks (60% NaOH and 40% NA_2CO_3).
- One 8,000-gallon chromic acid ($H_2Cr_2O_7$) tank (see 4.1.2.2.5).
- Two 24,000-gallon rinse tanks.

The overflow lines on all eight tanks are connected directly to the X-701C Neutralization Pit. The floor drains are connected to the building sump and solutions are delivered to the Neutralization Pit by sump pumps.

Additionally, there is a TCE vapor degreaser (14 feet by 12.5 feet by 11.5 feet) containing roughly 4,000 gallons of TCE. The degreaser is not connected to the floor drain or overflow drain system. The only discharge of liquid TCE is the residual that is rinsed from equipment following immersion in the degreaser. A larger vapor degreaser (45 feet by 12.5 feet by 11.5 feet) was previously located between the dip tanks and the existing degreaser but was removed in the early 1980s.

The dip tanks are normally filled to capacity (i.e., up to the overflow line). Routine flows from the dip tanks result from the immersion of equipment into the cleaning solutions, with the overflow going to the 50,000-gallon X-701C neutralization pit. Because of the quantities of solution generated in the past, the pit required pumping approximately once per week. Prior to June 1982, these solutions were pumped to the X-701B Holding Pond following neutralization. However, with the completion of a reroute line, the effluent from the X-701C neutralization pit is now transferred to the Recirculating Cooling Water blowdown line for treatment of the residual chromate at the X-616 Liquid Effluent Treatment Facility.

East Drainage Ditch (Map Site 7). The PCB-contaminated East Drainage Ditch may be a source of continuing and future groundwater and surface-water contamination.

Presently the site of a massive cleanup operation, the East Drainage Ditch has served as both a disposal area and a pathway for contamination for approximately 35 years. The East Ditch continues to receive discharges from various areas on the plant site--both storm surges and process effluent from X-705. The East Ditch drains through NPDES 001 to Little Beaver Creek. Because of past disposal of PCBs into the ditch, a project to excavate and drum contaminated soil was undertaken in 1986. The source of the PCB contamination is unclear but is believed to have resulted from the use of waste oil for defoliation. One worker on-site interviewed by the survey team indicated that he helped pour drums of waste oil down the side of the ditch to kill weeds. No information on waste quantity was available.

Although the cleanup operation will mitigate much of the contamination problem from runoff and leaching, continued discharges from other adjacent contaminated areas may recontaminate the area. In addition, there may be a problem with the system of site prioritization and selection of remedial alternative(s) reflected by this remedial action. Despite PUEC's own site assessment showing that the East Drainage Ditch was not in the group of highest ranking sites, it was the first remedial project undertaken. Also, no alternatives other than exhumation and off-site disposal were considered. This issue is discussed further in Section 4.5.2.

Recirculating Cooling Water (RCW) System (Map Sites 8a and 8b). The Recirculating Cooling Water (RCW) System may be a source of continuing or future chromium contamination in groundwater. The RCW System consists of a large network of

above-ground and underground piping and valves and seven large cooling towers. Hexavalent chromium is maintained at 9 to 18 mg/l throughout the system as part of a corrosion inhibitor. Pipe failure and leakage could result in significant loss of chromium-contaminated cooling water to the groundwater. Pipe ruptures have occurred in the system, but no information was readily available on the frequentcy or severity of these failures. Although major losses have not been detected, a comprehensive study of the integrity of the system has never been conducted.

A non-chromium substitute for the corrosion inhibitor is being investigated by PUEC. Such a replacement would eliminate concerns about ongoing chromium releases from the RCW system but would not address the potential problem of past releases.

The RCW System is cathodically protected to help prevent external corrosion. There are four very large (more than 100 feet long by 50 feet high) cooling tower systems located at the northeast and northwest corners of the plant area. These towers are connected by underground pipes to the X-616 treatment system, on the west-central section of the site, and to the process buildings (X-333, X-330, and X-326) (see also Finding 3.1.4.3.2).

X-744G Building (Map Site 9). Spillage of hazardous substances from, and around, the X-744G building may be a source of continuing or future groundwater contamination.

The X-744G Building presently houses an aluminum smelter and various drummed wastes and equipment. There are three potential sources of soil and groundwater contamination from activities in and around the X-744G Building.

- Historical spills and discharges of solvents and cutting oils during pipe fabrication.
- Recent spills by storage and transfer of wastes near the North and East loading docks.
- Raffinate leakage and spillage in the field south of X-744G.

The building was used for pipe fabrication from 1952 until the late 1950s by contractors during the original construction by Peter Kewitt Company in the 1950s. During this operation, miscellaneous solvents and cutting oils are believed to have been disposed of in and around the building according to PUEC personnel interviewed by the survey team. No information is available on the quantities of waste used or disposed of.

In August 1986, the Survey team observed heavily oil-stained soil on the northeast side of the building near the garage door/loading dock and around the oil storage tanks. Also, oil-stained and denuded soil was observed near the loading dock on the north side of the building. These oil stains, on both the east and north sides of the building, appeared to be fresh. The exact type of chemicals spilled is unknown.

During the late 1970s, an unknown number of 6,000-gallon tank trailers containing raffinate wastes were stored in the field on the south side of X-744G. In addition to routine spillage, one trailer leaked its entire contents onto the ground. During the August 1986 Survey, this spill area was denuded of vegetation and marked by a coarse gravel fill placed in an attempt to grade the eroded and depressed area. Raffinate waste typically has an extremely low pH (≤ 1.0) and high nitrate (40 percent by weight), uranium (1,450 mg/l), and technetium (120 mg/l) concentrations.

2. North Area: Actual or Potential Sources of Groundwater and Surface Water Contamination

There are two relatively large actual or potential sources of groundwater and surface water contamination in the North Area of PUEC--the Old Landfill and the Construction Spoils Area. Very little information is available on the waste disposed of in these areas, and the groundwater has received very little investigation.

X-735 Old Landfill (Ruby Hollow) (Map Site 10). The area known as the Old (or "Ruby Hollow") Landfill may be a source of continuing and future groundwater and surface water contamination.

Located on the northwestern section of the site, the Old Landfill was replaced in 1981 by the X-735 Sanitary Landfill after about 13 years of use. The landfill was used mainly for solid waste since the phase-out of the Peter Kewitt and Sons Landfill (Map Site 15) in 1968.

No comprehensive study of the old landfill has yet been performed, but some information was obtained from miscellaneous sources. The landfill received about a million pounds of refuse per year (ERDA, 1977) from 1968 to 1981. About 2 percent of the debris came from the plant cafeteria. The X-600 Steam Plant generated about 100 to 250 tons of fly ash per week (5,200 to 13,000 tons/year; average = 9,100 tons per year). At this rate of

generation, about 67,600 to 169,000 (mean = 118,300 tons) tons of fly ash may have been disposed of in the old landfill during its 13 years of operation.

Hazardous wastes (F001, F003, and F005 wastes according to the June 1981 CERCLA Notification) (Davis and Manning, 1981) and uranium are also believed to have been disposed of along with construction debris and a large volume of fly ash from the X-600 Steam Plant, according to personnel interviewed at PUEC for the Phase I report. The amount of fly ash and other waste was adequate to fill in Ruby Hollow (about 50 to 100 feet deep) and support a rail line used for regular freight service. This landfill and the spoils area are immediately adjacent to Little Beaver Creek, and appeared to be eroding during high flows. An exposed face of the landfill revealing fly ash is one of the sampling and analysis locations identified by the survey team for survey-related sampling.

According to PUEC personnel interviewed during the August 1986 survey, floor sweepings from the process buildings (X-330 and X-333) were disposed in the Old Landfill. These floor sweepings have since been analyzed and found to contain PCBs (some greater than 50 ppm) and uranium (greater than 2 ppb).

In late 1980, a groundwater monitoring well on the north side of the Old Landfill was sampled and analyzed; the results showed 36 µg/l uranium. In April 1981, the soil at the base of the landfill was sampled and analyzed for pH and radionuclides. The pH was 6.5, and only background levels of uranium (4 µg/kg) and gross alpha (7 d/min/g) were detected. No analyses for organics or other parameters were performed on these 1980 and 1981 samples. Because of the high degree of variability in specific conductance and total organic carbon of the groundwater samples, some groundwater contamination is suspected.

An off-site residence is situated about one-half mile northwest of the landfill. No well contamination has been detected by PUEC at this residence as of 1986. Four monitoring wells were installed in 1977, one on each side of the landfill (see Section 3.4). PUEC had no remedial actions planned for the old landfill as of 1986.

Construction Spoils Disposal Area (Map Site 11). The construction spoils disposal area may be a source of groundwater and surface-water contamination at PUEC.

The construction spoils disposal area, originally a ravine, is adjacent to the old Ruby Hollow Landfill on the southern side. This area has been used for disposal of construction spoils since about 1978. Prior to 1978, the area was used for several years for disposal of fly ash from the X-600 Steam Plant. Based on interviews of PUEC personnel conducted during the Survey, it is believed that some hazardous waste has been disposed of there.

The spoils area is believed to have received smaller quantities of hazardous waste than the Old Landfill, X-749, or the Peter Kewitt and Sons Landfill. Precise quantities of waste disposed of are unknown. During the GCEP construction (1979 to 1985), the spoils area was closed to contractors to prevent inappropriate disposal of wastes.

Because the spoils area is adjacent to the old landfill, the leachate is probably indistinguishable from the Old Landfill leachate. Ravines caused by runoff have eroded and cut through the spoils area leading down the hill to Little Beaver Creek. These ravines may completely breach the cover on the spoils area and may allow potentially contaminated materials to enter the creek.

3. South Area: Actual or Potential Sources of Groundwater Contamination

There are a wide variety of actual and potential sources of groundwater and surface-water contamination in the South Area of PUEC. These sources range in apparent magnitude from large areas of disposal of concentrated hazardous waste for decades, such as the X-749 Landfill, to smaller areas of relatively low concentration of hazardous waste, such as the X-230K South Holding Pond. No comprehensive investigation of groundwater quality for the whole area has yet been completed. Instead, isolated piecemeal studies of individual facilities have been performed.

X-231A/B Oil Biodegradation Plots (Map Sites 12a and 12b). The X-231A and X-231B Oil Biodegradation Plots may be a source of groundwater and surface-water contamination at PUEC.

The X-231A/B Oil Biodegradation Plots have been used for land treatment of waste oil contaminated with solvents, metals, and radionuclides (including uranium and technetium). The plots are located in the South Central Area of the site, south and east of the coal piles and steam plant (X-600A). These areas have ceased operation and are expected to be closed by PUEC under RCRA. Existing solvent contamination, however, continues to spread to the groundwater and is difficult to distinguish from other nearby contamination areas.

Survey-related sampling and analysis of the "G-ditch," adjacent to X-231A and north of Patrol Road B, is planned. A discolored seepage from the west bank of the ditch was observed during the August 1986 survey. This seepage may be leachate from X-231A.

X-749A Classified Materials Burial Area (Map Site 13). The X-749A Classified Materials Burial Area may be a potential source of continuing or future groundwater and surface water contamination.

The Survey team reviewed classified records of the 43 burials that occurred at X-749A from November 1955 to 1986. Most of the classified material was classified for reasons other than chemical composition. No classified information related to potential environmental hazards, hence no classified information is presented here. Generally, the burials consisted of boxes and containers of aluminum scrap, barrier scrap, centrifuge manufacturer rotors scrap, magnetic tapes, computer discs, security ashes, and other miscellaneous material of a classified or sensitive nature. The largest single source of nickel in X-749A was the INCO Nickel Power Plant, which was dismantled and transported from Huntington, West Virginia, for burial at PUEC. The 1,333 cubic yards of buried piping and equipment from the INCO Plant was slightly contaminated with nickel carbonyl, according to PUEC, although no information was available on its concentration.

Groundwater contamination from X-749A may occur from direct leaching of hazardous substances from buried materials. The drums and wooden boxes used to contain these wastes have probably deteriorated. The threat of groundwater contamination is difficult to assess because of the lack of quantitative information on the constituents buried. The risk of groundwater contamination in this area is increased because acidic runoff from the X-600 coal pile may mobilize the metals (e.g., nickel and uranium) in X-749A and facilitate their migration to groundwater.

Surface-water contamination from X-749A may also occur because of erosion and seepage from X-749A directly into "G"-ditch, which runs along the western edge of X-749A and leads to Big Run Creek. The Survey team observed several erosion gulleys in the western bank of X-749A.

X-749 Contaminated Material Disposal Facility (Map Site 14). The X-749 Contaminated Materials Disposal Facility is a source of ongoing groundwater contamination at PUEC.

Located on the southern edge of PUEC, the 7.5-acre X-749 disposal facility is the primary disposal site for hazardous wastes at PUEC. The site is discussed in detail in the waste management and hydrogeology sections (4.1 and 3.4, respectively). In addition, the Phase I CERCLA Assessment draft report (PUEC, 1986) provides a summary of the facility. Survey related sampling of nearby wells is planned. The X-749 site is a likely candidate for cleanup under the Section 3004(u) provisions of RCRA.

There are no comprehensive records of the wastes disposed of in X-749. Based on a review of PUEC Chem Ops records by the Survey team, information from a few monthly reports was discovered. Prior to 1984, the PUEC Chemical Operations Department (Chem Ops) provided a typewritten report of monthly activities, including a section entitled "Scrap Hauling to X-749 Hot Yard."

For July 1983, the report listed

- Seventeen 1/2-ton truckloads of scrap
- Eight 2-1/2-ton truckloads of scrap
- Forty-nine gallons of ammonia was processed
- Nine gallons of x-ray solution was processed
- Sixty-two polybottles of oil was processed
- One polybottle of solution from X-705 was processed
- One farmwagon of scrap
- Fifteen bags of insulation
- One barrel of shoes from stores

For June 1983, the report listed

- Twenty 1/2-ton truckloads of scrap
- Twelve 2 1/2-ton truckloads of scrap
- Fifty-two gallons of ammonia was processed
- Fifteen gallons of x-ray solutions was processed
- Fifty-nine polybottles of oil was processed
- Six polybottles of solution from X-705 was processed
- One farmwagon of scrap
- Thirty-two bags of insulation
- One barrel of shoes from stores

For September 1983, the report listed

- Twenty drums of scrap
- Eight 1/2-ton truckloads of scrap
- Sixty-nine gallons of ammonia was processed
- Four gallons of x-ray solution was processed
- One hundred eighty-eight polybottles of oil was processed
- Seventeen bags of insulation

This sampling of information is inadequate to lead to any conclusions about the long-term waste disposal practices at X-749. These records do indicate, however, that significant quantities of hazardous waste were routinely disposed of in X-749. A comprehensive site study has not yet been performed.

Peter Kewitt and Sons (PKS) Landfill (Map Site 15). The Peter Kewitt and Sons (PKS) Landfill may be a source of continuing and future groundwater and surface-water contamination at PUEC.

The 10-acre PKS Landfill (named for the original construction contractor) was operated from 1952 until 1968. The PKS Landfill is located west of and adjacent to Big Run Creek, immediately south of the X-230K South Holding Pond. Unlike current (1986) PUEC waste patterns, the largest volume of waste generated during construction was probably construction debris, but a significant volume of hazardous waste was likely disposed of in the site as well. PUEC records indicated that a sign reading "Toxic Materials Buried Here"

was posted at the PKS site. There are no records as to what was buried at PKS. There is no groundwater monitoring system around PKS.

A bright orange-red leachate was found to be emanating from the southeastern corner of the PKS Landfill into the Big Run Creek. Also, a seam of exposed fly ash about 5 feet thick by 15 feet long was observed located on the east side along Big Run Creek. Finally, discarded pieces of reinforced concrete and pipes were protruding from the bank along the Big Run Creek and lying in the creek.

A sample of the leachate seepage, collected in 1981 by PUEC, was analyzed for pH, other conventional parameters, and radioactivity parameters (uranium, technetium, and alpha activity), but not for organics. The pH of that sample was found to be slighty acidic. The orange color may be the result of that acidity, which causes iron to precipitate from the water and form the rust-colored iron-oxide stain on soil and rocks. The analysis for uranium, technetium, and gross radioactivity did not reveal any above-background concentrations in the leachate or sediment at the seep. The sampling report did not record any observations about the weather preceding or during the sampling.

Two downstream surface water locations in Big Run Creek were also sampled in the spring (May) as well as the fall (September) of 1981. These samples were also analyzed for conventional pollutants (BOD, temperature, COD, TDS, etc.) and revealed no contamination above background. TOC and COD concentrations were low (3 mg/l), a fact which indicates normal background organic concentrations.

Although the 1981 sampling results did not indicate a contamination problem, the occurrence and persistence of a leachate seep does provide a direct pathway for future contamination. A potential environmental problem exists because of the presence of a source (PKS), a pathway (seepage), and a receptor (Big Run Creek). Survey-related sampling is planned.

X-230K South Holding Pond (Map Site 16)

The X-230K South Holding Pond may be a present and future source of groundwater and surface-water contamination.

The X-230K Holding Pond receives runoff from the steam plant coal pile, from X-231A and B oil biodegradation plots, and from the X-749A landfill and storm sewers leading from various possible spill areas on the south side of the site. In 1980, PUEC degredged 25,000 cubic yards of sediment from X-230K and land filled it on the east side of the pond. The sediments in this dredge spoils landfill are similar to the sludge from the coal run off pile treatment facility. This material has passed the EP toxicity test (40 CFR 261) but has not be analyzed with the new Toxic Characteristics Leaching Procedure (TCLP). The only other analyses available for this material indicates 5-195 µg/g copper, 150-66 µg/g zinc, and pH of 6.8-11.8. Because X-230K may have received hazardous substances in the past (e.g., heavy metals and uranium), and because the pond may serve as a seasonal source of local groundwater recharge, failure to examine the sediments and the sludge from in and around X-230K may result in undetected releases groundwater or surface-water contaminants (see Finding 3.3.4.2.1). Survey-related sampling is planned.

4. Miscellaneous Areas: Actual or Potential Sources of Groundwater Contamination

Several areas of actual or potential contamination to groundwater or surface water are described below in a miscellaneous group. These sources either are not readily aggregable according to a discrete geographic area at PUEC, or constitute a site-wide threat, such as widespread road oiling.

X-615 Old Sewage Treatment Plant (Map Site 17). Low-level PCB contamination may remain in the sludge-drying lagoon of the old sewage treatment plant, and may present direct contact or fugitive dust emission problems.

A material that looked like sludge was observed by the Survey team in an area that was recently excavated and considered "clean" by PUEC with regard to PCBs. However, PCBs are known to have been in the sludge, and visual inspection of the excavation area indicates that not all of the sludge has been removed for ultimate disposal. Groundwater contamination from PCB is unlikely because of the low water solubility and the high organophilic (tend to cling to organics) nature of PCBs. Other contaminants from the old sewage treatment plant, however, may threaten groundwater.

Various hazardous constituents, including PCB and radionuclides, were disposed of in the now-abandoned sewage treatment plant. These contaminants, except for insoluble PCB,

primarily presented a threat to groundwater. The site is not likely to affect surface waters because of the distance to the nearest waterway.

The sludge drying plots are being excavated to remove PCBs and the soils are being drummed. Visual inspection by the Survey team revealed that the sludge layer, which was believed to be uniformly contaminated, has not been completely excavated. Therefore, some contamination may remain. The volume of sludge remaining has not been investigated but is probably between 100 and 1,000 cubic yards, according to a Survey team estimate. In addition, several railroad ties that were used to line the pits appear to have been contaminated.

Miscellaneous Drums and Spills (Map Site 18). Stained soils around several of the loading docks and chemical storage pads indicate that past spills may have resulted in soil and groundwater contamination. The presence of stained soil also indicates the lack of an adequate reporting and spill cleanup program. The type of substances spilled is not known. No sampling has been conducted in these areas, but the solvents and oils used around the site would reach the water table if spilled in sufficient quantity. If not, small amounts of these substances would be retained in the soil matrix to be slowly leached by infiltrating precipitation.

Several apparent spill areas are noted in other findings in Section 4.5.2.3 (e.g., Finding 9). Only one spill is marked on the location map for illustrative clarity, although it is intended to represent several locations. The following locations were also the sites of readily identifiable, but relatively small, spill areas for which Survey-related sampling is planned.

- "Oil-stained" soil on the north side of X-740 west of the garage door, and outside of the drum crusher.
- Open drum of oily sludge on stained soil south of X-109A, west of X-740.
- Four drums (two gray, one yellow, one black) and "oil-stained" soil located on the south side of X-530D inside the switchyard fence.

- "Oil-stained" soil, gravel, and asphalt around the "Radicator" (incinerator), and basement full of discolored waste under the Radicator building (X-705C; located between buildings X-700 and X-705).

- Drum rusted through and stained soil in X-533 switch yard

This is not intended to be a comprehensive compilation of spill sites at PUEC, but rather is a listing of sites observed by the Survey team during facility tours.

Groundwater contamination is probably resulting from the accumulated effects of many years of routine accidental spills from tanks and drums on unprotected ground. Discolored soil was observed around virtually every loading dock and storage pad on the reservation. In addition, several abandoned drums were found in fields in a deteriorated or failed condition. The summed effects of these incidental releases to the ground may be as significant as that occurring from larger scale "point sources" such as X-701B or the East Ditch.

Secondary problems from these routine spillage and abandoned drum practices are the potential for fire or explosion from flammable materials and the possible hazard from direct contact with materials that present a dermal hazard.

GCEP Building Area (Map Site 19). Groundwater contamination may have occurred in the Gaseous Centrifuge Enrichment Plant (GCEP) building area on the southwest part of the reservation. Aerial photographs of the reservation taken in the 1960s and 1970s show that some disposal may have occurred in the area now occupied by the mothballed GCEP complex. No information was available on disposal in the GCEP area, and no interviews, records searches, or hydrogeological investigations have been performed or are planned.

West X-705 Pad Area (Map Site 20). Groundwater contamination from uranium and technetium disposal in the area on the west side of X-705 may have occurred.

A radiological survey by PUEC in the late 1970s indicated that the field on the west side of X-705 was contaminated with several hundred ppm of uranium. Some material was subsequently removed and the area was paved over. There is no information presently available on the residual contamination in this area. The area was not sampled after the

soil removal, and no records are available on the volume of soil removed or the disposal location.

Process Building (X-333, 330, and 326) Disposal of Solvents (Map Site 21). Groundwater contamination may have resulted from the practice of disposing of TCE in the gravel immediately outside the doors of the process buildings.

PUEC personnel interviewed by the Survey team in August 1986 indicated that a previous practice at the plant was to pour excess TCE onto the ground outside of the X-333, X-326, and X-330 process buildings. For most of the 30 years when these individuals were involved with process building maintenance, workers carried buckets of TCE (two each) from X-700 to X-333, X-326, and X-330 to use as a degreaser during seal change-outs. Instead of carrying the dirty TCE back to X-700, workers typically poured the remaining TCE from their buckets onto the ground.

There is no information on the amount of TCE poured onto the ground outside the process buildings, but a reasonable estimate may be made by making the following assumptions: If 4 gallons are used per change-out, and 2 to 4 change-outs occurred per week over a 30-year period, then a total of 12,000 to 24,000 gallons of TCE could have been disposed of onto the ground. This range should probably be considered a high estimate because some of the TCE poured onto the ground evaporated before contaminating soil or groundwater. This estimate does not consider the effect of the plant modernization during the 1980s.

Survey-related soil sampling is planned outside of the doors leading from the process buildings toward X-700.

West Ditch Disposal Area (1978 Accident) (Map Site 22). Residual uranium in the "West Ditch" near NPDES sampling point 010 may be a source of continuing and future groundwater and surface water contamination at PUEC.

In March 1978, a 14-ton UF_6 feed cylinder ruptured in an accident near the X-342 building, releasing about 6,500 kg uranium (21,125 lbs of UF_6). About 450 kg uranium (1,000 lbs uranium-238) were precipitated into the bottom sediments of the West Drainage Ditch near X-230J3.

Most (75 percent) of the released UF_6 was dispersed into the atmosphere, but, according to a June 1978, Oak Ridge Operations Office investigation report, "essentially all of uranium in the runoff went down the west ditch." Of this runoff, most (1,500 pounds or 60 percent) was washed through the malfunctioning dropgate into the Scioto River, but a significant amount of uranium- and technetium-contaminated water was impounded in the West Ditch. The water had a maximum concentration of 450 mg/l uranium shortly after the accident, but following liming of the impoundment to precipitate out the radionuclides, this uranium contamination of water was reduced to background levels within a week of the accident.

After the uranium and technetium were precipitated in the West Ditch, the sediment and sludge were pumped out of the ditch in an attempt to prevent additional radioactivity from escaping into the Scioto River. This sludge was pumped into a bulldozed impoundment on the south embankment leading down to the West Ditch. Sludge largely flowed back down into the West Ditch, spreading out on the hillside south of the ditch. The impoundment basin was monitored for uranium and alpha concentrations in August and October 1978, and determined to be below economical recovery limits in the lime slurry. The basin was filled, covered, and seeded as part of the X-6619 Sewage Treatment Plant landscaping activities in 1983. During August 1986, a contract was let to dredge the West Ditch and rebuild the gate.

Sediment samples taken in early April 1978 from the impoundment area show uranium concentrations in soil as high as 33,500 mg/kg. In October 1978, however, sediment samples from the impoundment indicated only background uranium levels (4.2 to 5.7 mg/kg). Downstream from the West Ditch, about 100 feet east of old Route 23 (west of the Perimeter Road), sediment samples indicated a uranium concentration of 53 mg/kg in June 1978.

X-616 Chromium Sludge Lagoons (Map Site 23). The X-616 chromium sludge lagoons are a source of groundwater contamination at PUEC. PUEC found groundwater contamination from residual hexavalent chromium in treatment lagoons and possibly from trivalent chromium that may have reverted to additional hexavalent chromium through bacterial action. The chromium treatment lagoons are expected to be phased out in accordance with RCRA regulations, but there is significant residual contamination in the soil and groundwater. This problem is discussed in more detail in the hydrogeology section (3.4) and the waste management section (4.1).

"East Spot" (Map Site 24). Soils and/or groundwater may be contaminated in the vicinity of a barren area on the eastern edge of the site. This area, less than one acre in size, east of the Perimeter Road but inside the fence line, has been barren since 1966, according to aerial photographs reviewed by the Survey team.

Soil contamination is suspected; however, soil samples have never been taken in this area as of August 1986. A grey-green-colored layer of clayey-textured soils was observed at several locations on the site under about one foot of soil. If the soil discoloration and lack of vegetation were caused by contamination, then an environmental problem may exist from the standpoint of potential groundwater contamination and direct contact during future site use.

PUEC personnel interviewed by the Survey team were not aware that this site existed. Survey-related sampling is planned.

Road Oiling (Map Site 25). The application of used oil--containing uranium, PCBs, metals and solvents--to roads may have resulted in (1) surface-water contamination, (2) groundwater contamination, and (3) direct contact with contaminated vehicles, tires, and equipment. First, there is a potential for runoff contaminated with uranium, PCBs, metals, and solvents to enter surface water. Also, these contaminants may percolate into the groundwater and thus cause or add to the existing groundwater contamination problems, such as in areas near the X-231 oil plots and the X-749 landfill. Finally, road oiling may lead to contaminated vehicle and tires, which may result in direct human contact with the contaminants both on-site and off-site.

Road oiling is a form of routine and systematic contaminated-oil releases that may cause acute and chronic environmental problems. Short-chain hydrocarbons in waste oil may cause acute toxicity to aquatic organisms. Also, the oil may present a fire hazard from casual handling during road oiling because of residual low flash-point solvents and gasoline in the oil. Surface waters and groundwaters may suffer low-level degradation, and certain contaminants such as heavy metals may bioaccumulate through the food chain or concentrate in organic materials. Used oil, including crankcase oil that may contain lead, has been used for road oiling at the PUEC facility.

X-342C Neutralization Pit (Map Site 26). The X-342C Neutralization Pit may be a source of groundwater and surface water contamination.

The X-342C pit may be a potential groundwater and surface water contamination threat for different reasons. The pit itself may leach contaminants into the groundwater through the cracks observed in the walls. Fluorides may leach out of the sludge and limestone. Other contaminants such as chromium, solvents, oil, and grease may have flowed from X-342A to X-342C. To the extent these contaminants were in solution or leached from sludge or limestone, they would tend to leak out the bottom of X-342C into the groundwater. Some of these contaminants may have flowed out the north end of the pit, through the sump, to the North Holding Pond (X-2302), which had become filled with sediment and was scheduled for dredging. The North Holding Pond empties into Little Beaver Creek.

The X-342C Neutralization Pit is located near the northwest corner of the plant area, immediately east of Building X-344B. The X-342C pit is made of reinforced concrete and is 107.5 feet by 19 feet by 5 feet deep, with a capacity of about 10,000 cubic feet (75,000 gallons). The sides are sloped inward from the top, and it is partitioned into three sections with reinforced concrete walls. Each section is filled with about a 4-foot layer of limestone gravel (number 10 to 20 screen). A concrete sump is located at the north end of the pit, and is covered with a sheet metal trap door that is hinged on the side. This sump is 3 feet by 3 feet and is about 5 feet deep. A pipe leads from the X-342C pit to this sump about 3 feet from the bottom of the sump.

The intended operation of the X-342C pit was to neutralize waste hydrogen fluoride that might flow from the old HF tank farm. The X-342C pit has not been used since March 1982, according to PUEC staff. Effluents entered X-342X from a 3-inch pipe at the southern end of the pit. By flowing through the limestone bed, KHF_2 would ultimately react to form CaF_2, which would settle out of solution in the third section of the pit with the addition of a flocculating agent, sodium dodecyl sulfate. The supernatant then flowed to the north holding pond. It is unclear whether this intended operation was the primary operation that occurred in this pit. Acids and solvents may have entered the pit from X-342A from another line.

The Survey team observed that the 3-inch line entering the south end of the pit was severely rusted, clogged with sediment, and collapsed at the end. The concrete sides of

the pit were cracked in several locations, and gaps of about 1-inch had formed in the cracks. A few sections of the pit lining have collapsed. Another more intact pipe was found by the Survey team to have been installed in the eastern side of the southeast corners of the pit wall. This pipe was almost completely covered with sediment and debris. A PUEC employee told the survey team that he believed it led eastward from the dip tanks in X-342A. When the asphalt trench path was traced from the pit to X-342A, the line appeared to lead from a sump outside of X-342A. Immediately inside of X-342A was an acid dip tank and a rinse pit, which appeared to drain to the sump. The contents of the tank were not clean. PUEC staff nearby believed that it contained chromic or nitric acid; but, neither the contents of the tank nor the plumbing of the drains and sumps were confirmed.

The Survey team also observed discolored water and sludge in the sump on the north side of the X-342C pit. By using a clean rod, the survey team estimated that the greenish-brown sludge layer was 2 feet deep and that the supernatant water was 1 foot deep. Assuming that the sump was 3 feet square, then it would contain approximately 18 cubic feet (135 gallons) of sludge and 9 cubic feet (67 gallons) of water. Essentially, this sump was filled to the overflow pipes. One pipe opened from the X-342C pit to the south, while another led out the north side to the North Holding Pond, according to PUEC staff. Survey-related sampling is planned.

4.5.2.4 Category IV

1. Inadequate CERCLA 103(c) Notification. PUEC'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 corrected.

A compliant CERCLA notification would include information on all of the Phase I sites, as well as the Solid Waste Management Units (SWMUs) listed in the Part B permit application. These facilities are not covered by the limited exemptions and exclusions to the CERCLA notification requirement (EPA, 1981). 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.

Table 4-12 lists the Solid Waste Management Units given in the PUEC Part B permit RCRA application. Table 4-13 lists 38 facilities at PUEC that have been included in any of six compilations of solid waste disposal facilities prepared by PUEC for various purposes, or that have been observed during the survey. These listings show that there has not been a consistent accounting of disposal facilities, and that the CERCLA Section 103(c) notification fails to summarize or compile them. Of the 19 facilities included in the draft Phase I CERCLA assessment report, 11 of these sites were included among the 25 SWMUs listed in the Part B application submitted in 1984. Seventeen SWMUs listed in the Part B application were not included in the draft Phase I CERCLA Assessment report from April 1986. In early 1984 PUEC replied to Senator John Glenn's request for information on "potential problems to human health or environment" with a list of three sites (X-749, the Old Sanitary Landfill, and X-616 Lagoons). The "Environmental Protection Program" dated December 1985, listed six sites, two of which were included in the Glenn response (X-749 and X-616 lagoons). The 5-year management plan dated January 1986 lists six sites as potential CERCLA sites. Only one of these sites (X-231A) was included in the December 1985 Environmental Protection Program.

Although the purposes of these various compilations varied, the CERCLA notification requirement is the most extensive in the variety of sites it includes. Virtually all of the sites listed in the other categories should have been included in the CERCLA notification. Approximately 20 to 30 other facilities at PUEC also received hazardous substances, according to the documented beliefs of PUEC officials, but were not included in this notification submission.

2. Hazardous Waste Cleanup Planning and Implementation. The two active hazardous waste cleanup projects at PUEC (the X-615 Sewage Treatment Plant and the East Drainage Ditch) are inadequately planned and improperly implemented, possibly reflecting broader long-term inadequacies in PUEC's hazardous waste cleanup program that could result in the inadequate cleanup of these two sites and other sites at PUEC.

Generally there are three systematic problems with these cleanup projects, in addition to the obvious direct environmental problems discussed about Map Sites 7 and 17 in Section 4.5.2.3. First, the cleanups seem to have been undertaken lacking an explicit

TABLE 4-12

ATTACHMENT L OF PART B PERMIT APPLICATION
SOLID WASTE MANAGEMENT UNITS
PUEC - PIKETON, OHIO

- Construction Spoils Area
- Old Sanitary Landfill (Ruby Hollow)
- Peter Kewitt and Sons Landfill
- X-230K South Holding Pond
- Sludge from South Holding Pond

- X-230J5 West Ditch, West Holding Pond, Storm Areas
- X-230J6 Northeast Holding Pond
- X-230J7 East Holding Pond
- X-230L North Holding Pond
- X-231A Oil Biodegradation Plot

- X-333 PCB Storage Area
- X-342C HF Neutralization Pit
- X-344D HF Neutralization Pit
- X-611 A & B Lime Sludge Lagoons
- X-614 A,B,D, and P storage lift stations

- X-615 Old Sewage Treatment Plant
- X-616 Chromate Reduction Lagoons
- X-617 pH Adjustment at South Holding Pond
- X-701C Neutralization Pit
- X-705 Radiator

- X-735 Landfill
- X-740 Oil Storage Area
- X-2230 Southwest Holding Pond
- X-2230 Northwest Holding Pond
- X-6619 Sewage Treatment Plant

Source: PUEC Part B Permit Application: Attachment L (1983).

TABLE 4-13

PORTSMOUTH URANIUM ENRICHMENT COMPLEX
WASTE SITE NOTIFICATIONS SUMMARY
PUEC - PIKETON, OHIO

Sites	Category (see Notes)					
	A	B	C	D	E	F
Process Lines from X-700 & X-705 Buildings						X
X-231A Oil Biodegradation Plot	X	X*		X	X	X
North Oil Biodegradation Plot (X-701B)						X
Recirculating Cooling Water System						X
X-749 Contaminated Material Disposal Facility		*	X	X		X
East Drainage Ditch				X		X
X-701C Neutralization Pit		X				X
Old Sanitary Landfill (Ruby Hollow)	X	X	X		X	X
Construction Spoils Disposal Site		X			X	X
X-749A Classified Burial Ground					X	X
X-615 Sewage Treatment Plant		X				X
West Dr. Ditch Impoundment Basin (March 1978)		X				X
X-710 Neutralization Pit						X
Peter Kewitt and Sons Landfill		X			X	X
X-611A Lime Sludge Lagoons		X				X
X-[illegible]C Waste HF Neutralization Pit		X				X
X-344D HF Neutralization Pit		X				X
X-230K South Holding Pond Sludge Landfill		X			X	X
X-530 & X-533 Switchyards						X
X-701B North Holding Pond		*		X		
X-230 South Holding Pond		X				
X-230J6 NE Holding Pond		X				
X-230J7 East Holding Pond		X				
X-230L North Holding Pond		X				
X-231B Oil Biodegradation		X				
X-333 PCB Storage Area		X				
X-614 A, B, D, and P Storage Lift Stations		X				
X-616 Chromate Sludge Reduction Lagoons		X*	X	X		
X-617 pH Adjustment at South Holding Pond		X				
X-707 Radicator		X				

TABLE 4-13
PORTSMOUTH URANIUM ENRICHMENT COMPLEX
WASTE SITE NOTIFICATIONS SUMMARY
PUEC - PIKETON, OHIO
PAGE TWO

Sites	Category (see Notes)					
	A	B	C	D	E	F
X-735 Landfill		X				
X-740 Oil Storage Area		X				
X-2230 South West Holding Pond		X				
X-2230 Northwest Holding Pond		X				
X-6619 (0.7 mgd)		X				
East Spot						
X-231B		*		X		
X-735						

Source: DOE Survey team compilation using sources listed below.

A. CERCLA Notification (Davis and Manning, 1981).

B. PUEC Part B permit application listing of Solid Waste Management Units (PUEC, 1983).

C. Response to Sen. John Glenn's request (March 1984) for "Potential Problems to Human Health or Environment."

D. Environmental Protection Program. Listing of Remedial Projects GAT 103-85-377 (GAT 1985d).

E. GAT Five Year Management Plan, (GAT 103-85-377) "Potential CERCLA Sites" (GAT 1986c).

F. PUEC Phase I CERCLA Assessment Draft Report (PUEC 1986).

*Subject of Part B application.

context. For example, the East Ditch received a relatively low score in PUEC's ranking of its CERCLA sites (scored number six in the CERCLA Phase I report, in the lower half of the scores: 9.9 chemical). The X-615 Sewage Treatment Plant, which is undergoing early cleanup, also received a relatively low score on PUEC's ranking of CERCLA problems. The five sites that scored in the upper half of the Phase I scoring are in the early stages of investigation or have not yet been addressed. The problem with the apparent lack of a CERCLA management system is significant because it results in deferred action on other, more serious environmental problems.

Another potential problem with modeling future cleanups after the East Ditch and X-615 project is that a relatively narrow range of cleanup alternatives was considered. Other, broader alternatives such as biodegradation, chemical treatment, or encapsulation do not appear to have been explicitly considered in the alternatives assessment and selection process.

Finally, the cost estimation for the East Ditch cleanup was performed using the Means' Building Construction Cost Data (1986) manual, which does not consider the cost of health and safety protection requirements or other operation characteristics that are unique to hazardous waste site cleanups. The resulting underestimate in price may result in the application of insufficient resources to a project. The functional result of this underfunding may be a reduced level of effort in the cleanup or reduced health and safety protection. In the case of the East Ditch project, cleanup technicians were observed to be working on-site without the dust masks, gloves, and other requirements spelled out in the Health and Safety Plan for the project. Although worker health and safety issues are beyond the scope of this survey, it is relevant to environmental planning in this case because of the traditional competing pressures of industrial hygiene and production. In this case, the cleanup is the production process. If proper worker protection were provided, the overall cleanup might be compromised for a project that lacks adequate resources for both aspects of the cleanup process.

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APPENDIX A

SURVEY PARTICIPANTS

APPENDIX A

SURVEY PARTICIPANTS

Larry Weiner	DOE Headquarters	DOE Team Leader
Karen Knight	DOE Headquarters	DOE Assistant Team Leader
Margaret Wilson	DOE, ORO	ORO Supervisor
Joseph Crist	NUS Corporation	NUS Coordinator/Air Quality
Dennis Smith	NUS Corporation	Air Quality
Henry Firstenberg	NUS Corporation	Air Quality
Joseph Boros	NUS Corporation	Surface Water
Amy Hubbard	NUS Corporation	Groundwater/Soil
Ralph Basinski	NUS Corporation	Waste Management
Arthur Olszewski	NUS Corporation	Toxic and Chemical Materials/ Quality Assurance
Mark Francis	NUS Corporation	Direct Radiation
James Werner	ICF	Inactive Waste Sites and Releases

APPENDIX B

SITE-SPECIFIC SURVEY ACTIVITIES

SUMMARY OF 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 Portsmouth Uranium Enrichment Complex (PUEC) in June 1986. Mr. Lawrence A. Weiner was designated the DOE Team Leader, with Ms. D. Karen Knight serving as the Assistant Team Leader. Ms. Margaret Wilson was the point of contact in all Survey efforts for the Oak Ridge Operations Office. The remainder of the team was composed of contractor specialists from the NUS Corporation and its subcontractor, ICF Corporation. These individuals and their areas of expertise are listed below.

Speciality	Name
Air	Joseph Crist*
Surface Water	Joseph Boros
Waste Management	Ralph Basinski
Inactive Waste Sites	James Werner
Hydrogeology	Amy Hubbard
Radiation	Mark Francis
QA/Toxics	Arthur Olszewski

* NUS Coordinator

Survey team members began reviewing PUEC general environmental documents and reports in July 1986. Messrs. Weiner, Smith, Crist, Francis, Gerlach, Ballou (of Argonne National Laboratory), and Ms. Knight conducted a pre-survey site visit on July 1-2, 1986, to gain familiarity with key DOE and site personnel. They toured the facility and completed a cursory review of the data generated in response to an information request of June 3, 1986. The request listed environmental information of interest to the Survey team for Survey planning purposes. A meeting was held with Ohio Environmental Protection Agency (OEPA) representatives at the DOE Area Office located on the PUEC site on July 2, 1986. The purpose of this meeting was to review environmental issues and explain the scope of the Survey.

The Survey team intensively reviewed the information generated during the pre-Survey visit and prepared a Survey Plan for the PUEC site. This plan described the specific approach to the Survey for each of the technical disciplines and included a proposed schedule for the on-site activities.

B.2 On-Site Activities

The on-site portion of the Survey was conducted during the period of August 4-15, 1986. The opening meeting was held on August 4, 1986, at the site and was attended by representatives from DOE Headquarters, the Oak Ridge Operations Office, Goodyear Atomic Corporation, Argonne National Laboratory (ANL), NUS Corporation, and ICF Corporation. Discussions during this meeting centered on the purpose of the Survey, logistics at PUEC, and an introduction of the key personnel involved.

During the Survey, team members reviewed file materials, permits and applications, background studies, engineering drawings, accident reports, and operating logbooks. The production process was thoroughly analyzed to identify existing and potential pollutants. Site operations and monitoring procedures were observed. Extensive interviews were conducted with plant personnel regarding environmental controls, operations, monitoring and analysis, past operations, regulatory permits, and waste management.

Periodic meetings of the Survey team members were held to report observations and compare findings. The DOE Team Leader, Assistant Team Leader, the NUS Coordinator, and Survey team members met daily to discuss findings and progress, and to arrange for specific site personnel and facilities to be to be available, as needed, on the following day.

The Survey team members identified further sampling and analysis requirements necessary to complete the Survey effort. The sampling and analysis requirements were discussed with ANL representatives on August 14, 1986. ANL was designated by DOE to provide the sampling team for the PUEC site and to perform the laboratory analytical services.

A site close-out briefing was held on August 15, 1986, where the DOE Team Leader presented the preliminary observations of the Survey team. These observations were classified as preliminary, because additional research and, in some cases, additional field sampling were required to positively confirm the observations.

B.3 Sampling and Analysis

ANL will perform the sampling and analysis portion of the Survey. ANL evaluated the Sampling and Analysis Requests made by the Survey team and determined sampling and analysis logistics, costs, and schedules. The Sampling and Analysis Plan prepared by ANL includes a quality assurance plan and a health and safety plan. The Sampling and Analysis team is expected to begin work at the site during August 1987.

B.4 Report Preparation

A Survey Preliminary Report for the PUEC site will be prepared for DOE review. Comments from this review and the results of the sampling and analysis efforts will be incorporated and the report will be reissued as an Interim Report. The timing of the Interim Report is dependent upon the completion of the sampling and the reporting of the analytical results to the Survey team.

APPENDIX C

SURVEY PLAN

ENVIRONMENTAL SURVEY PLAN

PORTSMOUTH URANIUM ENRICHMENT COMPLEX

AUGUST 4-15, 1986

PORTSMOUTH, OHIO

1.0 INTRODUCTION

The Environmental Survey is a one time baseline inventory of existing environmental problems and environmental risks at DOE operating facilities. It will be conducted in accordance with the principles and procedures contained in the Draft Environmental Survey Manual distributed on May 16, 1986.

The Environmental Survey is an internal management tool to aid the Secretary and Under Secretary in allocating resources for maintaining progressive environmental programs and for mitigating environmental problems at DOE facilities.

2.0 SURVEY IMPLEMENTATION

The Environmental Survey will be managed by the Team Leader, Lawrence Weiner and the Assistant Team Leader, Karen D. Knight. Margaret Wilson serves as the Oak Ridge Operations Office representative on the Environmental Survey team. Technical support is provided by NUS Corporation personnel as follows:

Joseph G. Crist	NUS Coordinator/ Air
Arthur Olszewski	QA/TSCA
Joseph Boros	Surface Water
Mark Francis	Radiation
Ralph Basinski	RCRA/ Solid Waste
James Werner	CERCLA
Amy Hubbard	Hydrogeology

2.1 Pre-Survey Activities

Survey team members began reviewing the Portsmouth environmental documents that were available at NUS offices in June, 1986. A team consisting of Mr. Weiner, Ms. Knight, Ms. Wilson, Mr. Crist, Mr. Francis, Mr. Steve Ballou (Argonne National Laboratory), Mr. Wm. Smith (NUS Survey Manager) and Mr. R. Gerlach (NUS Health and Safety Advisor) conducted a pre-survey site visit on July 1 and 2, 1986 to become acquainted with key DOE and Goodyear personnel and to become familiar with the site. The team toured the facility and gathered documents that were assembled by site personnel in response to the memorandum of June 3, 1986.

That memorandum announced the pre-survey site visit and requested environmental information of interest to the Survey Team for survey planning purposes. Pertinent documents were transferred to NUS Pittsburgh offices for use by team members during the planning stage of the survey.

2.2 On Site Activities

The Environmental Survey will be conducted from August 4, 1986 through August 15, 1986. The Agenda is as shown in Table 1. It is expected that modifications will be made as appropriate to minimize disruption of site activities, to enhance survey efficiency and effectiveness, and as members of the survey team continue reviewing the documents prior to the survey, and during the actual site survey.

Interviews and consultations will be conducted with environmental, safety, operations, waste management, purchasing and warehousing personnel, among others, in the course of the Environmental Survey.

2.3 Sampling and Analysis

Based on available site environmental information and the results of the survey activities on site, the sampling and analysis (S&A) phase of the survey process will be implemented on September 8, 1986 with pre-sampling reconnaissance and with the site sampling to begin during the week of September 15, 1986. This effort is expected to have a 2-3 week duration and

will be conducted by Argonne National Laboratories (ANL). Steve Ballou will be the ANL project manager and Kevin Flynn will be the ANL Team Leader for the sampling and analysis. Results of the S&A effort will be transmitted to the Environmental Survey Team Leader.

2.4 Conclusions and Reporting on the Survey

A close out briefing will be conducted as noted on the agenda to describe the general conclusions of the site activities. During the 3rd or 4th week of September, a Draft Environmental Survey Report will be completed. Within 4 weeks of the availability of the analytical results from the sampling and analysis phase of the Environmental Survey, an Interim Environmental Survey Report will be completed.

3.0 QUALITY ASSURANCE

3.1 Issue Identification

The quality assurance survey of the environmental program will be primarily an evaluation of the site sampling and analytical capabilities at Portsmouth. The intent will be to verify and review the quality assurance procedures for obtaining process/effluent and environmental samples, performing the analytical work to identify the concentration of pollutants, and the handling and reporting of data. All aspects of the quality assurance program relating to environmental management of the Portsmouth site will be reviewed, including operator training, equipment and instrument calibration/maintenance, precision and accuracy studies, blank, split, and spike sample analyses, sample handling and chain of custody procedures, data reduction and validation, data reporting and documentation, and calculation and logbook reviews.

The procedures for sampling and analysis will be monitored to ensure proper implementation and conformance to regulatory agency requirements. Quality assurance plans will be reviewed for the sampling and analytical activities, as well as any internal QA audits that have been completed.

The QA programs currently in force in the Portsmouth Laboratories, as administered by DOE through the Environmental Measurements Laboratory (EML) and EPA will be evaluated. QA procedures imposed on any outside sampling or analytical laboratories will also be reviewed in this study effort.

3.2 Records Required

During the site visit, the following records/documents will be reviewed:

- Analytical Laboratory and Environmental Sampling Quality Assurance Plans (Environmental and Waste Management Divisions)
- QA Audits of Laboratory and Sampling Program
- Bimonthly QA Reports for the Portsmouth Laboratories
- Laboratory and Sampling procedures manuals
- DOE (EML) and EPA QA results for prepared and analytical samples
- Operator training records (laboratory and sampling)
- Instrument maintenance and calibration records (laboratory and sampling)
- Laboratory and sampling calculations and workbooks
- Precision and Accuracy studies

4.0 SURFACE WATER/DRINKING WATER

4.1 Issue Identification

The 1985 Environmental Audit identified a number of findings and recommendations for improvements in the areas of surface water monitoring, pollution control and compliance with existing permits. Portsmouth's Environmental Protection Program, GAT-S-53, has addressed most of these findings and recommendations, implementing many and progressing on several longer-term studies gathering data for use in evaluating other issues. The Environmental Survey will review the impact of these programs, both completed and on-going. A review of the drinking water system and compliance with applicable regulation will be made. Other issues of potential concern that will be evaluated include:

- o NPDES Permit Issues
  - Negotiations with Ohio EPA concerning permit renewal
  - Methods for reduction of permit exceedances and violations
- o Wastewater Treatment Plant Operation Issues
  - Increased preventative maintenance
  - Improving operations at existing facilities
  - Need for additional facilities, e.g. a new treatment process for X-705 effuents.
- o On-going R & D studies, including elimination of X-701B Holding Pond, the pilot biodenitrification plant, and evaluation of alternative treatment for X-705 effluents.

- Implementation of Sample Collection, Preservation and Handling Changes recommended during 1985 Environmental Audit

- Identification of Data Gaps or Inadequacies
  - The need for additional sample points to better characterize wastewaters
  - Better provisions for composite sampler maintenance and spare parts inventories
  - Improved sample cooling and preservation techniques
  - Maintenance of strict chain-of-custody procedures
  - Improved record keeping and documentation

- Quality of On-Site and Off-Site Drinking Water Supplies

Future NPDES Permits may require further reduced pollutant loadings from Portsmouth to meet water quality standards in the Scioto River. Pollutant loadings from the Portsmouth Facility and their effect on the numerical water quality criteria established by OEPA for the Scioto River will be evaluated.

Stormwater discharges will be evaluated, since future NPDES Permits will cover such discharges.

The site assessment will review plant procedures for the operation and maintenance of sampling and treatment equipment, then following through by looking at records, interviewing personnel, and observing procedures to determine how they are followed. A walk through of the plant area will be made to identify all liquid waste streams from plant processes and all discharges from the plant property.

4.2 Records Required

Records that may be reviewed during the visit to obtain information include:

- Analytical data used for preparation of the NPDES monitoring reports
- NPDES discharge monitoring reports and violation reduction studies
- Records of drinking water quality both on and off-site
- Operators log books and reports for treatment plant operations
- Sampling log books and laboratory tracking reports
- Treatment plant and monitoring equipment maintenance records and/or logs
- Progress reports and/or final reports for on-going R & D studies of wastewater control and treatment options
- Internal memos and correspondence relating to surface water/drinking water problems
- Applicable water quality standards for the Scioto River

5.0 AIR

5.1 Issue Identification

The nonradioactive survey will involve an assessment of the plant-wide air emissions, emission control and monitoring, and the acquisition and processing of ambient air quality data. There will be emphasis on operational and procedural practices associated with the control equipment, fugitive sources of emissions, and mitigative procedures for fugitive sources.

The general approach to the survey will involve a review of existing air permits, pending air permit applications, operating procedures, and the physical inspection of the processes and control equipment and compliance with DOE ALARA requirements for radionuclide emissions. The survey will review the air contaminants from different processes in the plant, evaluate the existing control equipment for the air contaminants, and assess the need for additional monitoring or controls to characterize or reduce potential environmental problems from the emissions.

The meteorlogical monitoring program will be evaluated to determine if the program is adequate to characterize the impacts, both existing and potential, of routine and non-routine discharges from the plant.

The ambient air monitoring system survey will involve inspection of the ambient samplers and proposed new sampling sites, review of documentation applicable to data acquisition, review of calibration procedures, data validation, and data processing. The primary emphasis will be an assessment of the use of these data to characterize the overall environmental impact of plant operation and the defensibility of these data.

Areas of particular interest include process related emissions of radionuclides, and fluorides from the purge vents of the process buildings. The effectiveness of control systems to limit the emissions of sulfur dioxide from the power plant will be evaluated. The X-705 Decontamination Facility and X-700 Maintenance Facility contain numerous points where emissions of acids, radionuclides, and organic solvents, either can potentially occur or actually occur on a routine basis. These emissions will be evaluated to determine if they are adequately characterized, monitored and controlled. The adequacy of the Portsmouth Emissions Inventory, which quantifies emission will be evaluated.

Another area of concern are the open lots where contaminated (radionuclide contaminated) materials are stored (X-747H, X-747G, X-747B, X-747J). These areas have the potential for windborne releases of radionuclides.

The incinerator (X-705A) uses a propane fired upper chamber to control emissions including radionuclides. The adequacy of this control procedure and monitoring procedures will be evaluated.

The recirculating cooling water systems use hexavalent chromium as a cooling water additive. The potential exists for releases of chromium into the environment from the cooling towers. Evaluations will be made of these potential releases.

5.2 Records Required

- o Air permits (Registrations, Installation and Operation)
- o Source and source emissions inventories
- o Supporting calculations, stack tests, etc.
- o Descriptive documentation on add-on emission controls
- o Operating procedures for processes and control equipment
- o Correspondence between regulatory agencies: air-related
- o Reports on accidental releases
- o Ambient air monitoring program procedures

  - Duty observer
  - Calibration procedures and records
  - Laboratory procedures and quality assurance
  - Ambient air monitoring data

6.0 RADIATION

6.1 Issue Identification

Areas of primary concern for investigation during the site survey will include:

- o Ambient air quality and associated impact on the environment
- o Air release points and impact
- o Ground and surface water discharges, quality and impact
- o Soil radionuclide contamination on and off-site
- o Vegetation radionuclide monitoring data
- o Laboratory procedures and programs

Evaluation of these listed issues will be based upon observations of processes, operations, effluent control and monitoring equipment along with discussions with operations and supervisory personnel. Reports, records, and other data associated with continous, intermittent, and any accidental releases should be available for review as needed for complete evaluation of each operation investigated.

Support Facilities such as the X-700 Convertor Shop and Cleaning Building, and the X-705 Decontamination Building have many processes which are sources of air and water radionuclide emissions. These facilities as well as others will be evaluated to determine if radionuclide emissions are properly controlled and monitored.

Radionuclide contamination material is stored in several areas including the X-744 Bulk Non-USEA Storage Building, four outdoor contaminated storage lots (X-705B, X-747G, X-747J, X-747H) and the X-749 South Contaminated Materials Storage (Burial) Facility. These storage areas will be evaluated for proper control and monitoring of air, surface and groundwater, and soil radionuclide emissions.

Other areas of concern will include population dose assessment methodologies and biological pathway radionuclide assessment strategies. Extent of radioactive material use in the GCEP new construction area, even though this process was never fully operational, will also be investigated.

The radiological Environmental Survey will be co-ordinated with the Air, Water, Solid Waste, CERCLA and Hydrogeology Surveys.

6.2 Records Required

- o Radionuclide ambient air monitoring data
- o Radionuclide point source air monitoring data
- o Radionuclide surface water monitoring data
- o Radionuclide ground water monitoring data
- o Radionuclide soil and sludge monitoring data
- o Radionuclide vegetation monitoring data
- o Accident reports and data (radiation related)
- o Laboratory procedures and analytical methods

- Dose assessment methodologies
- Plot plans with monitoring locations
- Biological and food pathway radionuclide assessment strategies
- GCEP radionuclide use (if any)
- Other records as determined on site

7.0 TOXIC SUBSTANCES

7.1 Issue Identification

The toxic survey will include all raw materials and process-related chemicals used on the Portsmouth site. Use, handling, and disposal of polychlorinated biphenyls (PCBs), asbestos, pesticides, and hazardous substances will be within the scope of this effort.

All toxic and hazardous substances purchased, used, or manufactured on the site will be evaluated. Tracking, control, and management of these substances will be reviewed. Records of usage will be evaluated to determine the potential for entering effluent streams.

The status of the inventory of PCB and PCB contaminated electrical equipment in use at the facility will be determined. The condition of this equipment, its potential for leakage, and the quantity of contaminated fluids will be identified. Obsolete or used PCB items and contaminated items in storage will be inspected for proper container/packaging, adequate storage protection requirements, and inventory controls. In addition, the east drainage ditch and process building exhaust system will be inspected. Disposal practices will be reviewed for current and past inventories to determine the method of disposal and location of disposal sites. Procedures for PCB analysis, removal, handling, and disposal will be reviewed. Adherence to inspection and

reporting regulation (TSCA) for PCB transformers will be evaluated. In addition, adherence to reporting requirements for spills of the substances list in 40CFR302 will be checked especially for the Decontamination and Maintenance Facilities.

The use of asbestos insulation in Portsmouth buildings will be identified and projects for modification/removal will be reviewed. The use of asbestos in process equipment and related facilities will also be identified. This will include the steam plant. Asbestos procedures for modification/removal, handling, disposal, and environmental monitoring will be investigated. Disposal practices, both on and off site, will be reviewed to determine disposal methods and locations of disposal sites. Disposal sites will be visited.

Pesticides usage on the site will be reviewed including personnel training, application records, storage and disposal practices, and environmental monitoring.

Hazardous materials are used in many places including fluorine in the X-392 Feed Vaporization Facility and X-700 Convertor Shop Area, and acids and solvents in the X-700 and X-705 Maintenance Facilities, and other Facilities. The handling of these and other hazardous materials, including solvents, to avoid releases to the environment, will be evaluated. The Lithium Hydroxide Storage Warehouses (X-747-K, X-747-S, and X-744-T) will be inspected and evaluations made of storage procedures and conditions to evaluate the potential for releases to the environment.

7.2 Records Required

The following records/documents regarding toxic substances should be available for review during the site visit:

- 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 1985)
- Inventory of current PCB-contaminated electrical equipment
- Records of inspections of PCB transformers (1981 to present)
- Storage records of PCB items
- Disposal records for PCB items
- 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
- Asbestos handling, removal, disposal procedures, and environmental monitoring
- Records of asbestos use in process equipment and support facilities including the steam plan
- Pesticide training, handling, storage, disposal records, and environmental monitoring
- Standard operating procedures for pesticides

8.0 SOLID/HAZARDOUS/RADIOACTIVE WASTE

8.1 Issue Identification

The general approach to the survey will involve a review of all solid waste generated at the site, applicable regulations, and plant handling procedures. Findings and recommendations made in the 1985 environmental audit will be reviewed to determine if appropriate actions have been taken.

The hazardous waste Environmental Survey will initially place emphasis on the X-752 storage area, X-616 chromium sludge lagoons, X-231B oil biodegradation plots, and the X-701B holding pond for which RCRA permit applications were made. Waste analysis plans, personnel training, manifests, response plans, contingency plans, and closure and operating records required by RCRA will be reviewed. In co-ordination with the hydrology review, the adequacy of the ground water monitoring network will be evaluated. Solid waste management units as defined by RCRA will be evaluated.

Management practices for solid non-hazardous and contaminated (radioactive) wastes will be evaluated. Waste generation points both present and past, and past disposal practices will be characterized. This review will be co-ordinated with the CERCLA and hydrologic surveys to identify any possible releases violating regulations or posing a threat to the environment. Waste and hazardorous materials storage practices and waste oil handling practices will be reviewed.

Among the areas of particular interest will be the X-342 neutralization pit, X-735 GDP/GCEP sanitary landfill, X-744W closed and existing construction spoils disposal areas, X-749A classified waste burial yard, X-701B holding pond receiving waste from the Decontamination Building, and the X-705 heavy metals removal facility. Available data already shows that organics and metals have entered the groundwater from some of these areas. Waste storage in outdoor facilities such as the X-705B Incinerator Storage Yard, X-747G Storage Yard and other facilities, potentially could result in releases of contaminants to the environment. These facilities will be evaluated. All solid/hazadous/radioactive waste generation points, facilities, and records will be reviewed for conformance with existing and evolving federal and Ohio regulations. Discussions will be held with individuals knowledgeable of current and past waste management practices.

8.2 Records Required

The following records will be reviewed on site:

- Part B permit application
- 3016 inventory
- Part A application and 3010 notification
- Inspection documentation, (state and federal)
- Groundwater monitoring, sampling, and analytical documentation
- Groundwater quality assessment documentation
- Release notification or occurrence documentation

- o Waste inventory documentation
- o Enforcement action documentation
- o Groundwater monitoring system construction documentation
- o Internal facility inspection documentation
- o RCRA manifests
- o Correspondence with regulatory agencies on solid waste
- o Records dealing with the reuse/recyling of wastes

9.0 INACTIVE WASTE SITES/RELEASES (CERCLA)

9.1 Issue Identification

The survey will attempt to identify environmental problems and potential risks associated with the handling, storage and disposal of hazardous substances at the Portsmouth facility. The survey will focus on current and future risks related to the following:

- o Past waste disposal and treatment practices;
- o Past spills/releases;
- o Current waste management practices; and
- o Potential for future spills/releases.

All facilities that have handled or are currently handling hazardous, mixed and low-level radioactive wastes will be inspected and assessed. These facilities include waste water and sludge lagoons, drum storage areas, storage tanks, lithium hydroxide storage, fly ash piles, and landfills.

These facilities will be evaluated in terms of the materials that they contain, their environmental integrity and past and potential releases of hazardous substances. Records regarding the past usage of off-site disposl sites will also be reviewed. This portion of the survey will be coordinated with the SOLID/HAZARDOUS/MIXED Waste Review.

Among issues of concern is the PCB contamination found in soils along the East Drainage Ditch. Attempts will be made to determine from past records and interviews where this contamination originated. The cleanup procedures, and storage procedures for PCB contaminated soil will be reviewed. Records will be reviewed, and interviews held to determine if similar PCB contamination may have occurred in other areas (i.e., oil biodegradation plots, X-747-H Construction Spoils Area, etc.).

9.2 Records Required

The following records will be reviewed at the site:

- Waste management plans (old and current)
- SOPs regarding management of hazardous substances, disposal areas and storage areas
- Hazardous substances inventories
- Listing of areas used for hazardous substances use, storage, receiving, 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
- Descriptions and notification of spills/releases
- Descriptions of corrective actions

- Description of all waste management facilities, including buried tanks and structures (e.g., design, materials used, details on liners used in waste pits)
- On-going studies, including:

  Study plans to identify contaminated surplus facilities; and

  Groundwater studies (e.g., Law Environmental Testing Co. and Geraghty & Miller work)

10.0 HYDROGEOLOGY

10.1 Issue Identification

The preliminary review of the data available from the groundwater monitoring program at Portsmouth indicates that there have been studies performed on a number of waste management facilities at the site. In response to an Environmental Program Audit prepared by NUS Corporation in August 1985, Goodyear contracted with two consultants to design and install monitoring well networks at the following areas:

- o X-749 Contaminated Materials Disposal Facility
- o X-701B Water Treatment Facility
- o X-616 Chromate Sludge Impoundment
- o X-231A and B Oil Biodegradation Plots
- o X-749B Planned Classified Waste Burial Yard
- o X-749A Waste Lagoon

A major focus of the hydrogeology survey will be an evaluation of the adequacy of these recent studies and the status of the groundwater monitoring plan. Determinations will be made as to whether the recent activity at Portsmouth meets the recomendations made by NUS in 1985 and what further studies may be required. Trichloroethylene contamination of groundwater appears to be a widespread problem at several sites including the X-749 contaminated materials storage yard, X-231B oil biodegradation plots and

X-701B Holding Pond. Metals including uranium, technetium, cadmium and lead may have entered the groundwater from the X-701B Holding Pond. Chromium may have entered the groundwater from the X-701 Sludge disposal pond. The survey will review the adequacy of available information to characterize the extent of contamination, and groundwater flow patterns. Numerous other areas have been used to dispose of wastes and sludges. These include the X-611A Lagoons, X-230L Holding Pond, and X-747M Construction Spoils Area. Contamination of groundwater may have occurred in these as well as other areas. The Hydrogeology survey will, in conjunction with the RCRA and CERCLA Surveys, attempt to identify areas where groundwater contamination may have occurred and where monitoring of groundwater and determination of the hydrogeology of the groundwater should be undertaken.

Potential contaminants must also be addressed during this survey. For the most part, only a limited number of solvents, and occasionally radionuclides, have been analysed. The wastes have not been characterized in the existing file data. It must also be determined whether these analytes meet the early detector and compliance monitoring requirements of RCRA which were recently revised. Significant increases in contaminant concentrations can be determined from the statistical analyses recommended by NUS in 1985.

The value of the previous studies will be determined from a review of the data collected thus far. This includes a review of well locations and construction details, sampling procedures, chain-of-custody, QA/QC procedures in the field, compatibility of data from the various sources, and monitoring parameters.

10.2 Records Required

Records and Documents to be reviewed include the following:

- o New and recent work and work plans
- o Well sampling procedures
- o Sampling schedules
- o Monitoring parameters
- o Monitoring data and results
- o General groundwater sampling QA/QC and lab
- o Well installation reports and bore logs
- o Air photos (historic)
- o Groundwater sections of pertinent documents (e.g. RCRA permits)

TABLE 1

PORTSMOUTH ON-SITE SURVEY AGENDA

QA/TSCA

Week 1

Monday	Opening meeting, Orientation and Facility Tour Health and Safety Briefing, Security Briefing
Tuesday/ Wednesday	Tour East drainage cleanup from (X330 & 333) leakage, oil plots (X231), low-level burial ground, oil diversion (X237J7), transformers and capacitors, X-333 storage area, X-740 waste oil storage and process building exhaust system
Thursday	Review toxic substance mgmt. programs
Friday	Tour X735 (pit) and X342 (demolition area) Debrief with Team Leaders

Week 2

Monday	Meet with T.A. Acox (pesticides) Meet with J.D. Jordan (QA/audits) Tour X710 - laboratory and air monitoring stations Meet with Sampling Team
Tuesday	Review laboratory data mgmt/lab procedures Meet with Sampling Team
Wednesday	Review environmental sampling/surveillance programs
Thursday	Revisits Coordinate with other technical areas Develop Sampling Plan Debrief with Team Leader
Friday	Debrief with Team Leader (if necessary) 1:00 PM Close-out Meeting

TABLE I

HYDROGEOLOGY - SITE AGENDA

Week 1

Monday	Opening meeting, Orientation, Facility Tour Health and Safety Briefing, Security Briefing
Tuesday	Field/Observe well locations and sampling procedures check paperwork; sample collection techniques (purging, equipment, preservation, decontamination); sample packaging; chain-of-custody; measure well depths for comparison to "as built" data; measure water levels
Wednesday	Field/Continue Tuesday activities
Thursday	Office/Review of sampling documentation and comparison of historical analytical data
Friday	Office/Meet with Environmental monitoring personnel regarding sampling techniques and data management Debrief with Team Leaders

Week 2

Monday	Field/Visit other potential source areas, off-site reconnaissance Meet with Sampling Team (PM)
Tuesday	Field/On-site reconnaissance - revisit study areas Meet with Sampling Team (PM)
Wednesday	Office/Coordinate with RCRA, CERCLA, RAD
Thursday	Revisits Coordinate with other technical areas Develop Sampling Plan Debrief with Team Leader
Friday	Debrief with Team Leader (if necessary) 1:00 PM Close-out Meeting

TABLE I

SURFACE WATER - SITE AGENDA

Week 1

Monday	Opening meeting, Orientation, Facility Tour, Health and Safety Briefing, Security Briefing
Tuesday	Field/Plant boundary and process wastewater generation source tour
Wednesday	AM Office/Review SOPs for sampling procedures, maintenance of equipment, sample handling (B. Anderson) PM Office/Review SOPs for operation and maintenance of wastewater treatment and control facilities
Thursday	Field/Observe routine surface water/NPDES compliance sampling procedures
Friday	AM Lab/Observe water analysis procedures PM Office/Review data and plan additional work Debrief with Team Leaders

Week 2

Monday	Field/Observe in-plant water management and control activities for specific sources Meet with Sampling Team (PM)
Tuesday	AM Field/Same as Monday PM Office/Interview environments control staff members Meet with Sampling Team (PM)
Wednesday	AM Field/Interview wastewater control and treatment plant operations PM Office/Review records - NPDES monitoring reports, operator logs, plant maintenance records
Thursday	Revisits Coordinate with other technical areas Develop Sampling Plan Debrief with Team Leader
Friday	Debrief with Team Leader (if necessary) 1:00 PM Close-out Meeting

TABLE I

RADIATION - SITE AGENDA

Week 1

Monday	Opening Meeting, Health & Safety Briefing, Security Briefing, Site Tour
Tuesday	X-343 Feed Vaporization Seal Exhaust System Cold Recovery System X-326 Purge Process with drawals
Wednesday	X-705 Decon Bldg. X-705A Incinerator X-705B X-744G Bulk Non-UESA Storage Bldg.
Thursday	X-615 Old WWTP X-6619 New WWTP X-701B Holding Pond Sludge Retention Pond Ground Water
Friday	X-749A Classified X-749 (Cont.) Mats. Burial X-747G Scrapmetals X-747J Decon Storage Lot X-747H Low Level Storage Debrief with Team Leaders

Week 2

Monday	X-231A Oil Biodegredation Vegetation Monitoring Biological Pathway Meet with Sampling Team (PM)
Tuesday	Dose Assessment X-700 Maint. X-710 Laboratory X-345 Special Nuclear Materials Meet with Sampling Team (PM)
Wednesday	Revisits Sampling & Analysis Plan
Thursday	Revisits Coordinate with other technical areas Develop Sampling Plan Debrief with Team Leader
Friday	Debrief with Team Leader (if necessary) 1:00 PM Close-out Meeting

TABLE I

RCRA/SOLID WASTE - SITE AGENDA

Week 1

Monday	Opening Meeting, Orientations, Facility Tour Health and Safety Briefing, Security Briefing
Tuesday	Field/Detailed Process Tour/Auxillary Process Tour Emphasis Solid Waste Generation and Handling/ X-720 Maintenance
Wednesday	Field/X-749A Classified Landfill/X-231A & B Oil Bidegradation Plots/X-744K Lithium Hydroxide Storage/ X-710 Laboratory/X-750 Mobile Equipment/X-701C Neutralization Pit
Thursday	Field/X-705A Incinerator/X-700 Maintenance & Cleaning X-705B Contaminated Burnable Lot/X-705 Decontamination Facility/X-705 Decontamination Storage Area/X-345 SNM Storage
Friday	Field/X-611 RCW Treatment/X-611B Lagoon/X-747G Contaminated Material Storage/X-744G Bulk Non-USEA Storage Bldg./X-611A Lagoons Debrief with Team Leaders

Week 2

Monday	Field/230L Holding Pond/Construction Spoils Disposal/ X-747H Low Level Storage/X-752 Hazardous Waste Storage Meet with Sampling Team (PM)
Tuesday	Field/X-616 Chromium Reduction/X-744 S & T Lithium Hydroxide Storage/6619 Sewage Treatment Plant Meet with Sampling Team (PM)
Wednesday	Field/Followup Field Survey/File Review - offsite Facility Status - RCRA Monitors
Thursday	Revisits Coordinate with other technical areas Develop Sampling Plan Debrief with Team Leader
Friday	Debrief with Team Leader (if necessary) 1:00 PM Close-out Meeting

TABLE I

CERCLA - SITE AGENDA

Week 1

Monday	Opening Meeting, Orientation, Facility Tour, Health and Safety Briefing, Security Briefing
Tuesday	Spoils Area Old Sanitary Landfill Peter-Kewitt Landfill West Ditch at NPDES 010
Wednesday	X-749A Classified Landfill X-23K South Holding Pond Abandoned Sewage Treatment Plant
Thursday	X-231A Oil Biodegradation Plot Oil Plots North of X-701B X-616 Chromium lagoon and Tmt. X-530 and X-533 Smith Yards East Drainage Ditch Incinerator
Friday	X-611A Lime Sludge Lagoon RCW System X-342C Waste HF Neutralization Pit X-344D HF Neutralization Pit Debrief with Team Leaders

Week 2

Monday	X-701C Neutralization Pit Process Lines from X-705 and X-700 X-710 Neutralization Pit Sand & Gravel Pits across Rt. 23 Meet with Sampling Team (PM)
Tuesday	X-700 Maintenance & Cleaning Bldg. X-720 Maintenance & Storage Bldg. X-750 Garage X-710 Laboratory X-752 PCB Storage North Landfill areas X-611B Sludge Lagoon X-611A Lime Sludge Lagoons Meet with Sampling Team
Wednesday	Follow-up Field Survey File review of off-site disposal facility status
Thursday	Revisits Coordinate with other technical areas Develop Sampling Plan Debrief with Team Leader
Friday	Debrief with Team Leader (if necessary) 1:00 pm Close-out Meeting

TABLE I

AIR - SITE AGENDA

Week 1

Monday	Opening meeting, Orientation, Site Tour, Health and Safety Briefing, Security Briefing
Tuesday	Air Emissions Inspection, Meteological Site
Wednesday	Air Emissions Inspection (continued) Permits Review, Visit Cooling Towers
Thursday	Permits Review, Review of Emissions Inventory, Site X-705 Incinerator, X-700 Maintenance and Cleaning, X-705B Lot
Friday	Continue Files Review, Visit Air Monitoring Stations Debrief with Team Leaders

Week 2

Monday	Air Monitoring Stations Visits Meet with Sampling Team (PM)
Tuesday	Air Laboratory - Quality Control Meet with Sampling Team (PM)
Wednesday	Files Review, Re-visits
Thursday	Revisits Coordinate with other technical areas Develop Sampling Plan Debrief with Team Leader
Friday	Debrief with Team Leader (if necessary) 1:00 PM Close-out Meeting

APPENDIX D

COMMENTS SUBMITTED BY THE OHIO ENVIRONMENTAL PROTECTION AGENCY FOLLOWING THE PRE-SURVEY SITE VISIT

OHIO ENVIRONMENTAL PROTECTION AGENCY
DIVISION OF SOLID AND HAZARDOUS WASTE MANAGEMENT

COMMENTS BY MICHAEL MOSCHELL
JULY 1986

1. A comprehensive list of generation points of hazardous wastes and mixed (radioactively contaminated) solid or hazardous wastes should be developed and evaluated. The hazards posed by generation and by storage of radioactive wastes should be studied. Land disposal sites for such wastes should be thoroughly evaluated for releases, potential for releases, and populations potentially at risk. It is hoped that potential alternatives to present disposal practices will be developed.

2. Releases, and the potential for releases from RCRA, CERCLA, and solid waste management unit sites should be studied, as well as their possible impacts.

3. The need to develop and implement a facility-wide groundwater monitoring program and protection strategy should be addressed. The physical integrity of all on-site monitor wells and abandoned boreholes should be surveyed to determine if the well annulus is properly sealed to prevent direct contamination of groundwater.

4. Specific areas where groundwater contamination is indicated should be studied, such as the X-701B pond area, the X-749 landfill, and the X0235 oil plots. Areas of known soil contamination by solvents or PCBs should be surveyed to determine their hazard potential.

5. All available site groundwater monitoring data should be studied and reported.

6. The area where UF_6 process heels are stored is of concern and should be evaluated.

OHIO ENVIRONMENTAL PROTECTION AGENCY
DIVISION OF PUBLIC WATER SUPPLY

COMMENTS BY JEFFREY O. CRISLER
JULY 1986

1. The potential impact of air releases on open water supply treatment basins should be studied.

2. Areas where backsiphonage of process materials could enter the water supply should be determined.

3. The adequacy of present water supply monitoring and sampling, especially for radiological parameters, should be determined.

OHIO ENVIRONMENTAL PROTECTION AGENCY
DIVISION OF AIR POLLUTION CONTROL

COMMENTS BY SUSAN H. CLAY
JULY 1986

The following items should be addressed for air emissions at the Portsmouth Gaseous Diffusion Plant during the DOE baseline environmental survey:

1. The impact of accidental releases into the air of fluorides and/or radionuclides on private residences in proximity of the plant should be examined. This should also address the impact of such releases on the area of the Gas Centrifuge Plant since there is a possibility that plant will be taken over by private industry for non-nuclear industry.

2. The impact of any releases from the facility either accidental or routine on the open tanks in the potable water treatment system should be investigated. This should also be addressed for any private homes that use cisterns.

3. The amounts of fluorides being releasesd from the plant must be addressed. The sources of these releases should be identified and quantities from each source should also be determined. The chemical make-up of the fluoride releases should be identified.

4. The possible installation of a uranium-contaminated waste oil incinerator should be discussed in the survey. Is such an installation necessary? Exactly what types of oils and what kinds and levels of contaminants are to be disposed of in such an installation? What impact will this installation have with complying with NESHAPS for this facility?

5. How did an unplanned release of low assay uranium occur from December 20 to January 10 before detection? Why was this release not picked up by in-plant monitoring and the ambient monitoring network sooner?

6. What types of monitoring are conducted on the plant stacks? How often are the sources tacks monitored?

7. Do any synergistic effects occur when radionuclides and fluorides are released together?

8. The quantities and types of volatile organic compounds emitted by the facility should be identified.

9. How long does it take for airborne radionuclides that are released from the facility to be deposited into the soil? Is it possible for airborne contaminants to become groundwater contaminants or are the radionuclides bound up quickly in soil?

APPENDIX E

CHEMICAL SYMBOLS, ABBREVIATIONS, AND ACRONYMS

ACLs	-	Alternate Concentration Limits
Al	-	Aluminum
BOD	-	Biological Oxygen Demand
Ca	-	Calcium
$C_2C1_2F_4$	-	Freon - 114
CECOS	-	Commercial Hazardous Waste Disposal Firm
CERCLA	-	Comprehensive Environmental Response, Compensation, and Liability Act
CF_4	-	Carbon Tetrafluoride
CFR	-	Code of Federal Regulations
Cl	-	Chlorine
ClF_3	-	Chlorine Trifluoride
ClF_4	-	Chlorine Tetrafluoride
CM/sec	-	Centimeters per second
COD	-	Chemical Oxygen Demand
Cr	-	Chromium
$Cr+6$	-	Chromium - hexavalent
Cu	-	Copper
Cu. yd. or yard ^{3}	-	Cubic yards
d/m/g	-	Disintegrations per minute per gram
d/min/100 ml	-	Disintegrations per minute per 100 milliliters
DOE	-	Department of Energy
EP Toxic	-	Extraction Procedure Toxic
ERDA	-	Energy Research Development Administration
°F	-	Degrees Fahrenheit
F_2	-	Fluorine
Fe	-	Iron
FFCA	-	Federal Facility Compliance Agreement
gal	-	Gallon
GAT	-	Goodyear Atomic Corporation
GCEP	-	Gas Centrifuge Enrichment Plant
GDP	-	Gaseous Diffusion Plant
HF	-	Hydrogen Fluoride
Kg/yr	-	Kilograms/year
Km	-	Kilometers
Km^2	-	Square kilometers
lbs/year	-	Pounds/year
MCLs	-	Maximum Concentration Limits
MCLGs	-	Maximum Concentration Limit Guidelines
Mg	-	Magnesium
mgallon	-	Million gallons
MgF_2	-	Magnesium fluoride

mg/kg	-	Milligrams/kilogram
mg/l	-	Milligrams/liter
µCi	-	Microcuries
µg/l	-	Micrograms/liter
µR/h	-	Microroentgen/hour
NAAQS	-	National Ambient Air Quality Standards
NESHAPS	-	National Emission Standards for Hazardous Air Pollutants
NOx	-	Nitrogen oxides
NOD	-	Notice of Deficiency
NPDES	-	National Pollutant Discharge Elimination System
ODH	-	Ohio Department of Health
OEPA	-	Ohio Environmental Protection Agency
Pb	-	Lead
PCBs	-	Polychlorinated Biphenyls
pCi/g	-	Picocuries/gram
PKS	-	Peter Kewitt & Sons Landfill
ppm	-	Parts per million
PUEC	-	Portsmouth Uranium Enrichment Complex
PVC	-	Polyvinyl chloride
QA	-	Quality assurance
QC	-	Quality control
Rem	-	Roentgen equivalent man
RCRA	-	Resource Conservation and Recovery Act
RCW	-	Recirculating cooling water
S & A	-	Sampling and analysis
SAS	-	Semi-annual soils
SAV	-	Semi-annual vegetation
Si	-	Silicon
SO_2	-	Sulfur dioxide
SO_2F_2	-	Sulfuryl fluoride
SOPs	-	Standard Operating Procedures
SPCC	-	Spill prevention Control and Countermeasure Plan
TAP	-	Toxic Air Pollutants
Tc	-	Technetium
TCE	-	Trichloroethylene
TCLP	-	Toxicity Characteristic Leaching Procedure
TLD	-	Thermoluminescent Dosimeter
TOC	-	Total Organic Carbon
TSCA	-	Toxic Substances Control Act
TSD	-	Treatment Storage & Disposal
TSS	-	Total Suspended Solids
UF_6	-	Uranium hexafluoride
USEPA	-	United States Environmental Protection Agency
USTs	-	Underground Storage Tanks
VOCs	-	Volatile Organic Compounds

$yards^3$	-	Cubic yards
Zn	-	Zinc

END

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