# SITEWIDE EXCAVATION PLAN

## FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
## FERNALD, OHIO

INFORMATION ONLY

**VOLUME I**
**SECTIONS 1 through 7**

**JULY 1997**

**U.S. DEPARTMENT OF ENERGY**
**FERNALD AREA OFFICE**

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**DRAFT**

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## LIST OF ACRONYMS

| | |
|---|---|
| ACGIH | American Conference of Governmental and Industrial Hygienists |
| ALARA | as low as reasonably achievable |
| ALS | Analytical Laboratory Services |
| ARAR | applicable or relevant and appropriate requirement |
| ASCOCs | area-specific constituents of concern |
| ASL | analytical support level |
| ASTM | American Society of Testing and Materials |
| AVL | Approved Vendor List |
| AWWT | Advanced Wastewater Treatment Facility |
| BTVs | benchmark toxicity values |
| CAMU | Corrective Action Management Unit |
| CAWQC | chronic ambient water quality criteria |
| CERCLA | Comprehensive Environmental Response, Compensation and Liability Act |
| CFC | Certified for Construction |
| CFR | Code of Federal Regulations |
| COC | constituent of concern |
| COEC | constituent of ecological concern |
| CPC | constituent of potential concern |
| CQC | construction quality control |
| CRARE | comprehensive response action risk evaluation |
| CRP | Community Relations Plan |
| CT | central tendency |
| CU | certification unit |
| D&D | decontamination and dismantlement |
| DFO | Director's Findings and Orders |
| DGI | data group identifiers |
| DMEPP | Design, Monitoring, and Evaluation Program Plan |
| DOE | U.S. Department of Energy |
| EDMP | Environmental Data Management Plan |
| EMP | Fernald Site Environmental Monitoring Plan |
| EGAS | environmental gamma analysis software |
| EPA | U.S. Environmental Protection Agency |

## LIST OF ACRONYMS
## (Continued)

| | |
|---|---|
| FACTS | Fernald Analytical Computerized Tracking System |
| FDF | Fluor Daniel Fernald |
| FEMP | Fernald Environmental Management Project |
| FFCA | Federal Facilities Compliance Act |
| FRL | final remediation level |
| FRVP | Fernald Residues Vitrification Plant |
| FS | feasibility study |
| FTF | Fire Training Facility |
| FY | fiscal year |
| GIS | Geographic Information System |
| GMA | Great Miami Aquifer |
| GMR | Great Miami River |
| gpm | gallons per minute |
| GPMPP | Groundwater Protection Management Program Plan |
| GPS | global positioning satellite |
| HASP | Health and Safety Plan |
| HI | hazard index |
| HPGe | High Purity Germanium |
| HQ | hazard quotient |
| HWMU | hazardous waste management unit |
| IEMP | Integrated Environmental Monitoring Plan |
| IIMS | Integrated Information Management System |
| ILCR | incremental lifetime cancer risk |
| IRDP | integrated remedial design package |
| LDR | land disposal restriction |
| LSP | lime sludge ponds |
| LTRA | long-term response action |
| MCL | maximum contaminant level |
| MCLG | maximum contaminant level goal |
| MDC | Minimum Detectable Concentrations |
| MTL | material tracking location |

## LIST OF ACRONYMS
## (Continued)

| | |
|---|---|
| MTR | minimum technology requirements List |
| NAGPRA | Native American Graves Protection and Repatriation Act List |
| NCP | National Oil and Hazardous Substances Pollution Contingency Plan List |
| NESHAP | National Emissions Standards Hazardous Air Pollutants List |
| NIOSH | National Institute for Occupational Safety and Health List |
| NPDES | National Pollutant Discharge Elimination System List |
| NPL | National Priorities List |
| NRC | U.S. Nuclear Regulatory Commission |
| NRIMP | National Resource Impact Monitoring Plan |
| NRRP | Natural Resource Restoration Plan |
| NTS | Nevada Test Site |
| O&M | operations and maintenance |
| OAC | Ohio Administrative Code |
| OEPA | Ohio Environmental Protection Agency |
| ORC | Ohio Revised Code |
| OSDF | On-Site Disposal Facility |
| OSHA | Occupational Safety and Health Administration |
| OU | operable unit |
| PAH | polynuclear aromatic hydrocarbons |
| PID | photoionization detector |
| ppb | parts per billion |
| PPE | personal protection equipment |
| ppm | parts per million |
| PQL | practical quantitation limit |
| PRRS | Paddys Run Road Site |
| PSHASP | Project-Specific Health and Safety Plan |
| PSHSRM | Project-Specific Health and Safety Requirements Matrix |
| PSP | project-specific plan |
| QA | Quality Assurance |
| QAPP | Quality Assurance Project Plan |
| QC | Quality Control |

## LIST OF ACRONYMS
(Continued)

| | |
|---|---|
| RA | remedial action |
| RCRA | Resource Conservation and Recovery Act |
| RD | remedial design |
| RD/RA | remedial design/remedial action |
| RfD | reference dose |
| RFP | Request for Proposal |
| RI | remedial investigation |
| RI/FS | remedial investigation/feasibility study Decision |
| RME | reasonable maximum exposure |
| ROD | Record of Decision |
| RTRAK | Real Time Radiation Tracking System |
| RWP | Radiation Worker Permit |
| SCEP | Soil Characterization and Excavation Project |
| SCQAP | Sitewide CERCLA Quality Assurance Plan |
| SED | Sitewide Environmental Database |
| SEP | Sitewide Excavation Plan |
| SMMP | soil and miscellaneous media projects |
| SSC | systems, structures, and components |
| SSOD | storm sewer outfall ditch |
| SSP | Sitewide Sequencing Plan |
| STP | sewage treatment plant |
| SWIFTS | Sitewide Waste Information Forecasting and Tracking System |
| SWL | solid waste landfill |
| SWPPP | Storm Water Pollution Prevention Program |
| SWRB | storm water retention basin |
| SWU | Southern Waste Units |
| TAT | turn around time |
| TBC | to be considered |
| TCLP | toxicity characteristic leaching procedure |
| TLD | thermoluminescent dosimeter |
| TSS | total suspended solids |
| TU | temporary unit |

## LIST OF ACRONYMS

**(Continued)**

| | |
|---|---|
| UCL | upper confidence limit |
| UMTRCA | Uranium Mill Tailing Radiation Control Act |
| UST | underground storage tank |
| V/FCN | Variance/Field Change Notice |
| VITPP | Vitrification Pilot Plant |
| VOC | volatile organic compound |
| WAC | Waste Acceptance Criteria |

# EXECUTIVE SUMMARY

The Sitewide Excavation Plan (SEP) for the Fernald Environmental Management Project (FEMP), Fernald, Ohio, addresses sitewide planning for remediation of soil and at- and below-grade structures and debris at the FEMP. The SEP is identified in the Operable Unit 5 Remedial Design Work Plan (DOE 1996d) as the document that will provide the management strategy and technical guidelines necessary to govern sitewide soil remediation. A Sitewide Sequencing Plan (SSP) (Appendix B) for remediation is provided as a part of the SEP to guide the long-term planning/phasing of soil remediation and to facilitate sitewide coordination with the other activities at the FEMP. Other information included in the SEP consists of remediation drivers, goals, methods/protocols, and related requirements (e.g., health and safety, environmental controls and monitoring, recordkeeping, and data management) that will be consistently applied on each remediation project. General steps of each remediation project described in the SEP include pre-design investigation, remedial design, remedial action (including material handling and disposal), certification, and post-remediation activities. Figure E-1 provides an overview of the SEP organization.

Area-specific conditions may limit the applicability of available measurement, monitoring, and construction technologies to be used during remediation. Examples of such conditions include expected depth and extent of excavation, types and levels of contamination, and existence of above-grade structures. To accommodate the area-specific conditions, the SEP also defines representative conditions expected to be encountered throughout the FEMP and provides conceptual implementation approaches for efficiently complying with the general remedial requirements. These area-specific conditions will be addressed as work elements during the design process for each remediation project.

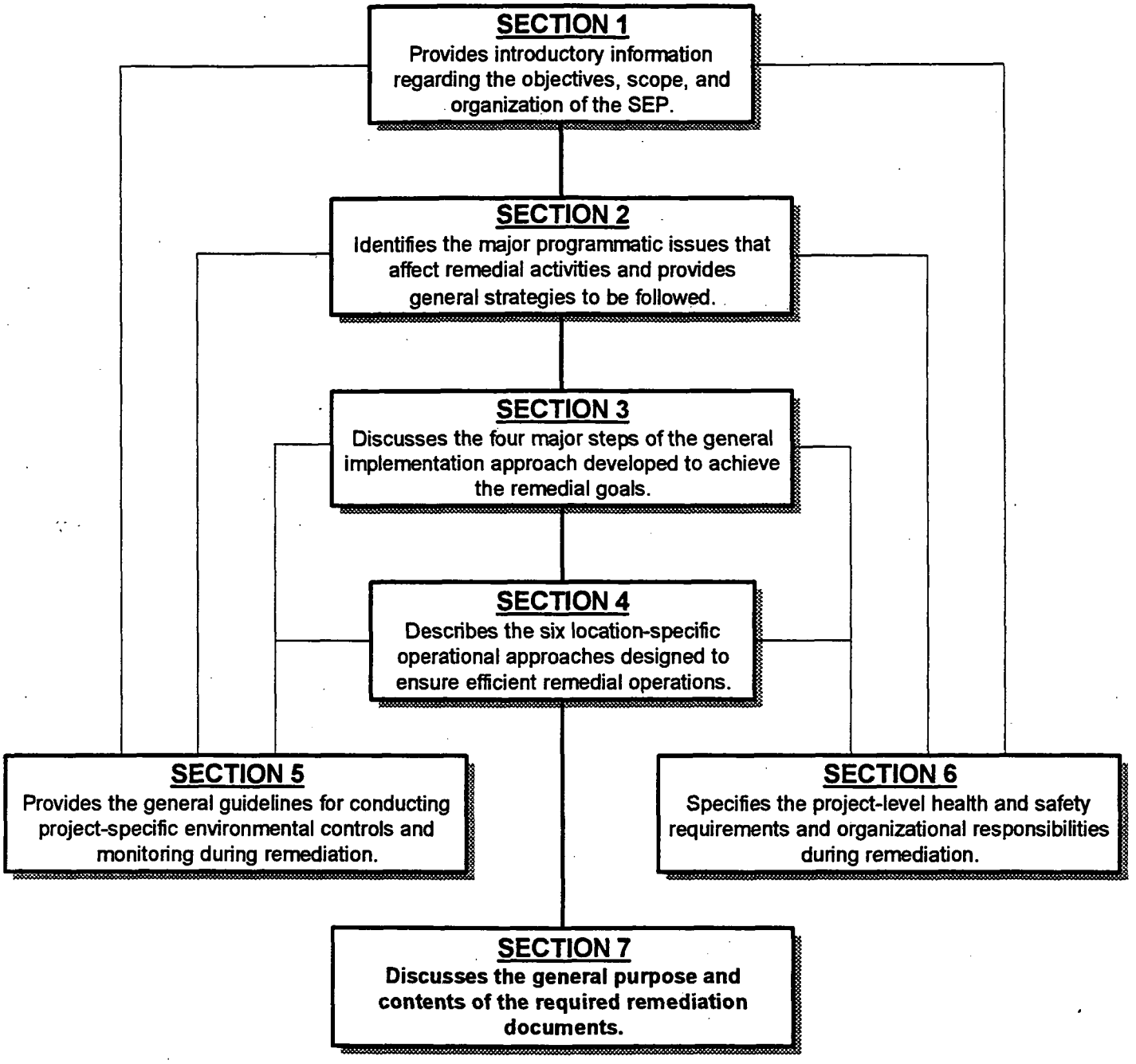
A remediation document hierarchy is also proposed in the SEP. Three area-specific remediation documents will be required for each remediation project identified in the SSP. Following approval of the SEP, an integrated remedial design package (IRDP) will be prepared for each remediation project. The IRDPs will present area-specific data and a detailed design of the area-specific remediation elements according to the SEP guidelines. Phasing of the IRDPs will also accommodate the lessons learned during previous phases of the sitewide remediation process. After completion of soil remedial actions according to an area-specific IRDP, an area-specific Certification Design Letter and a Certification Report will be prepared according to specifications provided in the SEP. The letter and the relevant

standard procedures described in the SEP will be used to guide the certification sampling and statistical analysis processes necessary to demonstrate attainment of all the applicable remedial requirements summarized in the SEP. The report will document these activities and results of the certification.

After completion of all the individual remediation projects, the sitewide final grading and restoration will be guided by the Natural Resource Restoration Plan to be submitted separately from the SEP. A Remedial Action Report will be prepared for each of the five operable units at FEMP to document all the remedial actions completed within the scope of the specific operable unit. After completion of sitewide remediation and restoration, a Site Closeout Report will be submitted to summarize all the activities conducted and the final conditions at the site.

By defining the general sitewide management strategy, major technical guidelines, representative area-specific implementation approaches, and hierarchy of all the remediation documents, the SEP will facilitate the development and review/approval of all future deliverables required during remediation. Specifically, the SEP will achieve this objective by providing accepted resolutions to any outstanding and expected global issues and by providing a template/guide for future documents and procedures.

# SITEWIDE EXCAVATION PLAN




**APPENDIX A** - Soil Remediation ARARs and TBCs
**APPENDIX B** - Sitewide Sequencing Plan
**APPENDIX C** - Constituent of Ecological Concern Selection
**APPENDIX D** - Wood Sampling Program
**APPENDIX E** - SEP Quality Assurance Project Plan (QAPP)
**APPENDIX F** - Implementation of Construction
**APPENDIX G** - Certification Design Rationale
**APPENDIX H** - Summary of Field Measurement and Laboratory Analytical Technologies
**APPENDIX I** - Sitewide Extent of Contamination by Constituent

**FIGURE ES-1 SITEWIDE EXCAVATION PLAN ORGANIZATION**

# 1.0 INTRODUCTION

This Sitewide Excavation Plan (SEP) provides technical guidance for all future activities related to the excavation and disposition of soil and at- and below-grade structures and debris at the Fernald Environmental Management Project (FEMP).

The SEP was prepared in accordance with Section XI of the 1991 Amended Consent Agreement (EPA 1991) between the U.S. Department of Energy (DOE) and the U.S. Environmental Protection Agency (EPA). It was also prepared, where feasible, using Superfund Remedial Design and Remedial Action Guidance (EPA 1986), Guidance on EPA Oversight of Remedial Designs and Remedial Actions Performed by Potentially Responsible Parties (EPA 1990a), and the Remedial Design/Remedial Action Handbook (EPA 1995). These guidance documents and agreements identify the requirements for the FEMP remedial design/remedial action (RD/RA) phase of remediation, as regulated by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (40 CFR 300).

Because of its general complexity and various area-specific conditions, soil remediation at the FEMP is a process that will require a "learn as you go" approach throughout the implementation period. Lessons learned from previous soil remediation conducted at the FEMP (i.e., Area 1, Phase I Project) that are applicable to future projects have also been incorporated in the SEP. Necessary modifications to the technical approaches and/or project schedules presented in the initial SEP will be developed with regulatory concurrence and documented in future, area-specific design packages or other appropriate official correspondences.

## 1.1 OBJECTIVES AND SCOPE

As described in greater detail in Section 1.2.2, the remediation of soil and at- and below-grade structures and debris at the FEMP will be organized into several separate projects. Remediation-related activities associated with these projects require a high degree of integration and consistency between and within the individual projects and activities. Integration and consistency improve the quality of project-specific planning and documentation, as well as ensure that project goals, procedures, and activities properly reflect sitewide issues and commitments. The SEP is the mechanism for

promoting this integration and consistency for site excavation activities. The overall objectives of the SEP are to provide guidance for:

- All planning, design, and remedial activities related to the excavation and disposition of soil and at- and below-grade debris, including the decontamination and dismantlement (D&D) of at- and below-grade structures and utilities.

- Integration of soil excavation activities of all areas of the FEMP.

The following activities must be completed for area-specific excavation projects as part of the RD/RA process:

- Pre-design investigations
- Remedial design
- Remedial action
- Pre-certification and certification
- Post-remediation activities.

The relationships among these activities are shown on Figure 1-1 and discussed in detail in Section 3.0. The SEP provides programmatic guidance for completion of these activities. This programmatic guidance also provides a model for the development of Integrated Remedial Design Packages (IRDPs), Certification Design Letters, and Certification Reports for individual excavation projects (Section 7.0). The IRDPs will provide details of project-specific activities, issues, and conditions. The Certification Design Letters will describe the process to be used on each project to demonstrate compliance with remediation goals. The Certification Reports will document attainment of these goals.

The SEP also defines the sitewide sequence of all area-specific remediation projects (Appendix B). Major sitewide and operable-unit-specific documents and reports to be developed during and after remediation are identified on Figure 1-2.

Specifically, as described in the Operable Unit 5 Remedial Design Work Plan (DOE 1996e), the SEP addresses the following:

- **Decision Criteria.** The overall logic for remediation decisions, including identifying the extent of contamination (Section 3.1.3), establishing sitewide constituent of concern (COC) screening criteria (Sections 2.1.2 and 2.1.3), determining area-specific COCs (ASCOCs) (Sections 2.1.2 and 2.1.3), addressing waste acceptance criteria (WAC) for the On-Site Disposal Facility (OSDF) (Section 2.2.1), and identifying methods for certifying attainment of Final Remediation Levels (FRLs) (Section 2.2.2).

- **Excavation of At- and Below-Grade Improvements.** Integration between Operable Unit 3 and Operable Unit 5 for excavation of at- and below-grade slabs, foundations, piping, and other structures (Sections 2.3.3 and 4.4).

- **Contingency Plan.** The strategy for implementing a contingency plan (Section 2.3.4).

- **Closeout Requirements.** The documentation, or procedures, that will be necessary during remedial action to successfully complete the goals of the selected remedy for soil (Section 2.3.7).

- **Impacted/Excavated Materials Management.** General protocol for soil segregation, stockpiling, staging, maintenance, and disposition (Section 3.3.2).

- **Sampling and Analysis Methods and Requirements.** Data quality objectives, analytical requirements, sampling methods, representative sampling, sampling rationale, and sampling frequency (Section 2.4).

- **Excavation Control.** Monitoring of excavation areas to achieve FRLs (Section 2.2.2), including protocols for perched groundwater dewatering (Section 2.5.4), slope stability (Sections 4.2.2 and 4.4.2), dust control (Section 5.1.2), and soil management and staging requirements (Section 3.3.2).

- **Site Health and Safety Matrix.** Health and Safety Protocols that remain the same for all IRDPs (Section 2.3.8).

- **Quality Assurance/Quality Control.** Outline of requirements for roles and responsibilities, standard operating procedures, document control, change notices, and sampling and analyses (Appendix E).

- **Access Controls.** Appropriate access controls to support soil remediation (Section 3.5.1.1).

- **Operation and Maintenance.** Guidelines for performing operations and maintenance for managing equipment and storage/staging areas, performing dust suppression, and implementing erosion and storm water controls (Section 5.0).

- **Excavation Monitoring.** General project-specific monitoring requirements for air, noise, and surface water to meet environmental and occupational regulatory standards (Section 5.0).

- **Regulatory Considerations.** The compliance strategy for applicable, relevant, and appropriate requirements (ARARs), site agreements, and other regulatory criteria that may affect procedures for conducting remediation (Section 1.3.1.1).

- **Baseline Grading.** The guidelines for site grading to control surface run-off after remediation, as a basis for developing final land use options, wetland mitigation, and associated institutional controls (Section 3.5.1).

- **Technology Studies.** Potential use of technology studies (Sections 1.4.2 and 2.4).

- **Measures to Minimize Impacts.** Identification of potential measures to ensure protection of threatened and endangered species, and protocol for ensuring protection of archeological and cultural finds during remediation (Section 1.3.2).

In addition, the SEP specifically addresses the following:

- Demonstration of WAC attainment (Section 2.2.1)
- Identification of characteristically hazardous waste (Section 2.1.1.3)
- Achievement and demonstration of the closure of hazardous waste management units (HWMUs) and underground storage tanks (USTs) (Sections 2.1.1.1 and 2.1.1.2, respectively)
- Achievement of as low as reasonably achievable (ALARA) considerations (Section 2.1.5.3).

It is important to note that several remediation and remediation-related activities are excluded from the scope of the SEP because the completion of these activities is the responsibility of other projects. These activities include:

- Excavation associated with nonremedial activities, such as minor maintenance-related excavation (NOTE: these activities are currently being addressed by ongoing programs.)

- Design and construction of, and placement of materials into, the OSDF

- Design, construction, and operation of groundwater restoration and wastewater treatment facilities
- Decontamination and demolition of above-grade structures and utilities
- Removal, treatment, and disposition of materials stored in the Waste Pits
- Removal, treatment, and disposition of Silos contents and above-grade structures
- Monitoring of sitewide environmental conditions during remediation
- Monitoring during post-remediation

The following subsections provide background information on remediation activities at the FEMP, the factors that are driving remediation, and a description of the remainder of the contents of the SEP.

## 1.2 BACKGROUND

The FEMP is a DOE-owned, contractor-managed facility located in southwestern Ohio. It is located north of the small community of Fernald, Ohio, northwest of Cincinnati, Ohio. Formerly known as the Feed Materials Production Center (FMPC), the facility was in operation from 1951 through 1989. The FMPC produced metallic uranium fuel elements, target cores, and other uranium products for use in weapons, production reactors, and other DOE programs.

The DOE began to focus resources on environmental issues at the site in 1986 and halted production in 1989 to fully devote available resources to environmental restoration initiatives. One of the first initiatives was the remedial investigation and feasibility study (RI/FS) process. As work progressed from the investigation/planning phases to the implementation phase, a more integrated approach to remediation activities was adopted. The following paragraphs of this subsection discuss the transition from the operable unit concept to the integrated approach.

### 1.2.1 Transition from the Operable Unit Concept

For the purposes of investigation and study, remedial issues and concerns that were similar in location, history, type/level of contamination, and inherent characteristics were grouped into operable units.

This management approach was seen as the most efficient way to gather information about the condition of the site. The site was divided into five operable units, which are defined in the Amended Consent Agreement (EPA 1991) as follows:

- Operable Unit 1: Waste Pit Area. Waste Pits 1 through 6, Clearwell, Burn Pit, berms, liners, and soil within the operable unit boundary.

- Operable Unit 2: Other Waste Units. Flyash Piles, other South Field disposal areas, Lime Sludge Ponds, Solid Waste Landfill, berms, liners, and soil within the operable unit boundary.

- Operable Unit 3: Former Production Area. Former Production Area and production-associated facilities and equipment (including all above- and below-grade improvements), including, but not limited to, all structures, equipment, utilities, drums, tanks, solid waste, waste, product, thorium, effluent lines, a portion of the K-65 transfer line, wastewater treatment facilities, fire training facilities, scrap metal piles, feedstocks, and coal pile.

- Operable Unit 4: Silos 1 through 4. Silos 1, 2, 3, and 4, berms, decant sump tank system, and soil within the operable unit boundary.

- Operable Unit 5: Environmental Media. Groundwater, surface water, soil not included in the definitions of Operable Units 1 through 4, sediment, flora, and fauna.

During the RI/FS process, human health and environmental concerns were identified and remedial alternatives were evaluated for each of these operable units. A Record of Decision (ROD) was produced for each operable unit after the RI/FS process was completed. Each ROD reviewed the results of the RI/FS documentation and identified the selected remedy. Excavation and disposition of contaminated soil and associated debris was the remedy selected for soil remediation.

As the RODs were issued, it became apparent that successful and efficient remediation of the site depended upon developing sitewide remediation plans that reintegrated the operable units. For instance:

- Remediation of most operable units (i.e., Operable Units 2, 3, and 5) at the FEMP involves the excavation of soil, at- and below-grade debris, and disposal of this material in the OSDF.

- Excavation within the OSDF footprint has to be completed and areas certified before the OSDF can be constructed.

- The sequencing of construction, building decontamination and dismantlement, and final soil and groundwater remediation must be closely coordinated among all operable units through remedial design and remedial action.

- The Operable Unit 5 scope includes excavation of all contaminated soils left after the remediation of the other operable units.

Therefore, integration with activities in other projects is essential to the successful excavation of contaminated soil and FRL certification of remaining site soil. The operable unit concept did not provide the required level of integration.

An integrated site remediation strategy was developed and discussed with the Ohio Environmental Protection Agency (OEPA) and EPA in September 1995; DOE and Fluor Daniel Fernald (FDF), the contractor selected to manage the site for DOE, then proceeded with implementation of the agency-approved integrated approach. The integrated implementation process refocused remedial activities planned under the operable unit concept into primary projects based on the selected remedy.

Organizing in recognition of "the way the work will be performed" fosters improved communication and project integration. The remediation responsibilities of each project and its relationship to the operable unit concept are shown in Table 1-1. The projects are as follows:

- Waste Pits Remedial Action Project (Operable Unit 1, for Waste Pit residue)
- OSDF Project (Operable Units 2, 3, and 5)
- Facilities Closure and Demolition Project (Operable Unit 3)
- Silos Project (Operable Unit 4)
- Aquifer Restoration Project (Operable Unit 5)
- Soil Characterization and Excavation Project (SCEP) (Operable Units 2, 3, and 5)
- Wastewater Treatment Project (Operable Unit 5).

These projects were then placed into three remedial action divisions within the FDF organization:

- Facilities Closure and Demolition Projects Division
- Soil and Water Projects Division
- Waste Management Technology and Silo Projects Division.

### 1.2.2 Integrated Implementation Approach

The Soil Characterization and Excavation Project (SCEP) is included in the Soil and Water Projects Division at the FEMP. The SCEP has responsibility for the characterization and excavation of soils including:

- Further characterization/confirmation of the nature and extent of contamination (pre-design investigation beyond RI/FS activities)
- Remedial design
- Construction
- Procurement
- Operations
- Maintenance of response activities and material stockpiles
- Excavation, segregation, and treatment of materials
- Disposition of material based on WAC and FRLs
- Treatment and disposition of characteristically hazardous wastes
- Pretreatment of remediation wastewater contaminated with listed wastes
- Certification of FRL attainment
- Demonstration of attainment of WAC
- Control and monitoring of project-specific environmental conditions
- Management of cultural resources
- Maintenance and enhancement of natural resources
- Coordination with stakeholders.

The SCEP is also responsible for producing documentation for planning and controlling these activities. The associated documentation includes:

- The SEP (this document)
- IRDPs for each remediation area and phase (Section 7.1)
- Certification Design Letters and Certification Reports (Sections 7.2 and 7.3)
- Remedial activity completion documents (Section 7.4).

Figure 1-2 shows the relationship and hierarchy of these documents.

The responsibilities of the SCEP have been categorized according to the following components, based on specific remediation activities as they relate to media:

- Soil and sediment
- Perched water
- Storm water/wastewater
- Remediation debris
- Impacted materials from Operable Unit 2 subunits.

The general strategy for remediation of each component is presented in Section 1.3.2. Table 1-2 identifies each remedy component and the operable unit(s) associated with that component, and cross-references the section of the SEP (or other relevant documentation) that discusses the component in detail.

In addition to arrangement by component, the remediation work has been organized into areas that correlate to the sequence in which work will be performed. The nine soil remediation areas are shown on Figure 1-3 and described below. In some cases, the areas will be managed in phases or even combined. This approach is discussed in greater detail in Sections 3.0 and 4.0 and in the Sitewide Sequencing Plan (Appendix B).

- **Remediation Area 1, North and East Regions of the FEMP (three phases).** This area includes the footprint of the OSDF, the North Entrance Road, the Trap Range, soil and at- and below-grade debris that will remain after D&D of the on-site portion of the old outfall line, and limited shallow excavation of the wetlands just north of the northern boundary line of Remediation Area 6. Remediation of Area 1 will be conducted in three phases. Phase I of Remediation Area 1 east and northeast of the former production area is being excavated first because it is located beneath the site of new, permanent construction for the OSDF. The IRDP for Area 1, Phase I, was submitted before the SEP, and the Certification Report is being submitted concurrently with the SEP. The Sewage Treatment Plant (STP) is included in Area 1, Phase II. Remediation of the STP involves removal of soil and at- and below-grade debris exceeding FRLs following D&D of the above-grade structure and may involve deep excavation. Potentially affected, off-property land adjacent to the STP may also be included in the STP remediation process.

- **Remediation Area 2, Southwestern Region of the FEMP (two phases).** Remediation Area 2 consists of the southern Operable Unit 2 waste units and material under these that exceed the FRLs. The waste units consist of the South Field and the Active and Inactive Flyash Piles, as well as suspect areas of contamination within Remediation Area 2 but outside the boundaries of the Inactive Flyash Pile, South Field, and Active Flyash Pile.

- **Remediation Area 3, North Portion of the Former Production Area.** Remediation Area 3 requires removal of soil and at- and below-grade debris exceeding FRLs following D&D of Operable Unit 3 above-grade structures within the northern portion of the Former Production Area. Deep excavation is expected in portions of Remediation Area 3. The Operable Unit 2 Lime Sludge Ponds (LSP) are also included in Area 3. Remediation of the LSP will involve removal of all sludges and soil exceeding FRLs. Remediation of the Fire Training Facility (FTF), which is also included in Area 3, will involve removal of soil and at- and below-grade debris exceeding FRLs, which may involve deep excavation.

- **Remediation Area 4 (A and B), Central Portion of the Former Production Area.** Remediation Area 4 (A and B) includes remediating impacted soil and at- and below-grade debris subsequent to D&D of the middle portion of the Former Production Area (Operable Unit 3).

- **Remediation Area 5, Southern Portion of the Former Production Area.** The scope of work in Remediation Area 5 includes remediating residual soil and at- and below-grade debris subsequent to D&D of the southern portion of the Former Production Area (Operable Unit 3), and potential remediation of the storm water retention basin.

- **Remediation Area 6, Waste Pits and Vicinity.** The scope of work for Remediation Area 6 consists of remediating soil and at- and below-grade debris in the vicinity of the waste pits, including rail lines, after removal of Operable Unit 1 wastes in the pits and removal of above-grade structures associated with remedial treatment facilities. The Operable Unit 2 Solid Waste Landfill (SWL) is also included in Area 6. Remediation of the SWL will involve removal of all landfill material and soil exceeding FRLs.

- **Remediation Area 7, Silos and Vicinity.** Remediation Area 7 consists of the soil and at- and below-grade debris remaining after removal of the Operable Unit 4 silos, above-grade structures associated with remedial treatment facilities, and the Advanced Wastewater Treatment (AWWT) facility, and miscellaneous corridors.

- **Remediation Area 8, West Bank of Paddys Run.** The west side of Paddys Run (including Paddys Run sediment) has been separated from other FEMP remediation areas to emphasize the fact that contamination has not been detected and there is no process knowledge indicating the potential for contamination. Although this area must be certified, only a minimal amount of spot excavation is expected.

- **Remediation Area 9, Off-Property Areas.** Off-property areas that may require remediation include the following:

  - Potentially impacted land adjacent to the northeast corner of the site
  - Land adjacent to the eastern fenceline north of the Sewage Treatment Plant

- Abandoned outfall line
- Abandoned outfall structure
- Great Miami River sediment.

## 1.3 FACTORS DRIVING REMEDIATION

Three primary factors are driving remediation at the FEMP and dictating its direction:

- Regulatory drivers
- The selected remedies identified in the RODs for each operable unit
- The plans for the final land use, which will be described in the Natural Resource Restoration Plan (NRRP) (Section 1.4.2).

The following paragraphs of this subsection summarize the issues associated with each of these factors that affect remediation.

### 1.3.1 Regulatory Drivers

Several regulatory criteria and legal obligations provide the basis for remediation activities at the FEMP. These include:

- ARARs and To Be Considered Criteria (TBCs)
- Permits
- Agreements
- Natural Resources Trusteeship.

The following paragraphs summarize the requirements of each of these.

#### 1.3.1.1 Applicable or Relevant and Appropriate Requirements and To Be Considered Criteria

The ARARs and TBCs in the Operable Units 2 and 5 RODs will be used as the basis for conducting soil remediation within Operable Unit 5 and beneath Operable Units 1, 2, 3, and 4. Excavation of at- and below-grade structures and debris will be conducted in accordance with the Operable Unit 3 ROD. The subset of soil remediation ARARs and TBCs pertinent to the scope of the SCEP remedial design deliverables indicates where compliance would be addressed by the remedial action.

These ARARs and TBCs pertinent to the excavation of soil and at- and below-grade debris are included in Appendix A. Area-specific IRDPs (Section 7.1) will identify the subset of ARARs and TBCs that are pertinent to each remediation area. Implementation of soil remediation will comply with these ARARs. Procedures for addressing the more significant ARARs and TBCs are provided in Section 2.1.

#### 1.3.1.2 Permits

The remedial actions to be performed at the FEMP are regulated under CERCLA. Section 121(e)(1) of CERCLA states that no federal, state, or local permit shall be required for the portion of any removal or remedial response action conducted entirely on site, where such response action is selected and carried out in compliance with Section 121. Although on-site response action is exempted from complying with the administrative requirements associated with a permit (e.g., administrative reviews, reporting and record keeping requirements, etc.), such action is not exempt from complying with the substantive requirements that would have been imposed by each permit.

To determine whether a permit is required for a remedial action, an evaluation must be made as to whether the action is "conducted entirely on site," as stated in Section 121(e)(1) of CERCLA. Discussions with the EPA and the OEPA have established a consensual strategy for permitting activities at the FEMP (Craig 1995). This consensual strategy determined that air releases, fill/dredging of wetlands, and excavation of soil and associated debris and associated management (through either disposal in the OSDF or transportation for off-site disposal), would be considered "on-site activities" and would not be subject to the administrative requirements of a permit. It was further decided that wastewater and storm water discharges to the Great Miami River and Paddys Run would be considered "off-site activities" and therefore subject to both the administrative and substantive requirements of the National Pollutant Discharge Elimination System (NPDES) Permit for the FEMP.

The Amended Consent Agreement (EPA 1991) for the FEMP requires that the compliance strategy for addressing the substantive requirements of permits which would otherwise be required, as well as other ARARs, be initiated at the start of remedial action. The Amended Consent Agreement requires the following specific information:

- Identification of each permit that would have been required in the absence of the CERCLA 121(e)(1) permitting exemption

- Identification of the standards, requirements, criteria, or limitations that would normally have to be met to obtain the permits

- Explanation of how the remedial action will meet the substantive requirements, criteria, or limitations identified above.

The Amended Consent Agreement further states that a permitting plan containing the above items should be submitted as a design deliverable. However, to address these requirements, DOE provided a letter to EPA and OEPA on June 12, 1995, which outlined the FEMP's strategy for compliance with substantive permit-related regulatory requirements for remedial actions at the site (Craig 1995). EPA and OEPA concurred with the strategy DOE outlined in the letter and agreed to the development of a compliance cross-reference (including substantive permitting requirements) as a substitute for a formal permitting plan (Craig 1995). These compliance cross-references are to be supplied with the remedial design submittals. Approval of the design documents by EPA and OEPA will constitute approval that the compliance strategy meets the intentions of the Amended Consent Agreement and fulfills the FEMP's obligation to address ARARs and TBCs in the remedial design process.

#### 1.3.1.3 Agreements

In addition to the pertinent ARARs and TBCs, there are other legal agreements between DOE, EPA, and OEPA. These agreements, as discussed below, introduce additional requirements for soil remediation.

The Consent Agreement for the FEMP was originally signed in 1990 (EPA 1990b) and was amended in 1991 (EPA 1991). In addition to defining the schedule and documentation for remedial design and remedial action, the consent agreement also requires that a five-year review process be initiated, in accordance with Section 121 of CERCLA. The first five-year review will be conducted a maximum of five years from the initiation of remedial action. Subsequent reviews by EPA will occur in at least five-year increments to ensure that human health and the environment are being protected by the remedial actions being implemented.

The Amended Consent Agreement requires that certain project plans be included in the remedial design or remedial action work plan. Table 1-3 outlines these requirements and identifies where the requested information will be documented.

On June 4, 1996, OEPA, DOE, and FDF, formerly Fernald Environmental Restoration Management Corporation (FERMCO), agreed to an OEPA Director's Findings and Orders (DF&O) regarding Resource Conservation and Recovery Act (RCRA)/CERCLA Integrated Closure (OEPA 1996). This agreement covered requirements for closure of HWMUs at the FEMP. The DF&O allows closure to be deferred until CERCLA remediation for HWMUs, including those with soil contamination and those which cannot be reasonably closed independent of the D&D process. The DF&O also allows RCRA closure performance standards for these HWMUs to be addressed as part of CERCLA remediation and CERCLA documentation. Section 2.2.4 of the SEP discusses this provision in greater detail.

#### 1.3.1.4 Natural Resources Trusteeship

Two mechanisms drive protection of natural resources during remediation. These include the Natural Resource Trusteeship process and the compliance with pertinent federal and state regulations. Both of these mechanisms will be incorporated into Operable Unit 5 soil remediation planning and implementation.

CERCLA, Executive Order 12580, and the National Contingency Plan collectively require certain federal and state officials to act on behalf of the public as trustees for natural resources. The Natural Resource Trustees for the Fernald site are the Secretary of the DOE; the Secretary of the U.S. Department of the Interior; and officials of OEPA, appointed by the governor of Ohio.

The trustees act as guardians for public natural resources at or near the Fernald site. The trustees are responsible for determining whether natural resources have been injured as a result of a release of a hazardous substance or oil from the site and, if so, how to restore, replace, or acquire the equivalent natural resources to compensate for the injury. DOE is responsible for costs related to natural resource injury, in addition to costs associated with remediation of the site. The Fernald Natural Resource Trustees are responsible for resolving the FEMP's compensatory restoration requirements on behalf of the public.

The Fernald Site Natural Resource Trustees Council has been meeting since June 1994 to evaluate and determine the feasibility of integrating the Trustees' concerns with future remedial design activities. The trustees have identified their desire to fulfill their obligations by integrating their concerns with remedial design and restoration activities.

Aspects of natural resource management and monitoring are mandated through the incorporation of National Environmental Policy Act (NEPA) values into remedial action planning. In June 1994, a revised secretarial policy on NEPA compliance was issued by DOE. This policy called for the integration of NEPA values into the CERCLA decision-making process. Therefore, values such as the protection of threatened and endangered species and cultural resources are to be considered throughout remedial activities to be consistent with the Operable Unit 5 ARARs; the Amended Consent Agreement; and agreements made with EPA, OEPA, and Natural Resource Trustees.

### 1.3.2 Components of the Sitewide Selected Remedy

Project implementation under the SCEP will be conducted through specific remediation activities as they relate to affected media (soil and sediment, debris, waste, perched groundwater, storm water, and wastewater). Measures will be taken to minimize environmental impacts of remediation for each medium. This section summarizes the 11 components of the selected remedy for soil and debris, as presented in the RODs for Operable Units 1, 2, 3, 4, and 5. Implementation will be focused to meet the FRLs specified in the Operable Unit 2 and 5 RODs for soil, and for excavation of debris for the Operable Unit 3 ROD (Section 2.3.3). In addition, soil FRLs within Operable Unit 1 will be applied when they are more stringent. Table 1-2 identifies each remedy component and the operable unit(s) associated with each component, and cross-references the section of the SEP (or other relevant documentation) that discusses the component.

1.3.2.1 Soil and Sediment

Soil and sediment exceeding WAC for the OSDF, including material that is characteristically hazardous (40 CFR 261) from the seven areas described in Section 1.3.2.6, will be excavated and dispositioned in one of the following methods: 1) transported to an off-site disposal facility for treatment, as required to meet WAC for the off-site facility, and disposal; 2) treated on site, as required to meet WAC for the off-site facility, and transported off site for disposal; or 3) treated on site for organic and/or inorganic contaminants, as required to meet the WAC for the OSDF, and dispositioned in the OSDF. As stated in the Operable Unit 5 ROD, on-site treatment/disposal of soil that exceeds radiological WAC for the OSDF will not be considered. Off-site disposal will be conducted in accordance with the terms of the Amended Consent Agreement (EPA 1991) and EPA's Off-Site Rule.

Following removal of known material exceeding the WAC for the OSDF, soil and sediment exceeding FRLs will be excavated and placed directly in the OSDF. Table 1-4 presents the WAC for the OSDF and FRLs for soil and sediment at the FEMP. Figure 1-4 provides a planning-level estimate of the projected footprint of soil, perched water, and sediment requiring excavation as part of the remedy for Operable Unit 5. Details regarding the procedures for completing WAC- and FRL-driven excavation activities are included in Sections 3.0 and 4.0.

Appropriate mitigative measures will be used during excavation activities to minimize the resuspension of dust particles (Section 5.0). Worker health and safety monitoring will be provided during excavation activities as part of the health and safety program described in Section 2.3.8.

Some facilities at the FEMP, including the AWWT facility, service roads, and other long-term RA facilities (e.g., silos and groundwater restoration facilities), will not be decommissioned before the OSDF is closed. The possible remediation of soil beneath these facilities will, if necessary, be included in an IRDP that addresses long-term remedial actions.

1.3.2.2 Perched Water

Perched water zones in the Former Production Area and the STP that present an unacceptable threat to the underlying aquifer will be extracted and/or excavated with contaminated soil. An unacceptable threat is defined as one having a cross-media impact to the underlying Great Miami Aquifer that would

produce concentrations of contaminants in groundwater exceeding the FRL. In this area, perched water will be removed both during the necessary dewatering operation for deep excavation as well as during excavation of contaminated soil. In general, extracted, perched groundwater from the Former Production Area will require treatment at the AWWT facility before it can be discharged. Perched groundwater that contains significant levels of organic contamination or listed hazardous wastes has potentially come in contact with may require pretreatment prior to discharge to the AWWT facility.

Perched water zones requiring excavation as part of the selected remedy are included in Figure 1-4, which also delineates the projected footprint of excavations for Operable Unit 5 soil and sediment. Updates will be included in future, area-specific IRDPs (Section 7.1). Additional details regarding perched water are provided in Sections 2.5.4, 3.0 and 4.0.

Outside of the former production area, perched groundwater that is collected during dewatering operations associated with soil excavation that has potentially come in contact with listed hazardous waste at HWMUs (i.e., the STP Sludge Drying Beds and the FTF) may also receive pretreatment prior to discharge to the AWWT facility. The AWWT facility's capacity must be considered in designing such dewatering operations. Such consideration and pretreatment requirements will be identified in the respective IRDP.

#### 1.3.2.3 Storm Water/Wastewater

The FEMP maintains a storm water collection system that includes conveyance systems and retention basins. This system is designed for a 10-year, 24-hour storm event. This system can prevent most storm water from entering the Storm Sewer Outfall Ditch (SSOD) and Paddys Run. As remediation of the site progresses, the storm water collection system will be decommissioned in stages to ensure continued storm water collection from the portions of the site not yet remediated. Run-on and run-off controls are addressed in the SEP (Section 5 and Appendix F), and storm water phasing is included with the Sitewide Sequencing Plan (Appendix B). Storm water and wastewater management is part of Operable Unit 5.

Sanitary and process wastewater continue to be generated at the FEMP because of the occupancy of the site by the work force and ongoing cleanup initiatives, such as building decontamination. Additionally,

process wastewater is expected to be generated as a consequence of the implementation of remedial actions for all operable units. The FEMP will continue to collect and direct this wastewater for treatment, as necessary, as part of the selected remedy.

In some deeper excavations, dewatering activities may be required. This water will be treated, as necessary, through the AWWT facility prior to discharge.

1.3.2.4 Remediation Debris

Debris is expected to be generated throughout remediation by the Facilities D&D Project (above-grade) and SCEP (at- and below-grade). Initial planning has identified that debris will be generated from D&D of the STP, FTF, structures in the Former Production Area, Operable Unit 5 groundwater extraction system, service roads, and AWWT facility. The Operable Unit 3 ROD has identified specific debris from the Former Production Area that is designated for off-site disposal. This includes acid brick, because of elevated concentrations of several RCRA constituents, and several areas of surface concrete containing elevated levels of technetium-99. At- and below-grade excavation, management, and disposal of at- and below-grade debris from the site are addressed in Sections 3.0 and 4.0.

1.3.2.5 Waste from Operable Unit 2 Subunits

The Operable Unit 2 subunits (SWL, LSP, Inactive Flyash Pile, South Field, and Active Flyash Pile) will be remediated as described in the "Remedial Design Work Plan for Remedial Actions at Operable Unit 2" (DOE 1995e). Sampling and analysis will be performed in the excavated area to confirm that material with concentrations above the FRLs has been removed (Table 1-4). If the results of the certification sampling and analysis indicate that contamination above FRLs remains, then additional excavation will be performed. All waste material that meets the on-site WAC will then be transported to the OSDF for final disposition. Material exceeding the on-site WAC will be transported off site for disposal. Excavation, management, and disposal of these wastes are addressed in Section 3.0 and 4.0.

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1.3.2.6 Corrective Action Management Unit Rule

The Corrective Action Management Units (CAMUs) and Temporary Units (TUs) Final Rule (58 CFR 865829) was promulgated to meet the objectives of a cleanup program under RCRA, as amended. Management of remediation (and investigation) waste within a CAMU is not subject to the strict land disposal restrictions (LDRs) and minimum technology requirements (MTRs) contained in Subtitle C of RCRA.

The Operable Unit 2, 3, and 5 RODs acknowledged that EPA's CAMU rule is an ARAR for the FEMP's on-property disposal remedy that provides the regulatory framework for determining the treatment and on-property disposal requirements for RCRA-regulated constituents in the materials destined for disposal. Among other items, the CAMU rule provides needed relief for on-property disposal from strict RCRA Subtitle C disposal requirements, including LDRs and MTRs. The CAMU rule permits the on-property disposal of both RCRA listed and characteristic waste provided a protective, implementable remedy is identified through the following three decision steps, cited in Section 264.552 of the CAMU rule.

1. The remedy must be protective of human health and the environment.
2. The remedy must minimize the potential for future release.
3. The remedy must enhance long-term effectiveness through the application, as appropriate, of treatment technologies that reduce toxicity, mobility or volume of wastes that will remain in place following closure of the CAMU.

1.3.2.7 RCRA Characteristic Waste Disposal

Based on a review of the FEMP's site characterization data and historical process knowledge, DOE, EPA, and OEPA collectively agreed that several of the FEMP's RCRA toxicity-characteristic waste streams offer a reasonable site-specific potential to provide additional cost-effective treatment prior to on-property disposal. The following geographic areas and waste streams were designated in the FEMP's RODs as exhibiting the potential for sufficient quantities of RCRA toxicity characteristic material to offer reasonable opportunities to apply cost-effective levels of treatment before disposal in the OSDF (or alternatively, disposal off site):

- The estimated 300 cubic yards of lead-contaminated soil located at the FEMP's firing range (Figure 1-5). (Under the terms of the Operable Unit 2 ROD, this material is designated for off-site disposal.)

- RCRA characteristic soil from six geographic areas within Operable Unit 5 (Figure 1-5): the abandoned sump west of the pilot plant; the area between the KC-2 warehouse and railroad tracks; the FEMP's trap range; the fill material west of the silos along Paddys Run stream bank; the scrap metal pile area; and the area north of the maintenance building.

- Operable Unit 3 lead sheeting (formed as flashing, window sills, and door moldings) and acid brick. In accordance with the Operable Unit 3 ROD, the acid brick will be sent off site for disposal because of technetium-99 limitations.

As stated in the Operable Unit 5 ROD, DOE, EPA, and OEPA agree that sufficient existing data and historical process knowledge are available to identify the boundaries of the above geographic areas as those that represent a reasonable opportunity for cost-effective soil treatment. Outside of these geographic areas, DOE, EPA, and OEPA all concur that there is no reasonable basis to conclude that an increased potential for the presence of RCRA characteristic waste exists that would provide additional opportunity for cost-effective soil treatment. Therefore, outside the boundaries of the designated geographic areas, no additional analytical data will be required to screen for the presence of characteristic waste before placement in the OSDF. Only the site-specific WAC developed for the OSDF, as listed in Table 1-4, will be applied to excavated soil outside the six areas identified int he Operable Unit 5. The EPA's toxicity characteristic leaching procedure (TCLP) was stated in the Operable Unit 5 ROD as the mechanism to guide the identification of soil requiring treatment within the boundaries of the designated geographic areas.

The decision to send the firing range's lead-contaminated soil off site for disposal was an element of the Operable Unit 2 ROD, which proceeded the Operable Unit 5 remedy decision by approximately seven months. The off-site disposal decision was based solely on the relatively small volume of material under consideration, and the fact that the final decision regarding the fate of the similarly contaminated, but potentially larger volume, Operable Unit 5 RCRA characteristic materials was not yet available. This allowed the Operable Unit 2 ROD to be finalized without delaying any material decisions pending the outcome of a later decision from a subsequent operable unit. With EPA and OEPA concurrence, DOE is planning to preserve the option to treat and dispose of the estimated 300 cubic yards of soil

from the firing range in a manner identical to the RCRA characteristic soil from the six geographic areas ultimately specified in the Operable Unit 5 ROD. This will bring into alignment all portions of the FEMP's remedy for similarly contaminated soil and will facilitate the selection and sizing of treatment systems during detailed design.

Viable technologies for treating the FEMP's RCRA characteristic soil were specified in the Operable Unit 5 ROD. The technologies cited include EPA-approved stabilization technologies (for inorganic constituents) and low temperature thermal desorption techniques (for organic constituents). Stabilization technologies are also contemplated for treatment of the Operable Unit 3 RCRA characteristic waste streams prior to their disposal. The decision to treat the FEMP's RCRA characteristic materials on site (and dispose of them in the OSDF) versus sending them off site for treatment and disposal will be a case-by-case, cost/benefit decision that will be made as part of the detailed remedial design processes for both soil and debris. These decisions will be communicated in the IRDPs for soil and the D&D Implementation Plans for debris.

The FEMP is committed to identifying, segregating, and treating, as needed, the contaminated soil from within the seven designated geographic areas (i.e., Operable Unit 2 and 5 areas in Figure 1-5) that exhibits the RCRA characteristic, as well as the lead sheeting and acid brick from the Operable Unit 3 D&D waste stream. This commitment satisfies the requirements of the Operable Unit 2, 3, and 5 RODs regarding the disposal of RCRA characteristic waste in the OSDF.

Figure 1-6 summarizes the treatment and disposition requirements for RCRA characteristic waste to be identified and segregated from the seven geographic areas at the FEMP. Decisions regarding on-site versus off-site treatment of the characteristic waste from these areas will be made during the area-specific design process considering availability of on-site treatment facility and results of cost-benefit evaluations. When treatment of the characteristic waste for on-site disposal is the preferred remedial option, the Temporary Unit (TU) concept will be used to facilitate the construction/permitting process of the on-site treatment facility. The characterization, treatment, and disposition of soil from these seven areas are described in greater detail in Section 2.1.1.3.

1.3.2.8 Measures to Minimize Environmental Impacts

DOE has factored environmental impacts into the plans for excavation. Measures to minimize environmental impacts to on-property natural resources (e.g., wildlife and wildlife habitat, wetlands, floodplains, surface water, groundwater) have been identified in the final Operable Unit 5 Feasibility Study Report and Proposed Plan (DOE 1996a, 1995c). Impacts to on-property vegetation and wildlife habitat will result from the removal and movement of contaminated soil and sediment and from construction of support facilities. Measures taken to minimize impact are discussed in Sections 3.0 and 5.0 but will ultimately be decided on a project- and/or area-specific basis and addressed in the IRDPs.

1.3.2.9 Sitewide Environmental Monitoring

Sitewide environmental monitoring of air, soil, water, and noise will be part of the selected remedy. Monitoring will be designed to detect and quantify releases from the site attributable to the implementation of all the remedial actions at the FEMP and will include monitoring of the air, surface water, and groundwater pathways. Monitoring devices that provide real-time or near real-time data will be evaluated and applied, if practical. Monitoring will also be conducted following the completion of remedial actions to assess the continued performance of the remedy. Sitewide environmental monitoring activities are addressed through the Integrated Environmental Monitoring Program (IEMP) (Section 1.4.2) and will be implemented by a sitewide monitoring program. The current draft final IEMP specifies the monitoring strategy for the next two years (DOE 1997a). Project-specific monitoring activities which will be conducted by SCEP are discussed in greater detail in Section 5.0.

1.3.2.10 Institutional Controls/Monitoring

One element of the selected remedy that will be used to ensure protectiveness of human health and the environment is institutional controls. Institutional controls were identified as requirements in each of the operable unit RODs. Institutional controls include continued access controls at the site during the remediation period, continued federal ownership of the OSDF and necessary buffer zones, and deed restrictions to preclude residential and agricultural uses of the remaining regions of the FEMP property. Additionally, proper notifications, as mandated by CERCLA, will be provided before the transfer of any federal property that is known to contain or has been used in the processing of hazardous substances. These measures will minimize the potential for human exposure to soil and groundwater contamination. These measures will also minimize exposure to the contaminated material

contained in the OSDF following completion of remedial activities at the site (DOE 1997b). Specific institutional control measures to be implemented at the site will be established in the Natural Resources Restoration Plan (NRRP) (Section 1.4.2).

1.3.2.11 Community Involvement

The DOE and EPA are committed to continuing the active community involvement program at the FEMP throughout the duration of remedial activities and post-remediation monitoring at the site. This program will include public meetings, public comment periods (as needed), newsletters, tours, and small focused group sessions assessing specific cleanup issues.

The Community Relations Plan (CRP) for DOE-Fernald (DOE 1995a) was revised in September/ October 1994. The revised CRP was approved by Ohio EPA in December 1994 and by the U.S. EPA in January 1995. The CRP complies with the public participation requirements of all applicable laws and regulations, including CERCLA, Federal Facility Compliance Act (FFCA), NEPA, and the National Contingency Plan (NCP), and also reflects EPA guidance in Community Relations in Superfund: A Handbook (EPA 1992b). Throughout the duration of FEMP remediation activities, the CRP may be revised to reflect changing community concerns, as well as changes in the law, regulations, or regulatory agreements.

The CRP describes how management will involve the public in decisions related to the site during the remedial action phase of CERCLA response action at the FEMP. Required activities are as follows:

Required Public Involvement Activities During Remedial Design

Upon completion of the final engineering design, prepare a fact sheet describing the remedial design (NCP 300.435).

Required Public Involvement Activities During Remedial Action

- Provide a public briefing upon completion of the final engineering design and prior to the beginning of the remedial action (NCP 300.435).
- Publish in a local newspaper of general distribution a Notice of Availability of documents submitted to the EPA under the remedial action (DOE commitment/directive).

The DOE has surpassed regulatory requirements in offering public involvement opportunities at the FEMP and will continue to do so throughout the remedial action phase of site cleanup.

### 1.3.3 Final Land Use

As stated in Section 1.3.2, the NRRP identifies the natural resource restoration strategy for the site and, when finalized, will serve as the final land use plan. The current commitment for the final land use is an undeveloped park. Therefore, it is not expected that extensive backfilling or regrading will be required following remediation activities. Some small, localized areas where deep excavation is necessary will be backfilled and regraded to provide proper drainage or support to permanent facilities such as the OSDF. The current direction is that larger areas where deep excavation is necessary will remain as ponds (i.e., in the former production area) or as a bench along Paddys Run (i.e., in the Silo, Waste Pit, and South Field Areas). In addition, vegetation will be established on the remaining earthen areas of the site.

## 1.4 ORGANIZATION OF THE SITEWIDE EXCAVATION PLAN

This subsection describes the remaining contents of the SEP and other documents related to the SEP.

### 1.4.1 Contents of the Sitewide Excavation Plan

The remainder of the SEP consists of the following sections:

- **Section 2.0, Remediation Issues and General Strategies,** which presents the major programmatic issues that affect remediation activities and discusses the general approaches to address them.

- **Section 3.0, General Implementation Approach,** which discusses the steps for implementing remediation and describes how the issues in Section 2.0 will be systematically addressed.

- **Section 4.0, Location-Specific Approaches,** which describes the location-specific guidelines for efficiently addressing excavation, WAC attainment, and certification requirements.

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- **Section 5.0, Environmental Controls and Monitoring,** which discusses the management strategy for implementing project-specific procedures to control and monitor environmental conditions during remediation of impacted soils.

- **Section 6.0, Project Health and Safety,** which discusses the health and safety requirements and procedures to meet these requirements on remediation projects.

- **Section 7.0, Soil Remediation Documents,** which discusses the general purpose and content of the IRDPs, Certification Design Letter, and Certification Report. Three other related documents (Remedial Action Report, Natural Resources Restoration Plan, and Site Closeout Report) required to complete the sitewide soil remediation and restoration are also described.

Information to further support the sections of the SEP is included in appendices at the end of the document. The following appendices are included:

- **Appendix A, Soil Remediation ARARs and TBCs.** The applicable regulatory requirements to excavation, both ARARs and TBCs, are presented in this appendix in table form, with a crosswalk provided to the sections of the SEP where the requirements are met.

- **Appendix B, Sitewide Sequencing Plan.** This appendix presents the sequence of remediation activities for the excavation of major areas of the FEMP.

- **Appendix C, Constituent of Ecological Concern Selection.** This appendix evaluates the results of the evaluation of ecological impacts presented in the Operable Unit 5 RI. It identifies the COCs that may have an adverse impact on ecological receptors if they are not monitored by screening against Benchmark Toxicity Values (BTVs). In addition, the appendix evaluates potential constituents of ecological concern (COECs) for source areas not considered in the Operable Unit 5 RI.

- **Appendix D, Wood Sampling Program.** This appendix presents the results of the on-site tree tissue sampling program to support plans to manage plant material.

- **Appendix E, SEP Quality Assurance Program Criteria.** This appendix discusses those elements of the FEMP Quality Assurance Plan which are applicable to implementation of the SEP and contains additional criteria needed to ensure that remediation subcontractors perform excavation activities properly.

- **Appendix F, Implementation of Construction.** This appendix presents the details of activities that will take place as part of the actual implementation of remediation activities.

- **Appendix G, Certification Design Rationale.** This appendix presents the statistical background for determining the number of samples required in each certification unit to demonstrate compliance with FRLs.

- **Appendix H, Summary of Field Measurement and Laboratory Analytical Technologies.** This appendix presents information of available and commonly used field measurement and laboratory technologies to support selection decisions for specific applications at the FEMP during soil remediation.

- **Appendix I, Sitewide Extent of Contamination by Constituent.** This appendix includes maps which provide the basis of area-specific constituents of concern (ASCOCs) (Section 2.1.3.3).

### 1.4.2 Related Documents

The SEP is intended to provide overall guidance for excavation activities and will be applied throughout the remediation process. The SEP documents an approach to sitewide excavation to be agreed upon by DOE and the regulatory agencies. Once the final version is approved by the regulatory agencies, it will not be revised, although revisions and variances due to site-specific conditions will be addressed in the IRDPs. There are, however, other documents related to the SEP that are reference documents for its preparation, have already been submitted, are being submitted concurrently with it, or will be submitted at a later date. These documents and their relationship to the SEP are as follows:

Existing or In Preparation

- **Impacted Material Placement Plan (IMPP) (DOE 1996b).** Describes the impacted materials acceptance, placement, compaction, and quality assurance/quality control activities associated with construction, placing, and closure of the OSDF.

- **Remedial Action Work Plan (the IRDP) for Area 1, Phase I (DOE 1996g).** Details the implementation plan for remediation in the northernmost area of the OSDF. This document was submitted in December 1996, prior to completion of the SEP, to allow construction of the OSDF to proceed on schedule. Therefore, many of the concepts and procedures contained in it are repeated in the SEP.

- **Certification Report for Area 1, Phase I.** Demonstrates that FRLs in Area 1, Phase I, have been attained. This document is being submitted concurrently with the SEP.

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- **Storm Water Pollution Prevention Plan (DOE 1996f).** Identifies potential sources of storm water pollution and describes the practices that will be employed to control these, including engineering, construction, and inspection procedures (Section 5.0). NPDES permit requirements are also addressed. This plan was submitted in May 1996.

- **Integrated Environmental Monitoring Program (DOE 1997a).** Provides the central mechanism for ongoing groundwater, surface water, and air monitoring and reporting activities at the FEMP.

- **Aquifer Restoration and Wastewater Treatment Project Operation and Maintenance Plan.** Will specify the capacity (hydraulic, chemical, and biological) of the AWWT, prioritize streams for treatment (including remediation-related streams), and provide waste acceptance criteria for those streams. This plan is scheduled for submittal to EPA in July 1997.

- **WAC Attainment Plan (WAP).** Will provide the sitewide strategy and detail regarding material-type-specific requirements for demonstrating attainment of WAC for the OSDF in one centralized document. For soil and at- and below-grade structure and debris, the WAP will summarizes the WAC attainment approaches already described in Sections 2, 3, and 4 of the SEP. This plan is scheduled for submittal to EPA in late 1997.

- **Site Preparation Package for Area 2, Phase II.** Details site preparation activities to be completed in Area 2, Phase II, and is being submitted concurrently with the SEP.

- **Technology Reports.** Four separate project reports--describing the potential application of physical separation to reduce soil volumes, vacuum extrusion/compaction of soil, phosphate soil stabilization, and geochemical barrier placement amendment, and recommending their application during remediation--were submitted to EPA and OEPA on May 24, 1996. Additional technology reports, including the Comparability Study and Applicability Study and the RTRAK Applicability Study, demonstrating the capabilities of high-purity germanium (HPGe) and RTRAK technologies (which is being submitted concurrently with the SEP), respectively, will be prepared and submitted, as required. During remediation, the need of additional technology reports to support area-specific and/or sitewide treatment and disposition decisions may be identified.

<u>To Be Prepared for Each Remediation Area (see Figure 1-1)</u>

- **Integrated Remedial Design Packages (IRDPs).** Will be prepared for each individual remediation area. Each of these packages will provide area-specific information that can't be fully addressed in the SEP, identify changes from the SEP, and/or provide detail not included in the SEP. The IRDP will present important results of all the pre-design investigation, including the estimated extents of excavation and certification information necessary for

borrow material to be used during the construction. Each IRDP will include an area-specific implementation plan, design drawings, and specifications. The content of the IRDPs is discussed in greater detail in Section 7.1.

- **Certification Design Letters.** Subsequent to completion of remediation and pre-certification survey activities (Section 3) in each area, in accordance with the IRDP, a Certification Design Letter will be issued. This letter will detail the certification survey design, including certification unit boundaries, number of samples to be collected and analyzed, and the analyses to be performed on each sample. This letter will become part of the complete Certification Report (Section 7.2).

- **Certification Reports.** Following completion of certification activities in each area, a Certification Report will be issued (Section 7.3). This report will incorporate the Certification Design Letter and demonstrate FRL attainment. In addition, the report will detail, as applicable, closure of HWMUs and USTs. The Certification Report will also include a section summarizing the procedures followed for WAC attainment. Information will be provided to demonstrate that all material exceeding the WAC for the OSDF in each area has been removed, staged for shipment to an off-site disposal facility, or disposed of in an off-site facility, rather than placed in the OSDF. This section will be prepared in accordance with the requirements specified in the WAC Attainment Plan.

Operable-Unit-Specific Documents To Be Prepared (see Figure 1-2)

- **Remedial Action Reports (RARs).** A Remedial Action Report will be prepared for each operable unit after the operable unit specific remedy is completed. The report will summarize all the remedial actions conducted for the operable unit and describe the residual conditions, using information generated and submitted during the remediation.

Sitewide Documents To Be Prepared (see Figure 1-2)

- **The Natural Resource Restoration Plan (NRRP).** The NRRP documents the natural resource restoration strategy to be employed at the site and describes the institutional controls that will be necessary to implement restoration goals under the site's selected remedy. The final revision of this document will also serve as the final land use plan for the site. This plan also summarizes the anticipated final contours for the FEMP, generally based on future land use as an undeveloped park.

- **Site Closeout Report (SCR).** A Site Closeout Report will be prepared for the site after all the operable-unit-specific remedies are completed. The report will summarize all the remedial actions conducted for the FEMP and will describe the residual conditions, using information provided in the individual Remedial Action Reports.

## 1.5 SCHEDULE FOR AGENCY SUBMITTALS

As originally discussed in the Operable Unit 5 Remedial Design Work Plan (DOE 1996e), the schedule shown in Table 1-5 has been established for formal submittal of documents. This schedule reflects the planned sequencing of remediation areas described in the Appendix B. The schedule of other area-specific documents listed above will be detailed in the future IRDPs considering area-specific remediation schedules.

## TABLE 1-1

## FEMP OPERABLE UNIT REMEDIES AND ASSOCIATED PROJECT RESPONSIBILITIES [a]

| OU Description | Remedy Overview [b] | Project Organization/Responsibilities | Planning Documents |
|---|---|---|---|
| Operable Unit 1<br><br>· Waste pits 1 - 6<br><br>· Clearwell<br><br>· Burn pit<br><br>· Berms, liners, caps and soil within the operable unit boundary | ROD Approved: March 1995<br><br>· Excavation of materials within the waste pits, caps, liners, and surrounding contaminated soils; off-site transportation for disposal at the permitted commercial disposal facility, or disposal at NTS if the waste fails to meet the PCDF WAC; the disposition of contaminated soils; and the D&D of the remediation facility<br><br>· Waste processing and treatment by thermal drying (as necessary)<br><br>· Off-site disposal of waste materials at a permitted facility<br><br>· Restoration | Primary Project:<br><br>Waste Pits Remedial Action Project responsible for rail upgrade, excavation of Operable Unit 1 waste units, waste processing and drying, loading, rail transport, and off-site disposal of contaminated soil and debris that exceed the waste acceptance criteria for the On-Site Disposal Facility. (Note: This project will be performed by the WPRAP, SCEP and the ARASA subcontractor.)<br><br>Related Projects:<br><br>Soil Characterization and Excavation Project responsible for sampling, excavation, and disposition of impacted soil beneath the rail construction area and the waste pits, as well as at- and below-grade remediation facilities, including the railroad. Soil excavation will be coordinated by SCEP and the ARASA subcontractor.<br><br>AWWT and Wastewater Project responsible for treating contaminated runoff and perched water collected during waste pit excavation; each project is responsible for containing and transporting remediation wastewater to the AWWT facility for treatment.<br><br>Facilities D&D Project responsible for D&D of all above-grade Operable Unit 1 remediation facilities. | Operable Unit 1 RA Work Plan<br><br>SEP and Area 6 IRDP for underlying soil excavation and certification<br><br>IEMP for sitewide environmental monitoring<br><br>A D&D Implementation Plan will be developed for above-grade facilities within Operable Unit 1. |

**TABLE 1-1**

**(Continued)**

| OU Description | Remedy Overview [b] | Project Organization/Responsibilities | Planning Documents |
|---|---|---|---|
| Operable Unit 2<br><br>· Solid waste landfill<br><br>· Inactive flyash pile<br><br>· Active flyash pile (now inactive)<br><br>· North and south lime sludge ponds<br><br>· Other south field disposal areas<br><br>· Berms, liners and soil within the operable unit boundary | ROD Approved: May 1995<br><br>· Excavation of all materials with COCs above FRLs<br><br>· Treatment for size reduction and moisture control as required<br><br>· Establishment of on-site WAC<br><br>· OSDF construction<br><br>· WAC attainment certification<br><br>· FRL certification<br><br>· Collection and treatment of Operable Unit 2 subunit and OSDF construction water<br><br>· On-site disposal in the OSDF<br><br>· Off-site disposal of a small fraction of excavated material that exceeds the WAC for the OSDF and lead-contaminated soil from the South Field Firing Range.<br><br>· Restoration | Primary Project:<br><br>Soil Characterization and Excavation Project responsible for excavation and disposition of waste from all Operable Unit 2 subunits.<br><br>Related Projects:<br><br>On-Site Disposal Facility Design Project responsible for design, installation, and closure of the OSDF that will contain Operable Unit 2 subunit wastes, Operable Unit 5 soil and debris, and Operable Unit 3 debris; responsible for monitoring leachate within the OSDF and perched groundwater in the till beneath the OSDF.<br><br>AWWT and Wastewater Project responsible for treating contaminated runoff and perched water collected during excavation of Operable Unit 2 subunit wastes; each project is responsible for containing and conveying remediation wastewater to the AWWT facility for treatment. | Operable Unit 2 RD and RAWP for OSDF construction, management, and closure<br><br>SEP, Area 2, Phase I IRDP and Area 2, Phase 2 IRDP for waste unit contents removal and soil excavation and certification, respectively<br><br>IEMP for sitewide environmental monitoring |

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**TABLE 1-1**

**(Continued)**

| OU Description | Remedy Overview [b] | Project Organization/Responsibilities | Planning Documents |
|---|---|---|---|
| Operable Unit 3<br><br>· Former Production Area and associated facilities and equipment (includes all above-, at-, and below-grade improvements) including, but not limited to:<br><br>· All structures, equipment, utilities, effluent lines, K-65 transfer line<br><br>· Wastewater treatment facilities<br><br>· Fire training facilities<br><br>· Coal pile<br><br>· Scrap metals piles<br><br>· Drums, tanks, solid waste, waste product, feedstocks, | ROD Approved: September 1996<br><br>· Adoption of Operable Unit 3 IROD<br><br>· Alternatives to disposal through the unrestricted or restricted release of materials, as economically feasible for recycling, reuse, or disposal<br><br>· Treatment of material for on-site or off-site material<br><br>· Required off-site disposal for process residues, product materials, process-related metals, acid brick, concreted from specific locations, and any other material exceeding the on-site WAC<br><br>· On-site disposal for material that meets the on-site WAC<br><br>· Restoration | Primary Project:<br><br>Facilities D&D Project responsible for D&D of all above-grade buildings and facilities at the FEMP.<br><br>Related Projects:<br><br>Soil Characterization and Excavation Project responsible for removal of at- and below-grade facilities. Responsible for certification sampling beneath excavated facilities.<br><br>AWWT and Wastewater Project responsible for treating contaminated and other wastewater during D&D activities; each project is responsible for containing and conveying remediation wastewater to the AWWT facility for treatment.<br><br>On-Site Disposal Facility Design Project responsible for design, installation, and closure of the OSDF that will contain Operable Unit 3 debris, Operable Unit 2 subunit wastes, and Operable Unit 5 soil. | SEP and Areas 3, 4, and 5 IRDPs under SCEP: Removal of all Operable Unit 3 at- and below-grade structures (building foundations, roadways, underground utilities, in-ground basins within Former Production Area, Sewage Treatment Plant, and the Fire Training Facility) and WAC attainment and debris management.<br><br>Facilities D&D Project Operable Unit 3 Integrated RD/RA Work Plan for D&D of above-grade facilities and applicable Implementation Plans.<br><br>IEMP for sitewide environmental monitoring. |

**TABLE 1-1**

**(Continued)**

| OU Description | Remedy Overview [b] | Project Organization/Responsibilities | Planning Documents |
|---|---|---|---|
| Operable Unit 4<br><br>· Silos 1 and 2 (containing K-65 residues)<br><br>· Silo 3 (containing cold metal oxides)<br><br>· Silo 4 (empty and never used)<br><br>· Decant tank system<br><br>· Berms and soil within the operable unit boundary | ROD Approved: December 1994<br><br>· Removal of silo residues and decant sump tank sludges with on-site vitrification of residues and sludges followed by off-site disposal<br><br>· Demolition and decontamination, to the extent possible, of silos and vitrification facilities<br><br>· Excavation of contaminated soil above the FRLs with on-site disposal for contaminated soil and debris that meet the on-site WAC<br><br>· Contaminated soil and debris that exceed the on-site WAC will be disposed of off-site<br><br>· Restoration | Primary Project:<br><br>Silos Project responsible for silo content removal, treatment, and transport off site.<br><br>Related Projects:<br><br>Soil Characterization and Excavation Project responsible for certification, excavation and disposition of contaminated soil beneath the silos that exceed to on-site WAC, and for removal of subsurface structures (i.e., sub-grade silo decant system).<br><br>AWWT and Wastewater Project responsible for treating decontamination and other wastewater during D&D activities; each project is responsible for capturing and transporting remediation wastewater to the AWWT facility for treatment.<br><br>Facilities D&D Project responsible for D&D of all Operable Unit 4 remediation facilities. | Operable Unit 4 RD documents - planning for removal of silo contents and their transport for off-site disposal<br><br>SEP and Area 7 IRDP - planning for excavating remaining contaminated soil, attainment of FRLs, final site restoration of Operable Unit 4.<br><br>IEMP for sitewide environmental monitoring<br><br>Implementation Plans for above-grade D&D |

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**TABLE 1-1**

**(Continued)**

| OU Description | Remedy Overview [b] | Project Organization/Responsibilities | Planning Documents |
|---|---|---|---|
| Operable Unit 5 | ROD Approved: January 1996 | Primary Projects: | SEP and all IRDPs. |
| · Groundwater<br>· Surface water and sediments<br>· Soil not included in the definitions of Operable Units 1-4<br>· Flora and fauna | · Extraction of contaminated groundwater from the Great Miami Aquifer to meet FRLs at all affected areas of the aquifer<br>· Treatment of contaminated groundwater, storm water, and wastewater to attain mass-based discharge limits and FRLs in the Great Miami River<br>· Excavation of contaminated soil, rubble, and sediment to meet FRLs<br>· Excavation of contaminated soil containing perched water that presents an unacceptable threat, through contaminant migration, to the underlying aquifer<br>· On-site disposal of contaminated soil and sediment that meet the on-site WAC<br>· Soil and sediment that exceed the WAC for the OSDF will be treated, where possible, to meet the on-site WAC or will be disposed of at an off-site facility<br>· Site restoration, institutional controls, and post-remediation maintenance | Soil Characterization and Excavation Project responsible for precertification and certification of sitewide soil; excavation and disposition of contaminated soil, sediment, impacted perched groundwater and at- and below-grade facilities; and final site restoration.<br><br>Aquifer Restoration Project is responsible for designing, installing, and operating the pumping systems for the Great Miami Aquifer groundwater restoration; responsible for groundwater monitoring in the Great Miami Aquifer, including the groundwater monitoring program for the On-Site Disposal Facility.<br><br>AWWT and Wastewater Project responsible for designing, constructing, and operating all treated effluent discharge systems, and for treating and discharging contaminated groundwater, storm water, run-off water, and remedial action wastewater at the FEMP.<br><br>Related Projects:<br><br>Facilities D&D Project responsible for D&D of all Operable Unit 5 remediation facilities.<br><br>On-Site Disposal Facility Design Project responsible for design, installation, and closure of the On-Site Disposal Facility that will contain Operable Unit 3 debris, Operable Unit 2 subunit wastes, and Operable Unit 5 soil. | Groundwater Monitoring and Sitewide Environmental Monitoring: Integrated Environmental Monitoring Plan. |

**TABLE 1-1**

**(Continued)**

Notes: [a] Source of information is from each operable unit's ROD and RD work plan.
[b] Each remedy includes institutional controls that will be managed for the site through the NRRP.

**TABLE 1-2**

**CROSS-REFERENCE BETWEEN OPERABLE UNIT REMEDY COMPONENTS AND THE SITEWIDE EXCAVATION PLAN**

| Remedy Component | Operable Unit | SEP Section Reference |
|---|---|---|
| Soil and Sediment | 2, 5 | 3.0 and 4.0 |
| Perched Water Treatment | 2, 5 | 2.0 and 4.0 |
| Regional Groundwater Aquifer | 5 | See Operable Unit 5 RD Work Plan |
| Storm Water/Wastewater | 2, 3, 5 | 2.0 and 4.0 |
| Treatment of Discharges | 2, 5 | 4.0, and Operable Unit 5 RD Work Plan |
| Debris | 3, 5 | 2.0, 3.0, and 4.0 |
| Operable Unit 2 Subunits | 2 | 4.0 |
| Measures to Minimize Environmental Impacts | 1, 2, 3, 4, 5 | 4.0 |
| Institutional Controls/Monitoring | 5 | 2.0 and 4.0 |
| Corrective Action Management (CAMU) Rule | 1, 2, 3, 5 | 1.0 |
| Community Involvement | 1, 2, 3, 4, 5 | 1.0 |

## TABLE 1-3

## REQUIRED PROJECT PLANS [a]

| Requirement | Cross-Reference |
|---|---|
| Sampling and Analysis Plan, including quality assurance project plan(s) and field sampling plan(s) | SEP (Section 2-4 and Appendix E)/ IRDPs/QAJSP/CQAP |
| Health and Safety/Contingency Plan | SEP (Section 2.3.8)/Project-Specific Health and Safety Plans (SEP Section 6.0) |
| Permitting Plan | SEP (Section 1.3.1.2)/IRDPs |
| Groundwater Monitoring Plan | IEMP |
| Operations and Maintenance Plan | SEP (Section 3.5)/IRDPs/NRRP |

Note: [a] As listed in the Amended Consent Agreement (EPA 1991).

# TABLE 1-4

## SUMMARY OF CONTAMINANT LEVELS PERTINENT TO SOIL REMEDIATION AT THE FEMP

| Constituent | Practical Quantitation Limit[a] | Background[b] | | | Waste Acceptance Criteria for Soil and Sediment in the On-Site Disposal Facility[c] | Benchmark Toxicity Value | Final Remediation Levels | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Operable Unit 5[d] | | | Operable Unit 2[e] | | | | | | |
| | | Surface Soil | Subsurface Soil | Sediment (Paddys Run) | | | On-Property Soil | Off-Site Soil | Sediment | Solid Waste Landfill | Lime Sludge Ponds | Inactive Flyash Pile (over GMA) | Inactive Flyash Pile (>16 ft natural soil) | South Field (over GMA) | South Field (>16 ft natural soil) | Active Flyash Pile |
| **Radionuclides (pCi/g)** | | | | | | | | | | | | | | | | |
| Cesium-137+1d | 2.00E-01 | 7.10E-01 | ND | | | 1.20E+04 | 1.40E+00 | 8.20E-01 | 7.00E+00 | | | | | | | |
| Lead-210+2d | 5.00E-01 | 1.30E+00 | 8.50E-01 | | | | 3.80E+01 | 2.20E+00 | 3.90E+02 | | | | | | | |
| Neptunium-237+1d | 2.00E-01 | | | | 3.12E+09 | | 3.20E+00 | 4.90E-01 | 3.20E+01 | | | | | | | 4.99E+00 |
| Plutonium-238 | 2.00E-01 | | | | | 3.80E+06 | 7.80E+01 | 9.30E+00 | 1.20E+03 | | | | | | | |
| Plutonium-239/240 | 2.00E-01 | | | | | 4.10E+06 | 7.70E+01 | 9.00E+00 | 1.10E+03 | | | | | | | |
| Radium-226+8d | 2.50E-01 | 1.42E+00 | 1.47E+00 | 5.00E-01 | | 6.70E+02 | 1.70E+00 | 1.50E+00 | 2.90E+00 | 1.80E+00 | 1.80E+00 | 1.80E+00 | 1.80E+00 | 1.80E+00 | 1.80E+00 | 1.80E+00 |
| Radium-228+1d | 5.00E-01 | 1.25E+00 | 1.31E+00 | ND | | 3.40E+05 | 1.80E+00 | 1.40E+00 | 4.80E+00 | 2.00E+00 | 2.00E+00 | 2.00E+00 | 2.00E+00 | 2.00E+00 | 2.00E+00 | 2.00E+00 |
| Strontium-90+1d | 5.00E-01 | 4.20E-01 | 4.40E-01 | | 5.67E+10 | 2.80E+03 | 1.40E+01 | 6.10E-01 | 7.10E+03 | | | | | | | |
| Technetium-99 | 1.00E+00 | ND | ND | | 2.91E+01 | 9.30E+04 | 3.00E+01 | 1.00E+00 | 2.00E+05 | | | | | 7.10E+01 | 7.10E+01 | |
| Thorium-228+7d | 1.00E-01 | 1.43E+00 | 1.38E+00 | | | 1.40E+06 | 1.70E+00 | 1.50E+00 | 3.20E+00 | 1.80E+00 | 1.80E+00 | 1.80E+00 | 1.80E+00 | 1.80E+00 | 1.80E+00 | 1.80E+00 |
| Thorium-230 | 1.00E-01 | 1.97E+00 | 1.91E+00 | | | 2.10E+05 | 2.80E+02 | 8.00E+01 | 1.80E+04 | | | | | 6.97E+00 | 6.97E+00 | |
| Thorium-232+10d | 1.00E-01 | 1.36E+00 | 1.26E+00 | | | 2.40E+05 | 1.50E+00 | 1.40E+00 | 1.60E+00 | 1.50E+00 | 1.50E+00 | 1.50E+00 | 1.50E+00 | 1.50E+00 | 1.50E+00 | 1.50E+00 |
| Uranium-234 | | 1.24E+00 | 1.04E+00 | | | | | | | 6.29E+01 | 1.96E+02 | 8.68E+00 | 4.24E+00 | 8.68E+00 | 4.24E+00 | 8.64E+00 |
| Uranium-235/236 | | 1.60E-01 | 1.50E-01 | | | | | | | 6.31E+01 | 1.95E+02 | 7.79E+00 | 3.35E+00 | 7.79E+00 | 3.35E+00 | 7.75E+00 |
| Uranium-238 | | 1.24E+00 | 1.12E+00 | | 3.46E+02 | 1.20E+04 | | | | 1.29E+01 | 4.53E+01 | 6.12E+00 | 3.22E+00 | 6.12E+00 | 3.22E+00 | 6.12E+00 |
| Uranium, total (mg/kg) (High $K_d$) | 1.00E-01 | 3.73E+00 | 3.69E+00 | 3.00E+00 | 1.03E+03 | 2.30E+02 | 8.20E+01 | 5.00E+01 | 2.10E+02 | 3.86E+01 | 1.36E+02 | | | | | 2.80E+01 |
| Uranium, total (mg/kg) (Low $K_d$) | 1.00E-01 | | | | | | 2.00E+01 | NA | | | | 2.48E+01 | 2.48E+01 | 2.48E+01 | 2.48E+01 | |
| **Chemicals (mg/kg)** | | | | | | | | | | | | | | | | |
| Antimony | 5.00E-01 | ND | ND | | | 1.00E+01 | 9.60E+01 | 6.10E-01 | | | | | | | | |
| Arsenic | 1.30E+00 | 8.20E+00 | 9.57E+00 | 7.00E+00 | | 3.00E+01 | 1.20E+01 | 9.60E+00 | 9.40E+01 | | | 1.69E+01 | 1.69E+01 | | | 1.69E+01 |
| Barium | 1.30E+00 | 9.41E+01 | 1.19E+02 | 2.10E+01 | | 5.00E+02 | 6.80E+04 | 1.20E+02 | | | | | | | | |
| Beryllium | 5.00E-02 | 6.00E-01 | 6.20E-01 | 5.00E-01 | | 5.60E+01 | 1.50E+00 | 6.20E-01 | 3.30E+01 | | | | | | | |
| Boron | 4.00E+00 | | | | 1.04E+03 | | 7.40E+03 | 4.00E+00 | | | | | | | | |
| Cadmium | 1.00E-01 | 8.70E-01 | 9.10E-01 | 3.70E+00 | | 5.00E+00 | 8.20E+01 | 9.10E-01 | 7.10E+01 | | | | | | | |
| Chromium VI | 2.70E+00 | 1.55E+01 | 2.07E+01 | 1.83E+01 | | 5.00E-02 | 3.00E+02 | 1.10E+01 | 3.00E+03 | | | | | | | |
| Cobalt | 3.00E-01 | 1.42E+01 | 1.57E+01 | 4.90E+00 | | | 7.40E+02 | 2.60E+01 | 3.60E+04 | | | | | | | |
| Copper | 5.00E-01 | 1.41E+01 | 2.00E+01 | 1.08E+01 | | 1.00E+02 | 2.20E+05 | 2.00E+01 | | | | | | | | |
| Cyanide | 3.30E-01 | 2.70E-01 | 1.70E-01 | | | | 1.20E+05 | 8.00E-01 | | | | | | | | |
| Fluoride | 7.00E-01 | | | | | | 7.80E+04 | 8.50E+02 | | | | | | | | |
| Lead | 5.00E-02 | 2.64E+01 | 1.56E+01 | | | 2.00E+02 | 4.00E+02 | 4.00E+02 | | | | | | 4.00E+02 | | |
| Manganese | 1.00E+00 | 1.35E+03 | 1.30E+03 | 4.11E+02 | | 1.50E+03 | 4.60E+03 | 1.40E+03 | 4.10E+02 | | | | | | | |
| Mercury | 1.30E-01 | 3.00E-01 | 2.90E-01 | ND | 5.66E+04 | 5.00E+00 | 7.50E+00 | 3.00E-01 | | | | | | | | |
| Molybdenum | 1.30E+01 | ND | 2.70E+00 | ND | | 1.00E+01 | 2.90E+03 | 1.30E+01 | | | | | | | | |
| Nickel | 4.00E+00 | 2.09E+01 | 3.43E+01 | 1.37E+01 | | 1.00E+02 | 1.50E+04 | 3.40E+01 | | | | | | | | |
| Selenium | 1.30E+00 | 7.20E-01 | ND | ND | | 3.00E+00 | 5.40E+03 | 2.50E+00 | | | | | | | | |

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# TABLE 1-4

## Continued)

| Constituent | Practical Quantitation Limit [a] | Background [b] | | | Waste Acceptance Criteria for Soil and Sediment in the On-Site Disposal Facility [c] | Benchmark Toxicity Value | Final Remediation Levels | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Operable Unit 5 [d] | | | Operable Unit 2 [e] | | | | | | |
| | | Surface Soil | Subsurface Soil | Sediment (Paddys Run) | | | On-Property Soil | Off-Site Soil | Sediment | Solid Waste Landfill | Lime Sludge Ponds | Inactive Flyash Pile (over GMA) | Inactive Flyash Pile (>16 ft natural soil) | South Field (over GMA) | South Field (>16 ft natural soil) | Active Flyash Pile |
| Silver | 1.30E+00 | ND | ND | ND | | 1.00E+01 | 2.90E+04 | 1.00E+00 | | | | | | | | |
| Thallium | 1.00E+00 | 5.80E-01 | 4.90E-01 | ND | | 6.30E+00 | 9.10E+01 | 1.00E+00 | 8.80E+01 | | | | | | | |
| Vanadium | 1.00E+00 | 3.04E+01 | 3.78E+01 | 1.24E+01 | | 1.50E+02 | 5.10E+03 | 5.80E+01 | | | | | | | | |
| Zinc | 1.00E+00 | 5.96E+01 | 8.20E+01 | 1.35E+01 | | 5.00E+02 | 1.20E+05 | 8.20E+01 | | | | | | | | |
| **Organic Compounds** | | | | | | | | | | | | | | | | |
| Acetone | 7.00E-03 | | | | | | 4.30E+04 | 4.30E-01 | | | | | | | | |
| Aroclor-1254 | 4.00E-02 | | | | | 1.00E+00 | 1.30E-01 | 4.00E-02 | 6.70E-01 | | | | | | | |
| Aroclor-1260 | 4.00E-02 | | | | | 1.00E+00 | 1.30E-01 | 4.00E-02 | 6.70E-01 | | | | | 2.50E+01 | 2.50E+01 | |
| Benzene | 1.00E-03 | | | | | | 8.50E+02 | 4.30E-01 | | | | | | | | |
| Benzo(a)anthracene | 7.00E-04 | | | | | 1.00E+00 | 2.00E+01 | 1.60E-01 | 1.90E+02 | | | | | 4.55E-01 | 4.55E-01 | |
| Benzo(a)pyrene | 7.00E-04 | | | | | 1.00E+00 | 2.00E+00 | 9.00E-02 | 1.90E+01 | | | | | 7.77E-01 | 7.77E-01 | |
| Benzo(b)fluoranthene | 7.00E-04 | | | | | 1.00E+00 | 2.00E+01 | 1.60E-01 | 1.90E+02 | | | | | 5.13E-01 | 5.13E-01 | |
| Benzo(k)fluoranthene | 7.00E-04 | | | | | 1.00E+00 | 2.00E+02 | 9.00E-02 | 1.90E+03 | | | | | 6.03E-01 | 6.03E-01 | |
| Bis(2-chloroisopropyl)ether | 2.20E-01 | | | | 2.44E-02 | | 4.20E+02 | 2.00E-01 | | | | | | | | |
| Bis(2-ethylhexyl)phthalate | 2.20E-01 | | | | | 7.00E+01 | 8.20E+02 | 2.60E+01 | 5.00E+03 | | | | | | | |
| Bromodichloromethane | 1.00E-03 | | | | 9.03E-01 | | 4.00E+00 | 1.80E-01 | | | | | | | | |
| Bromoform | 1.00E-02 | | | | | | 3.10E+01 | 1.60E+00 | 1.60E+02 | | | | | | | |
| Bromomethane | 1.00E-02 | | | | | | 8.20E+03 | 2.40E-02 | | | | | | | | |
| Carbazole | 4.00E-02 | | | | 7.27E+04 | | 1.20E+01 | 3.10E+00 | 6.30E+01 | | | | | | | |
| Carbon disulfide | 1.00E-03 | | | | | 7.80E+03 | 5.00E+03 | 6.20E+00 | | | | | | | | |
| Carbon tetrachloride | 1.00E-03 | | | | | | 2.10E+00 | 9.10E-02 | | | | | | | | |
| Chlordane | 2.00E-03 | | | | | | 1.90E-01 | 3.80E-02 | | | | | | | | |
| α-Chlordane | | | | | 2.89E+00 | | | | | | | | | | | |
| Chlorobenzene | 1.00E-03 | | | | | | 3.40E+02 | 1.90E+00 | | | | | | | | |
| Chloroethane | 1.00E-03 | | | | 3.92E+05 | | | | | | | | | | | |
| Chloroform | 1.00E-03 | | | | | | 4.50E+01 | 5.00E-01 | | | | | | | | |
| Chrysene | 2.00E-03 | | | | | 1.00E+00 | 2.00E+03 | 1.60E+01 | 1.90E+04 | | | | | | | |
| Dibenzo(a,h)anthracene | 5.00E-04 | | | | | | 2.00E+00 | 1.60E-03 | | | | | | 1.57E-01 | 1.57E-01 | |
| 3,3'-Dichlorobenzidine | 2.00E-01 | | | | | | 5.50E-01 | 2.00E-01 | | | | | | | | |
| 1,1-Dichloroethene | 1.00E-03 | | | | 1.14E+01 | | 4.10E-01 | 5.90E-02 | | | | | | | | |
| 1,2-Dichloroethene | 1.00E-03 | | | | 1.14E+01 | | 1.60E-01 | 1.30E-01 | | | | | | | | |
| Dieldrin | 4.00E-03 | | | | | 4.00E-02 | 1.50E-02 | 8.80E-03 | | | | | | 9.57E-03 | 9.57E-03 | |
| Di-n-octylphthalate | 2.00E-01 | | | | | | 1.10E+03 | 2.00E-01 | | | | | | | | |
| Ethylbenzene | 1.00E-02 | | | | | | 5.10E+03 | 1.00E-03 | | | | | | | | |
| Heptachlorodibenzofuran | 6.00E-06 | | | | | | 8.80E-04 | 5.00E-05 | | | | | | | | |
| Heptachlorodibenzo-p-dioxin | 6.00E-06 | | | | | | 8.80E-04 | 5.00E-05 | | | | | | | | |
| Indeno(1,2,3-cd)pyrene | 4.00E-03 | | | | | 1.00E+00 | 2.00E+01 | 1.60E-02 | 1.90E+02 | | | | | 4.96E-01 | 4.96E-01 | |
| 4-Methyl-2-pentanone | 7.00E-03 | | | | | | 2.50E+03 | 9.40E-01 | 2.10E+03 | | | | | | | |
| Methylene chloride | 3.00E-03 | | | | | 8.50E+01 | 3.70E+01 | 6.30E-01 | | | | | | | | |

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# TABLE 1-4

## Continued)

| Constituent | Practical Quantitation Limit [a] | Background [b] | | | Waste Acceptance Criteria for Soil and Sediment in the On-Site Disposal Facility [c] | Benchmark Toxicity Value | Final Remediation Levels | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Operable Unit 5 [d] | | | Operable Unit 2 [e] | | | | | | |
| | | Surface Soil | Subsurface Soil | Sediment (Paddys Run) | | | On-Property Soil | Off-Site Soil | Sediment | Solid Waste Landfill | Lime Sludge Ponds | Inactive Flyash Pile (over GMA) | Inactive Flyash Pile (>16 ft natural soil) | South Field (over GMA) | South Field (>16 ft natural soil) | Active Flyash Pile |
| 4-Methylphenol | 2.00E-01 | | | | | | 2.50E+02 | 2.70E-01 | | | | | | | | |
| 4-Nitroanaline | 9.00E-01 | | | | 4.42E-02 | | 1.50E+02 | 8.00E-01 | | | | | | | | |
| N-nitrosodiphenylamine | 2.00E-01 | | | | | | 5.10E+01 | 1.30E+01 | 2.60E+02 | | | | | | | |
| N-nitrosodipropylamine | 2.00E-01 | | | | | | 2.00E-01 | 2.00E-01 | | | | | | | | |
| Octachlorodibenzofuran | 1.30E-05 | | | | | | 8.80E-03 | 1.00E-05 | | | | | | | | |
| Octachlorodibenzo-p-dioxin | 1.30E-05 | | | | | | 8.80E-03 | 1.00E-05 | | | | | | | | |
| Pentachlorophenol | 9.00E-01 | | | | | | 2.30E+00 | 9.70E-01 | | | | | | | | |
| Phenanthrene | 1.00E-03 | | | | | | | | 3.00E-03 | | | | | 1.90E-01 | 1.90E-01 | |
| Tetrachloroethane | | | | | | | 3.60E+00 | 1.00E+00 | | | | | | | | |
| Tetrachloroethene | 1.00E-03 | | | | 1.28E+02 | 2.50E+01 | | | | | | | | | | |
| Toluene | 1.00E-03 | | | | | | 1.00E+05 | 2.70E+01 | | | | | | | | |
| Toxaphene | | | | | 1.06E+05 | | | | | | | | | | | |
| Tributyl phosphate | 4.00E-02 | | | | | | 2.50E+02 | 2.90E+00 | | | | | | | | |
| 1,1,2-Trichloroethane | 1.00E-03 | | | | | | 4.30E+00 | 1.90E-01 | | | | | | | | |
| Trichloroethane | | | | | | | 2.50E+01 | 1.50E+00 | | | | | | | | |
| Trichloroethene | 1.00E-03 | | | | 1.28E+02 | | | | | | | | | | | |
| Vinyl chloride | 1.00E-03 | | | | 1.51E+00 | | 1.30E-01 | 2.30E-03 | | | | | | | | |
| Xylenes, total | 1.00E-03 | | | | | | 9.20E+05 | 4.00E+02 | | | | | | | | |

Notes: [a] From Operable Unit 5 FS (DOE 1996a)

[b] From Operable Unit 5 RI (DOE 1995f).

[c] From *Impacted Materials Placement Plan - On-site Disposal Facility* (DOE 1996b).

[d] From Operable Unit 5 ROD (DOE 1996d).

[e] From Operable Unit 2 ROD (DOE 1995d).

ND = Not Detected

000079

## TABLE 1-5

## SCHEDULE OF REMEDIAL DESIGN DELIVERABLES

| Deliverable | Status | Submittal Date |
|---|---|---|
| Technology Reports | Draft | May 24, 1996 |
| Sitewide Excavation Plan (SEP) | Draft | July 14, 1997 |
| Integrated Remedial Design Packages (IRDPs): | | |
| Area 1, Phase I | Completed | N/A |
| Area 1, Phase II | Prefinal | November 21, 1997 |
| Area 2, Phase I | Prefinal | October 20, 1997 |
| Area 3 | Prefinal | July 2, 1998 |
| Area 4 and Area 5 | Prefinal | November 15, 2000 |
| Area 6; Area 7; Area 1, Phase III; and Area 2, Phase II | Prefinal | January 15, 2001 |
| Area 8 | Prefinal | To be determined |
| Off-property area | Prefinal | To be determined |

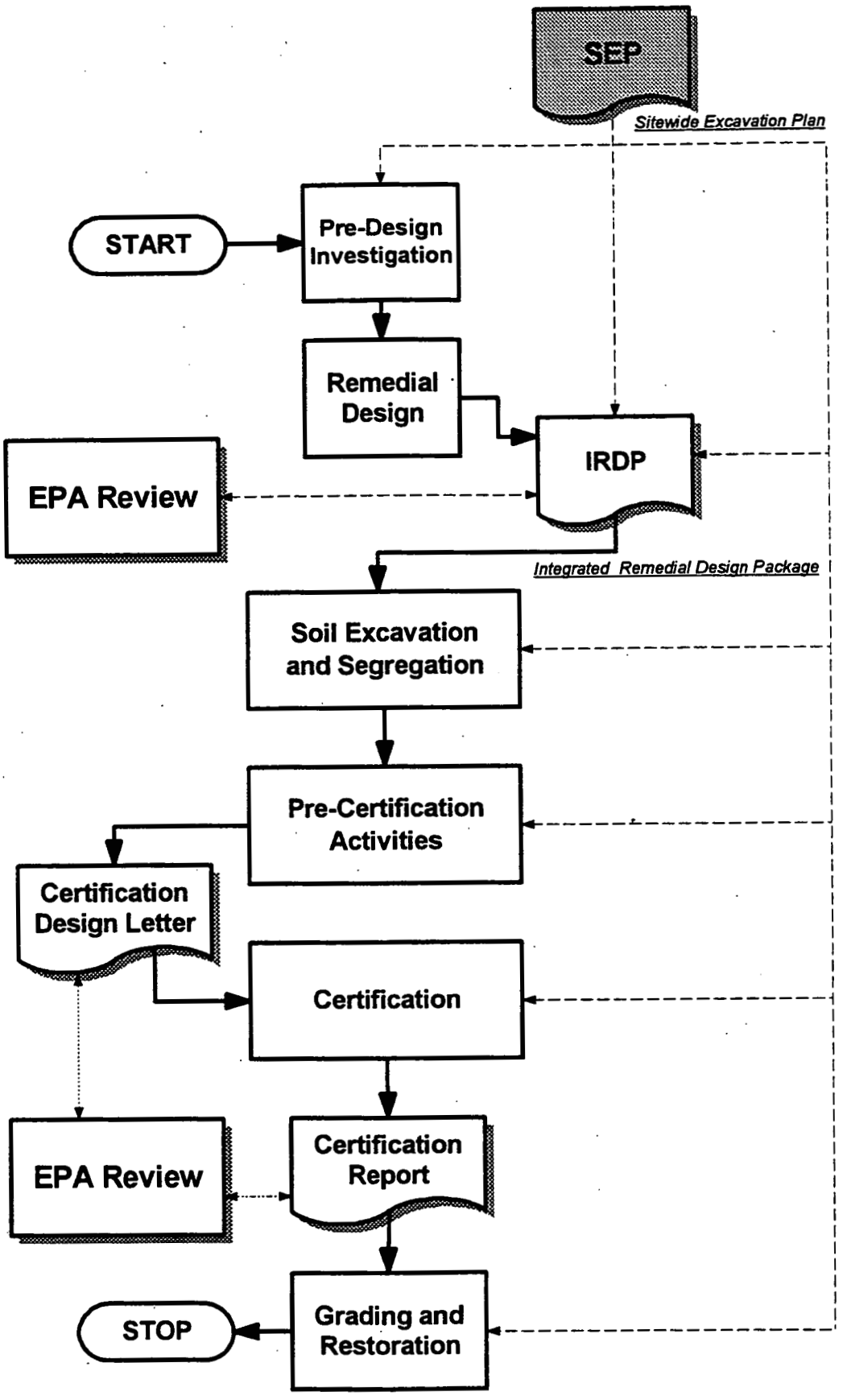
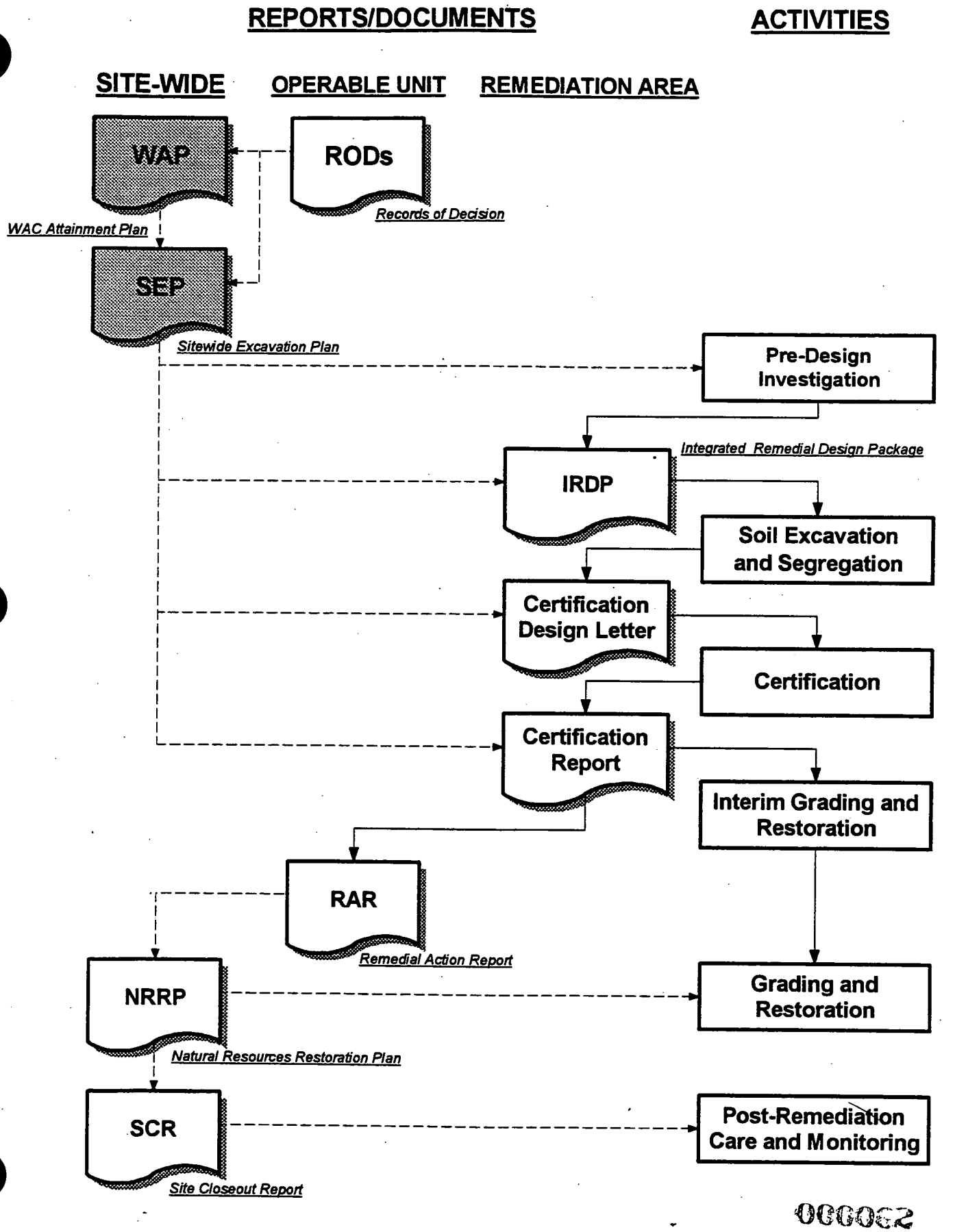
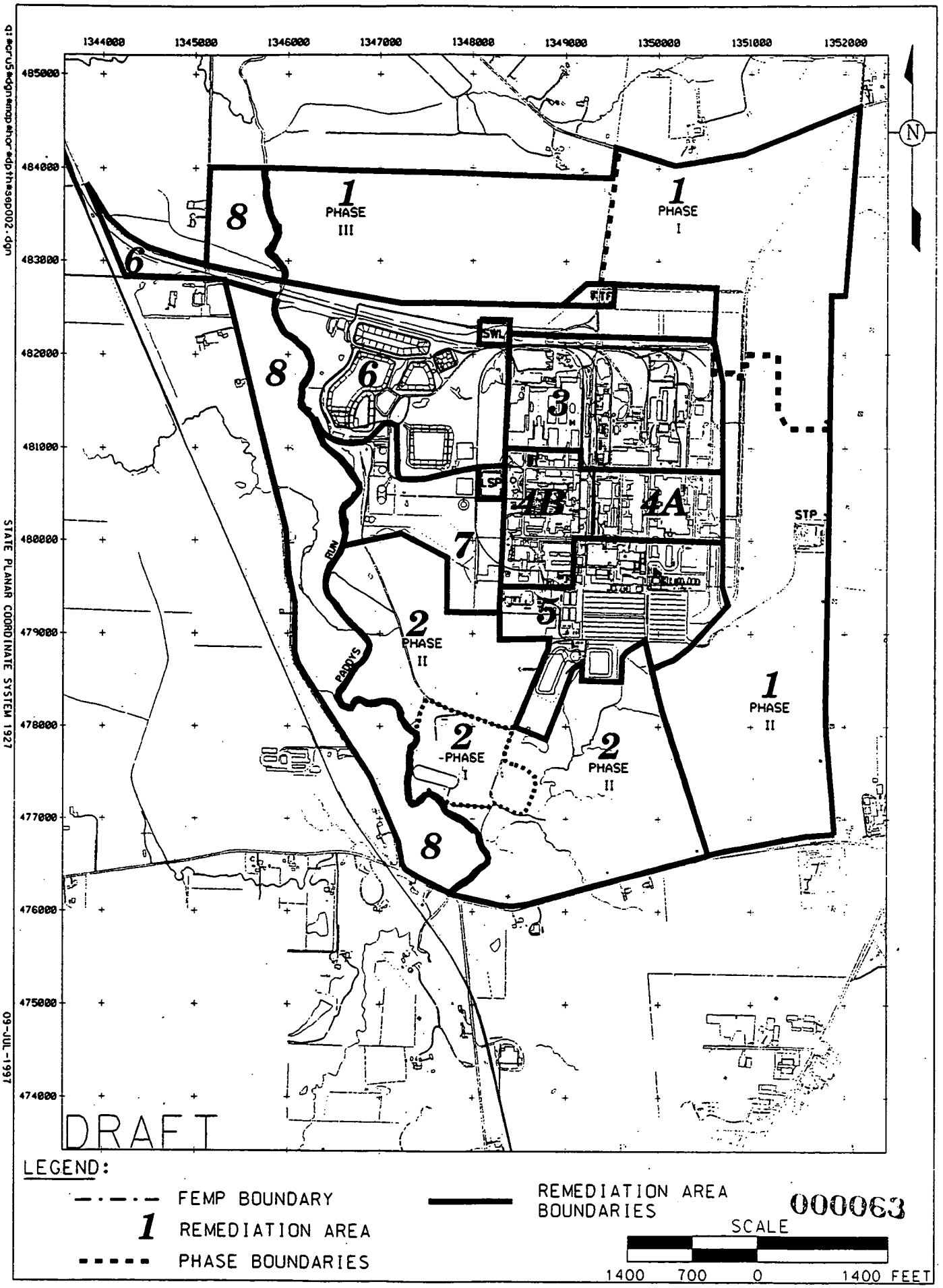



FIGURE 1-1 GENERAL AREA-SPECIFIC SOIL REMEDIATION PROCESS




290000

FIGURE 1-2 HIERARCHY OF SOIL REMEDIATION DOCUMENTS




000063

FIGURE 1-3. GENERALIZED SITEWIDE REMEDIATION AREAS

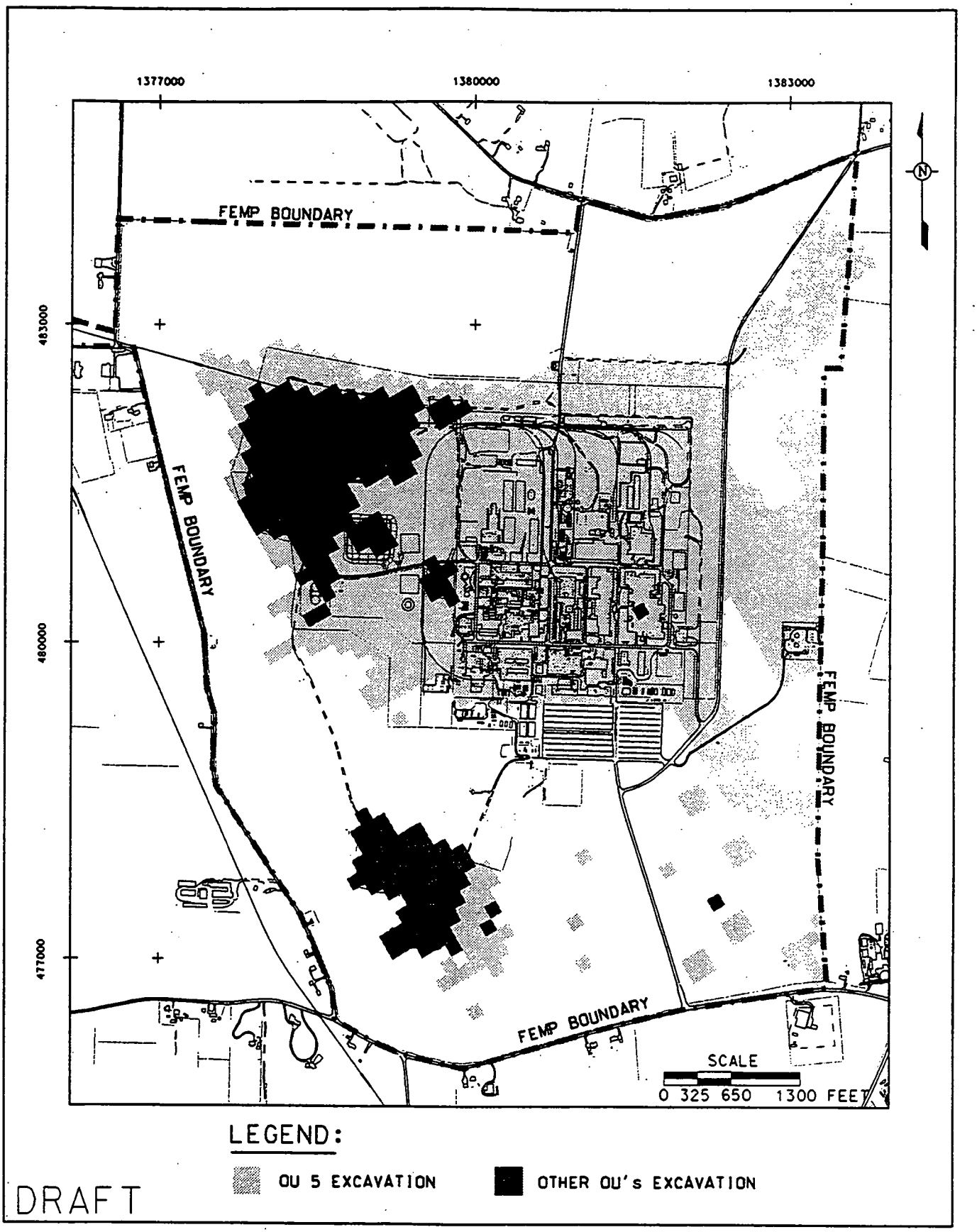
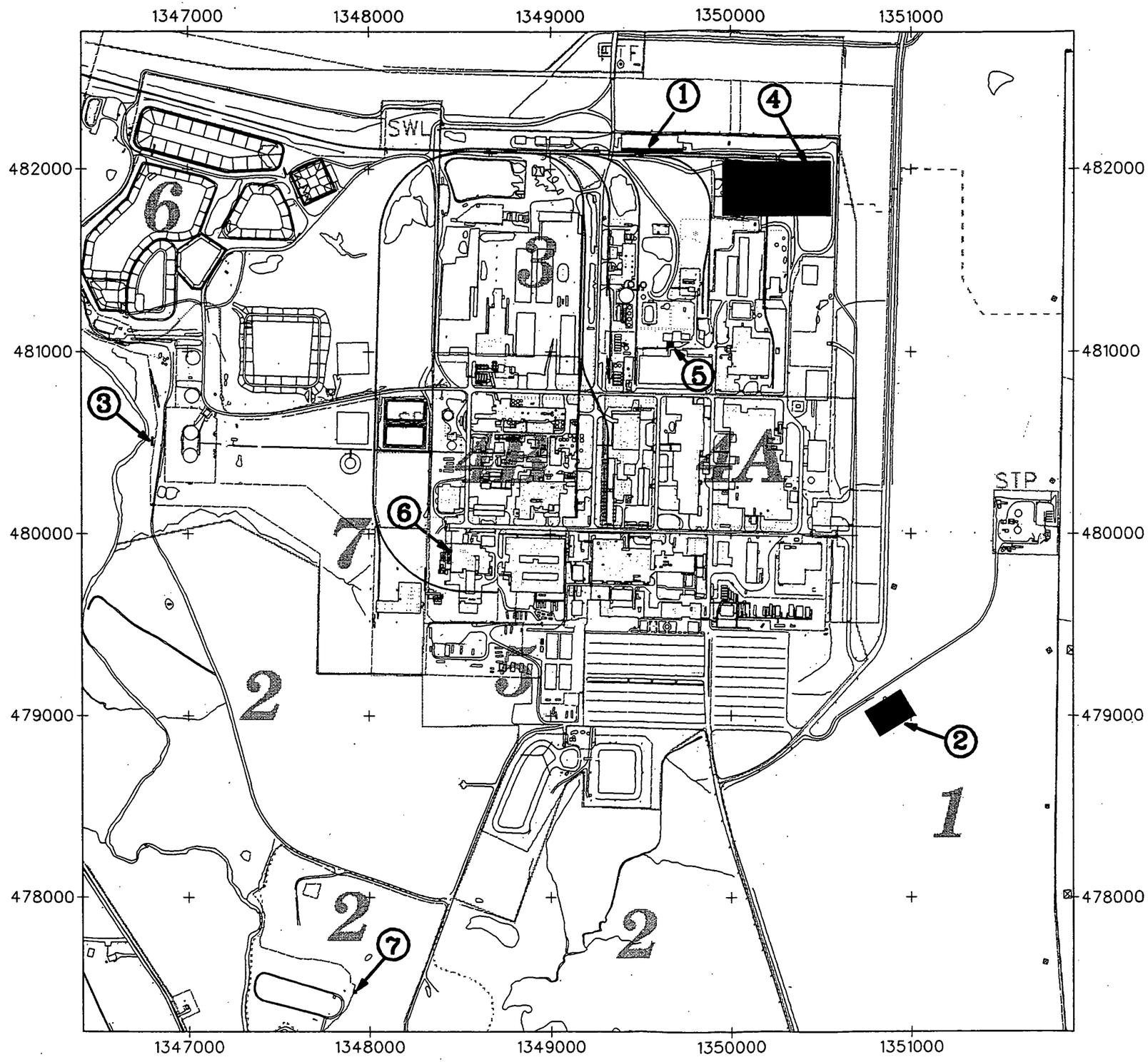



FIGURE 1-4. ANTICIPATED EXCAVATION FOOTPRINT OPERABLE UNIT 5

/USR/ERMA1/CRU5/DGN/MAP/HOR/DPTH005.DGN




LEGEND

RCRA AREAS

LOCATION IDENTIFIERS :

① AREA BETWEEN KC2 WAREHOUSE AND RAILROAD TRACKS
② TRAP RANGE
③ PADDYS RUN STREAMBANK FILL MATERIAL WEST OF SILOS 1-4
④ SCRAP METAL PILE AREA
⑤ AREA NORTH OF MAINTENANCE BUILDING
⑥ ABANDONED SUMP WEST OF PILOT PLANT (HWMU #22)
⑦ SOUTH FIELD FIRING RANGE

FIGURE 1-5. AREAS REQUIRING FURTHER CHARACTERIZATION AND POTENTIAL TREATMENT OF RCRA TOXICITY CHARACTERISTIC WASTES

DRAFT

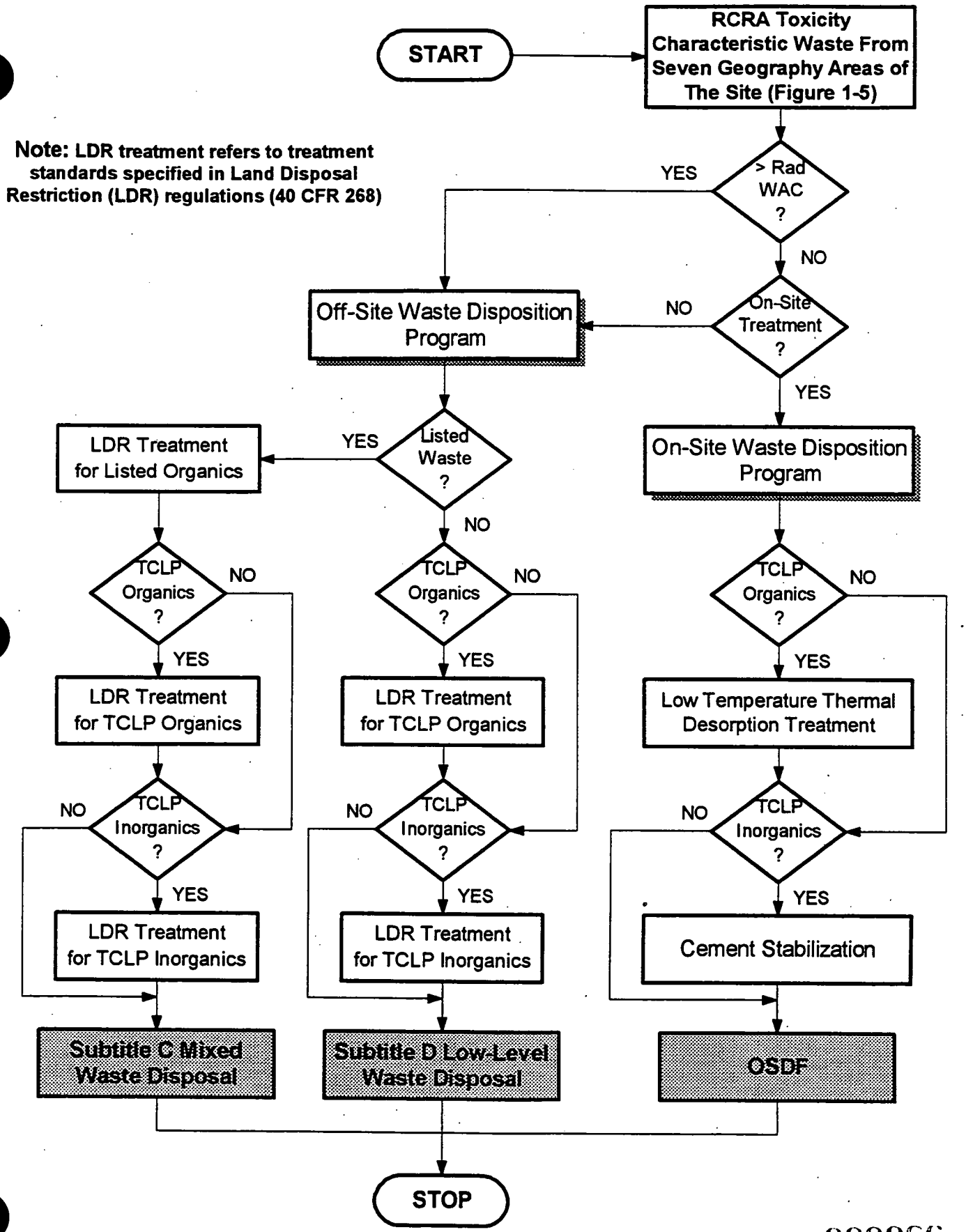





FIGURE 1-6 RCRA-REGULATED SOILS TREATMENT AND DISPOSAL REQUIREMENTS

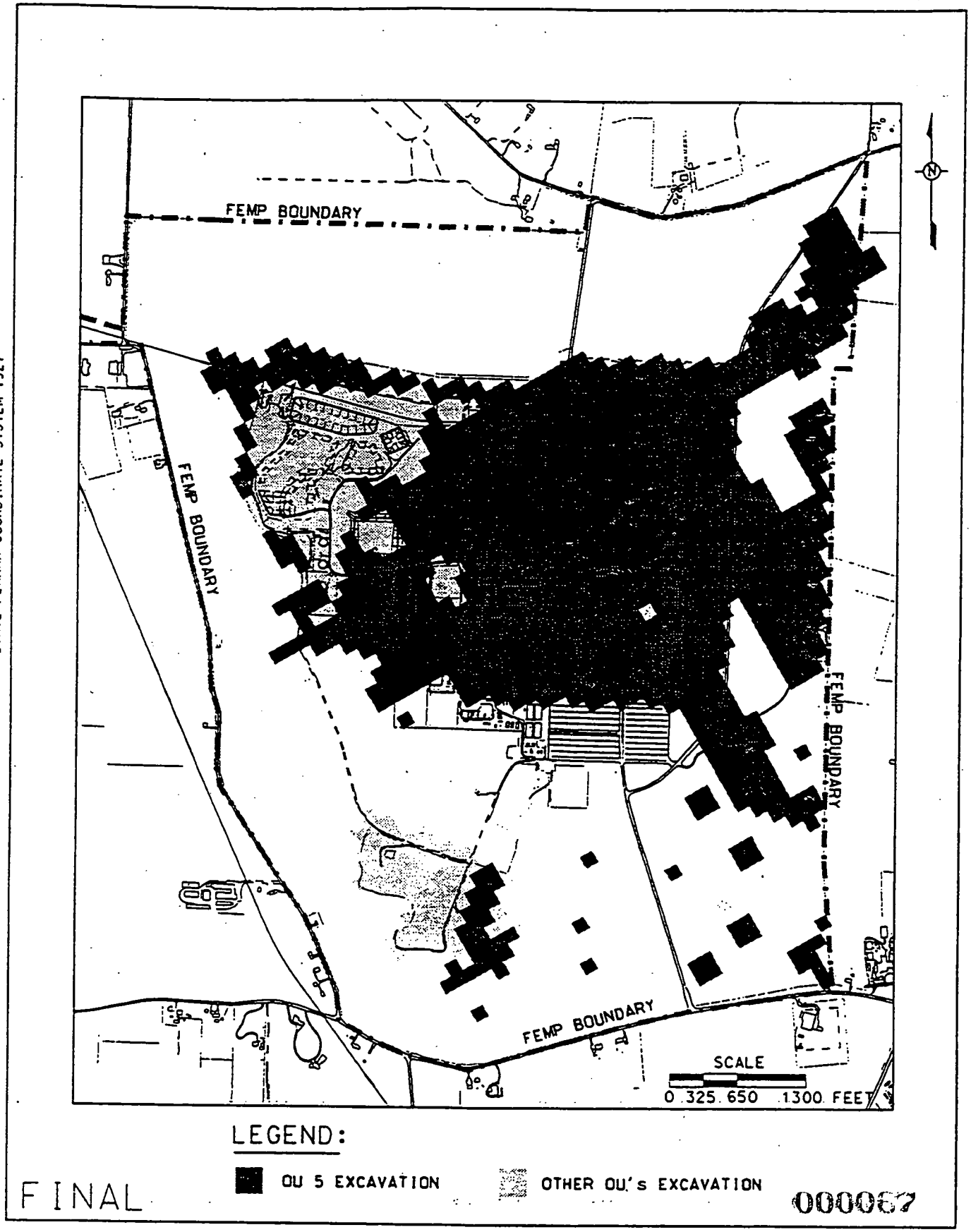
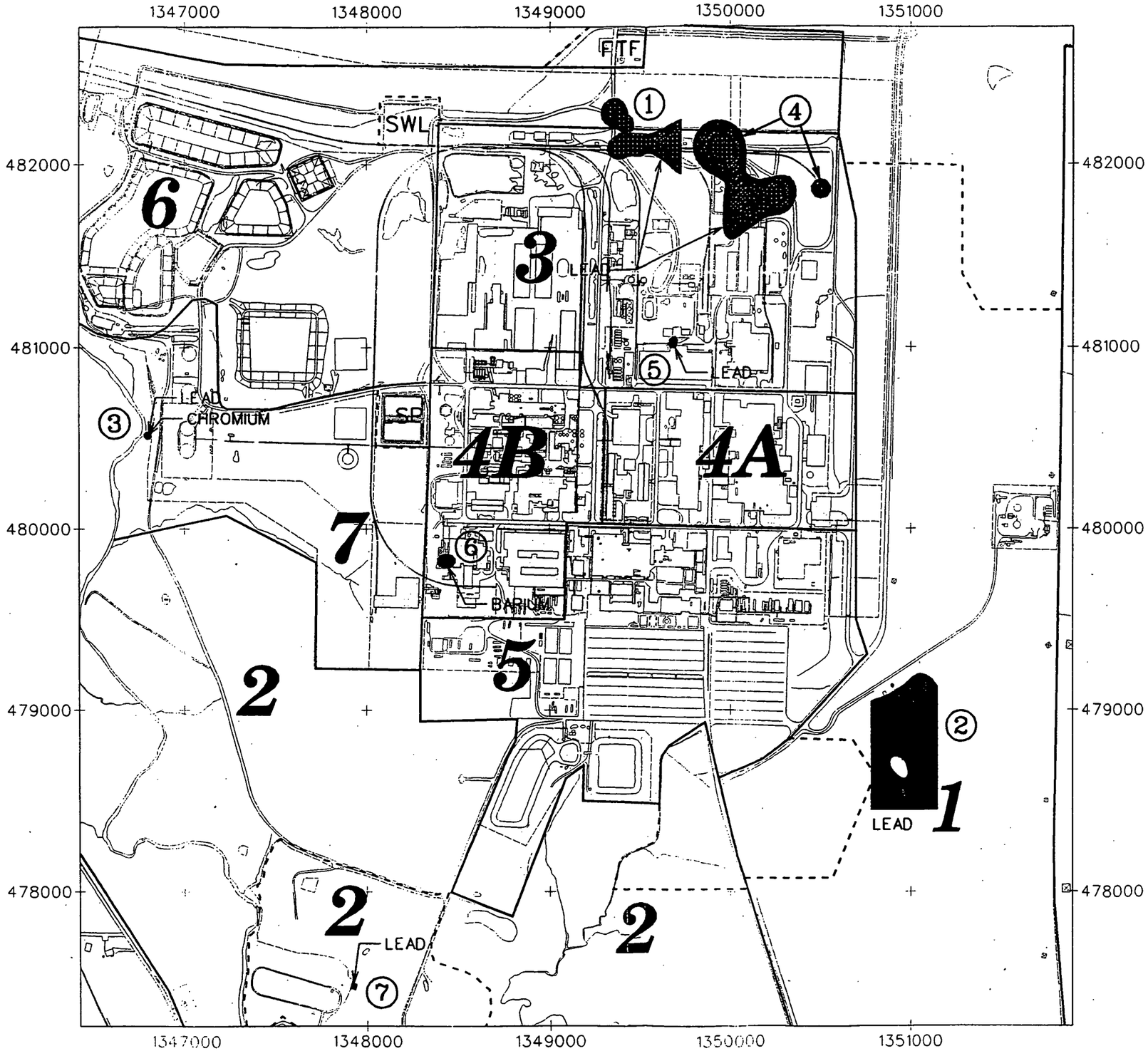



**FIGURE 1-7** EXCAVATION FOOTPRINT FOR OPERABLE UNIT 5




LEGEND

LOCATION IDENTIFIERS :

① AREA BETWEEN KC2 WAREHOUSE AND RAILROAD TRACKS
② TRAP RANGE
③ PADDYS RUN STREAMBANK FILL MATERIAL WEST OF SILOS 1-4
④ SCRAP METAL PILE AREA
⑤ AREA NORTH OF MAINTENANCE BUILDING
⑥ ABANDONED SUMP WEST OF PILOT PLANT (HWMU #22)
⑦ SOUTH FIELD FIRING RANGE

**FIGURE 1-8**

**FEMP AREAS WITH REASONABLE POTENTIAL FOR RCRA TOXICITY CHARACTERISTIC WASTES**

06-JUN-1997
8ADBD/DGN/RCRA.DGN

# 2.0 REMEDIATION ISSUES AND GENERAL STRATEGIES

Throughout the remedial investigation/feasibility study (RI/FS) phase of remediation activities at the Fernald Environmental Management Project (FEMP), certain details of implementation decisions have been deferred to the remedial design/remedial action (RD/RA) phase. As the RD/RA phase has developed, additional issues have been identified that must be addressed in conjunction with the implementation process. This section describes the various issues regarding remediation activities associated with the Soil Characterization and Excavation Project (SCEP) (Section 1.2.2) at the FEMP; discusses the general strategy for addressing each; and, as applicable, references the subsequent section in this Sitewide Excavation Plan (SEP) where each is discussed in detail.

The factors that influence remediation activities have been grouped into five categories:

1. Remediation drivers
2. Attainment of remediation goals
3. General implementation guidelines
4. Field measurements and laboratory analytical techniques
5. Logistical concerns.

The issues associated with each of these groupings are presented and discussed in the following five subsections.

## 2.1 REMEDIATION DRIVERS

As discussed in Section 1.3.1, the following requirements/factors are driving remediation activities at the FEMP:

- Applicable or relevant and appropriate requirements (ARARs) and to be considered criteria (TBCs)
- Permits
- Agreements
- Natural Resource Trusteeship.

Five aspects of these general categories are of particular interest in terms of the remediation of soil and at- and below-grade structures and debris:

1. The Resource Conservation and Recovery Act (RCRA)
2. Waste Acceptance Criteria
3. Final Remediation Levels
4. Benchmark Toxicity Values
5. DOE Orders.

The issues regarding each of these, and their respective impact on remediation activities, are discussed in the following paragraphs.

### 2.1.1 Resource Conservation and Recovery Act

RCRA regulations (40 CFR 260 and 280) and Ohio Environmental Protection Agency (OEPA) regulations (OAC Chapters 1301 and 3745-55) specify criteria for the identification and listing of hazardous wastes; regulations concerning the handling, treatment, and disposal of hazardous wastes; requirements for the closure of inactive hazardous waste management units (HWMUs) and underground storage tanks (USTs); and procedures for closing sites that have treated, stored, or disposed of hazardous wastes. These regulations affect three areas related to remediation activities at the FEMP:

1. HWMUs
2. USTs
3. Characteristic wastes.

#### 2.1.1.1 Hazardous Waste Management Units

A HWMU is defined as

> *... a contiguous area of land on/in which hazardous waste is placed, or the largest area in which there is significant likelihood of mixing hazardous waste constituents in the same area.* (40 CFR 260.10)

There were originally 54 HWMUs at the FEMP. Of these, 11 have been reclassified as solid waste management units (SWMUs) and 14 have been or are being closed under RCRA. The remaining 29 are planned to be closed under the RCRA/CERCLA integrated remedial response (Table 2-1), as discussed in Section 1.3.1.3. The procedures to be used to demonstrate closure are summarized in Section 2.2.4.

2.1.1.2 Underground Storage Tanks

The requirements for closing USTs are similar to those for HWMUs. There were originally 15 underground storage tanks at the FEMP. One of these was closed in 1988, prior to the promulgation of state and federal UST regulations, and eight have been closed since. However, closure of all but the one closed in 1988 will be demonstrated during soil excavation activities (Table 2-2). The procedures to be used to demonstrate closure are summarized in Section 2.2.5.

2.1.1.3 Characteristically Hazardous Wastes

As discussed in Section 1.3.2.7, the RI/FS program at the FEMP identified seven geographic areas where a reasonable potential exists for the presence of soil that qualifies as hazardous (RCRA toxicity characteristic) and also present a reasonable opportunity for cost-effective treatment. These areas are shown on Figure 1-5 and listed, along with their location and potentially hazardous constituents, in Table 2-3. The first six of the areas listed in Table 2-3 are identified in the Record of Decision (ROD) for Operable Unit 5 (DOE 1996d), whereas the seventh area was identified in the ROD for Operable Unit 2 (DOE 1995d). Screening for the presence of characteristic wastes will not be performed outside of these areas. It is conservatively estimated that approximately 28,000 cubic yards of material from these areas could be considered hazardous.

The hazardous potential in these seven areas was identified using validated data in the Sitewide Environmental Database (SED) for constituents with concentrations that exceed 20 times the respective toxicity characteristic leachate procedure (TCLP) limit (40 CFR 261.24). The 20 times rule accounts for the dilution effects of the TCLP test (i.e., 1 liter of diluent per 50 grams of sample). A sample with a contaminant content less than 20 times the TCLP limit cannot be characteristically hazardous. If the

contaminant concentration is greater than 20 times the TCLP limit, it may be hazardous, depending on the leachability of the contaminant as measured by the TCLP test.

A recent comparison of the SED data with lab data report sheets identified errors in the units of measurement that were originally input to the SED. Such errors involved the use of a larger unit of measurement (milligrams per kilogram) instead of the correct, smaller unit (micrograms per kilogram). The result was that concentrations are actually three orders of magnitude lower than that indicated with the incorrect units. Upon correction of these errors, only the constituents shown in the last column of Table 2-3 remain a concern. These constituents will be included in the list of area-specific constituents of concern (ASCOCs) (Section 2.1.3.3) for the respective remediation area.

As discussed in Section 1.3.2.7, characteristically hazardous wastes from these seven geographic areas will be disposed of in either an off-site facility or the On-Site Disposal Facility (OSDF). All such wastes that also exceed the radiological waste acceptance criteria (WAC) for the OSDF will be dispositioned off site. The characteristically hazardous wastes that are dispositioned off site must be treated to meet land disposal restriction (LDR) treatment standards (40 CFR 268.40) prior to disposal. The characteristically hazardous wastes from the seven geographic area that will be dispositioned to the OSDF will be treated to remove the characteristic before disposal. The decision as to whether such wastes that do not exceed the radiological WAC for the OSDF will be dispositioned to the OSDF or off site will depend on such factors as the availability of appropriate on-site treatment and the cost differential between on-site and off-site treatment/disposal.

The procedures to be used to identify, excavate, and handle these characteristically hazardous wastes are similar to those for material with contaminant concentrations that exceed the WAC for the OSDF (Section 2.2.1). The decision points and treatment options for the hazardous wastes from these seven areas are presented on Figure 1-6.

### 2.1.2 Waste Acceptance Criteria

Waste acceptance criteria (WAC) are physical and chemical/radiological characteristics of material that must be achieved if that material is to be acceptably disposed of in a particular manner. WAC are established by waste disposal facilities to assure that design constraints are not exceeded.

Waste generated during remediation of FEMP facilities will be disposed of in both off-site disposal facilities and the OSDF. Two issues are of primary interest in terms of WAC attainment at the FEMP:

- Material shipped to an off-site disposal facility must not exceed the WAC for that facility.
- Material known to exceed the WAC for the OSDF must not be placed in the facility.

2.1.2.1 WAC for Off-Site Disposal Facilities

WAC for potential off-site disposal facilities, and procedures for demonstrating compliance with them, are listed in Appendix E of the Operable Unit 5 FS (DOE 1996a). The conceptual waste disposition process described in Section F.5 of Appendix F provides conceptual procedures for managing and tracking the materials to be dispositioned off site during soil remediation.

2.1.2.2 WAC for OSDF

Materials to which the OSDF WAC apply fall into three basic categories: debris, soil/soil-like material, and ancillary waste. The following paragraphs present the WAC for the OSDF, discuss the associated issues, and discuss their application to these materials.

Summary of WAC for the OSDF

The chemical/radiological WAC for the OSDF are summarized in Table 2-4, and physical WAC are summarized in Table 2-5.

Two issues should be noted in terms of WAC for the OSDF:

1. As shown in Table 1-5, the WAC for two contaminants, 4-nitroaniline and bis (2-chloroisopropyl)ether, are below the practical quantitation limit (PQL). This is because the PQL was not taken into account when developing the WAC.
2. However, as discussed in the following paragraphs, only two of the chemical/radiological WAC (technetium-99 and total uranium) are commonly applicable to soil and soil-like material.

Application of WAC to Soil Remediation

As shown in Table 2-6, the OSDF WAC for all constituents is above the highest concentration detected during the RI/FS process for Operable Unit 5 except for five COCs (unshaded). In most cases, the

WAC is at least an order of magnitude above the highest detected level. Given the level of conservatism provided by the OSDF design (Section 2.2.1) and this difference between the respective acceptance criteria and the maximum concentration detected on site, no additional verification is required to demonstrate that the WAC has been met for these constituents in soil.

Of the remaining five constituents (shaded), three (bis(2-chloroisopropyl)ether, 4-nitroaniline, and trichloroethene) were used in specialized processes, as documented in the Operable Unit 5 RI/FS (DOE 1995f/1996a), and their presence at above-WAC concentrations is localized within the FEMP production area. Furthermore, the single indicated detection for both bis(2-chloroisopropyl)ether and 4-nitroaniline are estimated values. Therefore, all three of these contaminants are of only limited concern in terms of OSDF WAC attainment. Their presence in these limited areas will be appropriately reflected in the ASCOCs (Section 2.1.3.3) and the respective IRDP (Section 7.1), and verified during pre-design investigations (Section 3.1).

Of the remaining two constituents (technetium-99 and total uranium), technetium-99 is the most limiting for on-property soil in that the FRL and the OSDF WAC are equivalent. As shown on Figure 2-1, the seven regions of the site with the potential for technetium-99 contamination are localized. As described in Section 3.3.1.2, soils containing technetium-99 contamination above the WAC in these areas will be excavated for packaging and off-site disposal prior to the excavation of soil that may be transferred to the OSDF.

Uranium is the predominant contaminant at the site and will drive the excavation of most soil. A preliminary identification of the areas that exceed the OSDF WAC for total uranium is provided on Figure 2-2. As presented in Section 3.1, the extent of excavation will be determined in the pre-design phase. Within each area, data from the Operable Unit 5 RI/FS and additional validated data from the SED will be reviewed to determine whether the area to be excavated contains contaminant levels above the WAC. If the data show contaminant levels above the OSDF WAC, the extent of that material will be determined, in the manner described in Section 3.1.3. In such cases, the above-WAC materials will be excavated prior to excavation of soil to be disposed of in the OSDF. If the data evaluation indicates no contaminant levels above the WAC, the soil will be excavated and transferred to the OSDF for disposal. The data substantiating that the contaminant levels in the soil are below the WAC will be

included with the manifest for the soil and will serve as a basis for acceptance of the soil transfer at the OSDF, as described in the conceptual waste disposition process provided in Section F.5 of Appendix F.

Application of WAC to At- and Below-Grade Structures and Debris

As detailed in Appendix F, remedial planning performed under the SEP for at- and below-grade debris excavation will include an evaluation of the debris to be generated in order to determine handling, treatment, and disposition requirements. This evaluation, which is similar to that used in planning above-grade dismantlement of Operable Unit 3 materials (as discussed in the Operable Unit 3 Integrated Remedial Design Remedial Action Work Plan [DOE 1996h]), identifies debris for which there may be particular handling concerns. However, based on an initial evaluation of Operable Unit 3 materials that will remain after above-grade decontamination and dismantlement (D&D), it is anticipated that most debris will not require special handling, treatment, or off-site disposal.

The bulk of the debris anticipated to be encountered during excavation includes concrete pads, asphalt roads, below-grade piping and storm sewers, and structural steel (e.g., supports remaining in basements, etc.). All excavated debris destined for the OSDF will be size-reduced in accordance with the WAC. Acid brick will be removed as part of Operable Unit 3, above-grade building dismantlement and is therefore not expected to be encountered. Similarly, concrete in four process areas (as designated in the Operable Unit 3 Record of Decision for Interim Remedial Actions [DOE 1996c]) will be scabbled as part of above-grade building dismantlement to ensure that the mass-based technetium-99 limit for Operable Unit 3 debris dispositioned in the OSDF will be met. It has been demonstrated in the Operable Unit 3 RI/FS (DOE 1995g) that all remaining concrete to be excavated as part of at- and below-grade remediation meets the OSDF radiological/chemical WAC.

Below-grade piping that is not process-related (e.g., storm sewers, steam lines, potable water lines, conduit, etc.) will be size-reduced in accordance with the WAC and dispositioned in the OSDF. If these non-process pipes are excavated from areas of soil that do not meet the OSDF WAC, any remaining clumps of excess soil will be knocked or scraped off the exterior of the pipes prior to OSDF disposition.

Below-grade piping that is or has historically been process-related will be managed in accordance with the conceptual waste disposition process described in Section F.5 of Appendix F. In general, this piping will be inspected to ensure the piping is free from "visible process residues." The definition of visible process residues (green salt, yellow cake, etc.) is material on the interior surface of the pipe that is obvious and that, if rubbed, would be easily removed. Stains, rust, and corrosion do not qualify as visible process material. If a pipe fails visual inspection, a determination will be made either to decontaminate the piping or to containerize it for off-site disposition.

### 2.1.3 Final Remediation Levels

Final remediation levels (FRLs) are the cleanup goals for a remediation project. A FRL is the average concentration of a contaminant that can remain in an area under a given exposure scenario and still be protective of human health and the environment. Remediation at the FEMP will remove contaminated soil until the average residual concentration in any potential certification unit (CU) (Section 2.1.5.1) is at or below the respective FRL.

The FEMP FRLs are listed in Table 1-5. A summary of how FRL attainment will be demonstrated is provided in Section 2.2.2. Several issues regarding FRLs at the FEMP should be noted:

- Five contaminants listed in Table 1-5 (alpha-chlordane, chlorobenzene, tetrachloroethene, toxaphene, and trichloroethene) have an associated chemical/radiological WAC, but no corresponding FRL. This is because WAC were developed for all RCRA hazardous constituents, regardless of whether the contaminant was detected in environmental media at the FEMP or not.
- The FRL for several contaminants [technetium-99, bis(2-chloroisopropyl)ether, boron, bromodichloromethane, and 4-nitroaniline] is equal to or greater than the corresponding chemical/radiological WAC. This means that all material with contaminant levels that exceed the respective FRL also exceed the WAC. Except for that contaminated with technetium-99, such material must either be transported off-site for disposal, or treated, as required, for disposal in the OSDF. All material with technetium-99 levels above the WAC/FRL will be dispositioned off site. The fact that the FRL is less than or equal to the WAC does not change the approach to be used to excavate such contaminated material. As described in detail in Section 3.3.1.2, the general procedure is to delineate and excavate material that exceeds the WAC first. If all of the material that exceeds the WAC for these contaminants is removed, all of the material that exceeds the respective FRL will also be removed.
- The FRL for several contaminants (3,3'-dichlorobenzidine, heptachlorodibenzofuran, heptachlorodibenzo-p-dioxin, and n-nitrosodipropylamine) is at or below the respective PQL.

This is because the PQL was not taken into account when developing the FRL for these contaminants. As discussed below, none of these contaminants was detected at a concentration above the respective FRL.

- The FRL for total uranium is very low (20 mg/kg) in certain portions (Figure 2-3) of the Former Production Area and at the Sewage Treatment Plant (STP). This is because the uranium in these areas is more soluble, and therefore, more mobile, since the uranium purification process used at the FEMP involved solubilizing the uranium to separate it from the ore impurities. This low FRL will present special measurement concerns (Section 2.4) during excavation control, precertification, and certification activities.
- The FRLs for several radionuclides are very low in certain portions of the Inactive Flyash Pile and the South Field. This is because the till (which serves to retard the movement of contaminants) in these portions of these areas is very thin or nonexistent. These low FRLs will present special measurement concerns (Section 2.4) during excavation control, pre-certification, and certification activities.
- The FRL for thorium-232 will be used to assess attainment of thorium-228 and radium-228 FRLs. This approach is based on the assumption of secular equilibrium between members of the thorium-232 decay chain at the FEMP (DOE 1997e).
- As indicated on Tables 2-1 and 2-2, there are several constituents associated with HWMUs and USTs for which there are no FRLs. In addition, for the active HWMUs, the final list of constituents is to be determined. In all such cases, the nature and extent of contamination associated with HWMUs/USTs will be determined as part of remediation activities. To the extent possible, this determination will be made during the pre-design investigations (Section 3.1). In some cases, this may be unsafe, impractical or infeasible, in which event the determination of the nature and extent of contamination will be made after the HWMU/UST is removed. If constituents for which there are no FRLs are detected, location-specific FRLs will be developed and implemented.
- As discussed in the following paragraphs, a limited list of FRLs is widely applicable to soil and soil-like material. A more inclusive list is applicable to certain areas.

#### 2.1.3.1 Application of FRLs to Soil Remediation

As shown in Table 2-7, the FRL for most constituents (shaded) is above the highest concentration detected during the RI/FS process for Operable Unit 5. In most of these cases, the FRL is at least an order of magnitude above the maximum detected level. Given the level of conservatism provided in the development of the FRLs (Section 2.2.2) and this difference between the respective FRL and the maximum concentration detected on site, no additional verification is required to demonstrate that the FRL has been met for most of these constituents in soil. There is one exception to this: bromodichloromethane, which had detection limits for some samples that were above the respective FRL. This constituent will remain on the list of ASCOCs (Section 2.1.3.3) for the pre-design

investigations (Section 3.1) to confirm its presence or absence in the areas where the detection level was above the FRL. As discussed in Section 3.1, the list of secondary ASCOCs may change based on the results of the pre-design investigations.

2.1.3.2 Primary and Secondary COCs

As indicated in Table 2-7 by the number of positive detections versus the total number of samples taken, the extent of most of the constituents with levels above the respective FRL is limited. To account for this, primary and secondary COCs have been established. Primary COCs are considered to be the widespread contaminants which represent approximately 90 percent of the human health risk from soil. Secondary COCs are those which have localized contamination above the FRL, but the extent of contamination is limited to smaller areas, or has intermittent hits marginally above the FRL over large areas (metals) which may or may not reside entirely within the footprint of the primary constituents.

Primary and secondary COCs are identified in Table 2-8, along with the factor that drives their inclusion as a site-wide COC. There are five primary COCs (total uranium, radium-226, radium-228, thorium-228, and thorium-232) and 27 secondary COCs. In addition, constituents of ecological concern (COECs), which are related to Benchmark Toxicity Values (BTVs) (Section 2.1.4), are included to provide a complete list of constituents affecting remediation activities. As noted in Section 2.1.3, the activity of thorium-228 and radium-228 are assumed to be equivalent to that of thorium-232 for FRL attainment and reporting purposes.

2.1.3.3 Area-Specific COCs

Because, by definition, secondary COCs are limited in extent, each will be important only in the area in which it has been detected. Therefore, area-specific COCs have been established. ASCOCs represent the COCs that have been demonstrated to impact a specific work area and for which concentrations will be certified in that specific work area.

To evaluate the site-wide, spatial extent of the constituents, their relationship to FRLs, BTVs (Section 2.1.4), and OSDF WAC was determined. To do this, a series of maps (Appendix I) was assembled which display the actual distribution of contamination sitewide and identify the extent of contamination

within the eight Remediation Areas (Figure 1-3). These maps also indicate if a COC distribution is confined to a limited area or if it impacts larger areas. The ASCOCs for each of the remediation areas were identified based on the sample results represented by these maps, augmented by process knowledge. The results of this analysis are shown in Table 2-9. COECs (Section 2.1.4) are also included in Table 2-9 to provide a complete, area-specific list of constituents that affect remediation.

### 2.1.4 Benchmark Toxicity Values

Benchmark toxicity values (BTVs) are literature-derived levels of contamination considered protective of ecological receptors. The BTVs developed for soils at the FEMP are listed in Table 1-5. If the concentration of a contaminant exceeds its respective BTV, the constituent is identified as a constituent of ecological concern (COEC). The Sitewide Ecological Risk Assessment compares BTVs to all contaminant concentrations in non-source areas of the FEMP. As discussed below, only three constituents have been designated as COECs. The residual concentration of these constituents in the applicable area following excavation will be documented in the FRL certification process (Section 3.4). Based on these results, any further action recommended by the Natural Resource Trustees will be addressed in the Natural Resource Restoration Plan (Section 1.4.2).

Several issues should be noted in regard to BTVs, as detailed in the Constituent of Ecological Concern Review, included as Appendix C:

- The BTV for many constituents is higher than the respective FRL. Therefore, concerns in regard to the impact of these constituents on ecological receptors will be addressed through achievement of FRLs (Section 2.2.2).
- The BTV for 17 constituents in FEMP soil is below the respective FRL. The Constituent of Ecological Concern Review (Appendix C) shows that all of these constituents will be adequately addressed through current excavation plans.
- For the source areas not evaluated in the Sitewide Ecological Risk Assessment, a sitewide data review was conducted and is summarized in Appendix C. This review indicates that all but three contaminants (antimony, cadmium, and silver) are either at the respective background concentration (DOE 1993b) or are not detected above the BTV in the RI/FS database of samples of soil expected to remain after remediation. Antimony was detected at elevated levels in samples from the K-65 Silo and the Active Flyash Pile areas. Cadmium was detected at elevated levels in samples from the Boiler Plant and Building 12 areas. Silver was detected at elevated levels in samples from the Solid Waste Landfill, Building 12, and the Active Flyash

Pile areas. As stated above, the residual concentration of these constituents in the respective area will be documented in the FRL certification process after excavation.

### 2.1.5 DOE Orders

U.S. Department of Energy (DOE) orders provide generic guidelines for residual radioactive material. Of particular interest in terms of soil excavation at the FEMP are those sections which relate to the size of CUs and sitewide criteria for radiological hot spots, and which specify ALARA requirements. Other orders which affect soil excavation activities are discussed in Appendix A and will be incorporated into the area-specific IRDPs (Section 7.1).

#### 2.1.5.1 Size of Certification Units

Guideline levels of radionuclide contaminants are calculated levels that are expected to ensure protectiveness of human health and the environment. Guidelines are expressed in terms of activity per unit mass and are averaged over a predetermined area. Depending upon the regulatory agency, the methodology used to calculate the guidelines, the impacted medium, and the specific type of site, the averaging area generally ranges from 100 to 10,000 square meters and higher for land areas.

DOE guidelines for soil are defined as contaminant levels averaged over a surface area of 100 square meters (DOE Order 5400.5, Chapter IV, Section 4, Paragraph a). This surface area was originally adopted to ensure consistency of DOE decommissioning activities (in particular, the Uranium Mill Tailings Remedial Action Program [UMTRAP]) with the U.S. Environmental Protection Agency (EPA) mill tailings regulations (40 CFR 192) and the 1981, Nuclear Regulatory Commission (NRC) Branch Technical Position, "Disposal or On-Site Storage of Thorium or Uranium Wastes from Past Operations." With the exception of sites where the contaminant is mill tailings, an averaging area other than 100 square meters may be established as an integral condition of site-specific guidelines (DOE Order 5400.5, Chapter IV, Section 5, Paragraph a). Conditions and methods for establishing site-specific guidelines are provided in RESRAD (DOE/CH-8901). Development of CU size for FEMP certification activities is discussed in Section 3.3.3.2.

2.1.5.2 Radiological Hot Spots

Potential radiation doses are influenced by contaminant distribution patterns. Subareas which are significantly smaller than the averaging area (Section 2.1.5.1) will result in a smaller potential dose than would result if the entire averaging area were contaminated at that level. The relationship between acceptable contaminant levels in small areas and the average guideline level varies, depending on the radionuclide, the exposure pathway and scenarios, and the size of the area. DOE Order 5400.5 requires that site-specific limits for such hot-spot areas be developed for situations where the contaminant level in any area of less than 25 square meters exceeds the average guideline level by a factor of $(100/A)^{0.5}$, where A is the area in square meters (DOE Order 5400.5, Chapter IV, Section 4, Paragraph a[1]). From this guidance, it is evident that small areas of residual activity exceeding the average guideline levels may be present while still ensuring that the basic dose criteria are met. The development of radiological hot-spot criteria for the FEMP is discussed in Appendix G.

2.1.5.3 ALARA Requirements

Radiological release criteria for equipment, structures, and environmental media must be established as part of the decommissioning planning process (DOE/EM-0246). The document "A Manual for Implementing Residual Radioactive Material Guidelines" (DOE/CH-8901) is identified as the guidance document for developing DOE release criteria (DOE Order 5400.5, Chapter IV). In addition to being protective of human health and the environment, this guidance requires that socioeconomic and technical feasibility issues be considered when establishing ALARA levels for residual contamination. The guidance specifies that, for ALARA purposes, reasonable efforts must be made to remove residual contamination that exceeds 30 times the average guideline level (DOE Order 5400.5 and DOE/CH-8901). A discussion of the development and implementation of ALARA guidelines for the FEMP is provided in Section 3.3.1.4.

## 2.2 ATTAINMENT OF REMEDIATION GOALS

Several issues are of importance in attaining remediation goals at the FEMP. These include demonstrating attainment of WAC for the OSDF, certifying attainment of FRLs (including radiological hot-spot criteria), and closure of HWMUs and USTs. The general procedures for attaining these goals are discussed in the following paragraphs.

### 2.2.1 Demonstrating OSDF WAC Attainment

The objective of compliance demonstration is to provide an acceptable level of confidence that a criterion, in this case WAC for the OSDF, has not been exceeded. WAC for the OSDF are established in the Impacted Materials Placement Plan (DOE, 1996b). The WAC are based upon criteria established and approved in the Final ROD for Remedial Actions at Operable Unit 2 (DOE, 1995d), the Final ROD for Remedial Actions at Operable Unit 5 (DOE, 1996d), and the Operable Unit 3 ROD for Final Remedial Action (DOE, 1996c).

As indicated in these documents, the radiological/chemical WAC were generally developed by:

- Starting with an acceptable concentration of contaminants in the groundwater of the Great Miami Aquifer
- Making a series of conservative assumptions to determine, through transport modeling, the effective concentration of contaminants in the leachate from the OSDF that would produce the acceptable concentrations in the Great Miami Aquifer
- Making additional, conservative assumptions to determine the maximum average solid phase concentration, or total mass of contaminant, in the entire OSDF that would produce the leachate concentrations.

It is estimated that the assumptions used to develop the WAC for the OSDF provide at least an order of magnitude of conservatism in protecting human health and the environment. The issue is to recognize this built-in conservatism when establishing procedures to demonstrate attainment of WAC for the OSDF. Therefore, as described in further detail in Section 3.3.4.1, the general approach for demonstrating attainment of the WAC is to identify locations where contaminant concentrations exceed the WAC for any ASCOC (Sections 3.1 and 3.2), remove that material for separate handling (Section 3.3), and demonstrate that all such material has been removed from that location (Sections 3.3.3, 3.3.4, and 3.4). Because of area-specific conditions that may require different measurement (Section 2.4) and/or excavation procedures, area-specific approaches are required to allow efficient attainment of WAC. Section 4.0 provides the conceptual approaches to attainment of WAC in various types of areas at the FEMP.

### 2.2.2 Certifying FRL Attainment

Another goal of the soil remediation activities at the FEMP is to remove contaminated soil such that the average residual concentration of any contaminant in a CU is at or below the respective FRL. Documentation of FRL attainment must provide an acceptable level of confidence that this has occurred. Complete, or 100 percent, confidence cannot be obtained because it is impossible to sample every cubic foot of soil and, even if it were, there would still be some level of uncertainty in the analytical results. Therefore, to provide a quantitative estimate of the probability that the average residual concentration of a contaminant in a CU does not exceed the respective FRL, it is necessary to use statistical methods. Statistical methods provide for specifying (controlling) the probability of making decision errors and for extrapolating from a limited set of measurements to a specified area in a scientifically valid fashion. Appendix G provides a discussion of statistical methods to be applied to the certification process at the FEMP.

FRLs were developed during the RI/FS process for each operable unit in a manner similar to that used to develop WAC for the OSDF (OU5 ROD, DOE 1996d). The exception is that specific conditions outside the OSDF, including the hydrogeology, area, and area-specific thickness of underlying formations, were used for the fate and transport modeling process in developing FRLs. Like the WAC for the OSDF, the assumptions used to determine the FRLs also provide a very significant level of conservatism in protecting human health and the environment.

To certify FRL attainment, significant evidence must be provided to demonstrate that the average concentration of any ASCOC does not exceed the respective FRL. The issue is to recognize this built-in conservatism when establishing procedures for certifying FRL attainment. Therefore, the general approach for demonstrating attainment of FRLs is to identify locations where contaminant concentrations exceed the FRL for any ASCOC (Sections 3.1 and 3.2), remove that material for disposition in the OSDF (Section 3.3), and certify, with a specified level of confidence, that the average residual concentration of each ASCOC is below the respective FRL (Sections 3.3.3, 3.3.4, and 3.4). Because of area-specific conditions that may require different measurement (Section 2.4) and/or excavation procedures, area-specific approaches are required to allow efficient attainment of FRLs. Section 4.0 provides the conceptual approaches to attainment of FRLs in various types of areas at the FEMP.

### 2.2.3 Detection of and Criteria for Hot Spots

As described in Section 2.1.3, an FRL is the average concentration of a contaminant that can remain in place under a given exposure scenario and still be protective of human health and the environment. As such, FRLs are designed to limit risks incurred by various human receptors from direct and indirect exposures to contaminants in a large area. These risks are calculated using the assumption that contaminants are distributed approximately uniformly across a source area.

As described in Section 3.4.2, the residual concentration of contaminants will be characterized by sampling at a limited number of locations within each CU. As detailed in Appendix G, statistical methods will then be used to determine the attainment status of the CU based on the average level of each ASCOC compared to the FRL. However, there is a finite possibility that small areas of elevated residual contamination (i.e., hot spots) will be missed by the sampling program. It is desirable to identify and remove these hot spots, if possible.

The concept of hot spots may be applied to all ASCOCs (Section 2.1.3.3). However, some radiological ASCOCs can be detected in-situ using field scanning technologies and experience has shown that other ASCOCs at the site are often co-located with the primary ASCOCs. This in-situ scanning technology provides an additional capability to look for hot spots beyond that normally used for chemical contaminants. This improved capability allows the field survey teams to actively look for hot spots during pre-certification activities (Section 3.3.3). By identifying and excavating hot-spots containing the primary ASCOCs, this method also reduces the probability that hot spots of secondary ASCOCs will remain.

Currently the instrumentation discussed in Section 2.4 allows hot spots of uranium, thorium-232, and radium-226 to be identified and delineated. This approach provides additional confidence that all five primary ASCOCs will be remediated to health protective levels by the SCEP process, since thorium-232 is a reliable indicator of thorium-228 and radium-228 at the site (Section 2.1.3).

As detailed in Section 3.3.3.1, scanning of the entire surface of the remediated area will be used, to the extent possible, to reduce the possibility that radiological hot spots are missed. Such scanning may not be possible in some locations, including those near obstructions, such as trees and water, and in deep,

narrow excavations, such as those for pipelines. In the case of deep excavations, additional emphasis will be placed on RI/FS, pre-design, excavation control monitoring, and certification data to minimize the presence of hot spots.

Large-volume sodium iodide (NaI) detectors currently being tested at the site are capable of detecting areas of elevated radioactivity in a scanning mode. If such areas are detected, their locations will be marked and a direct measurement system using a high-purity germanium detector (HPGe) will be used to characterize the gamma-emitting activity of radionuclides and determine if the area meets the radiological hot spot criteria. This information will be used to decide whether further excavation in the area is warranted. The criteria for such decisions, as detailed in Appendix G, are as follows:

**Criteria for Radiological Hot Spots**

| Primary ASCOC | Maximum Level |
|---|---|
| Total uranium | 246 ppm |
| Radium-226 | 5.1 pCi/g |
| Thorium-232 [a] | 4.5 pCi/g |

Notes: [a] Assumed to be equivalent to activity of thorium-228 and radium-228 (Section 2.1.3).
pCi/g = picocuries per gram
ppm = parts per million

### 2.2.4 HWMU Closure

As described in Section 2.1.1, RCRA regulations require closure of HWMUs that are no longer in service. As discussed in Section 2.1.1.1, 29 HWMUs at the FEMP remain to be closed under the CERCLA remedial response action. RCRA regulations (40 CFR 264) and OEPA regulations (OAC Chapter 3745-55) describe closure requirements for various types of HWMUs, including containers, tank systems, surface impoundments, waste piles, land treatment units, landfills, incinerators, drip pads, and miscellaneous units. These regulations require closure in a manner that

> *. . . controls, minimizes or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere.* (40 CFR 264.111)

This is generally required to be accomplished by removing or decontaminating waste residues, contaminated containment system components, contaminated soils, and structures/equipment contaminated with the waste or leachate. A crosswalk between OEPA closure requirements and the FEMP CERCLA documentation that fulfills these requirements is included as Table 2-10.

In all cases, except the Abandoned Sump west of the Pilot Plant (HWMU No. 22), characteristically hazardous materials have been removed from the HWMU. In the case of the Abandoned Sump (which is one of the seven characteristically hazardous areas [Section 2.1.1.3]), any such materials exceeding limits for RCRA characteristically hazardous wastes (40 CFR 261.24) will be delineated during pre-design investigations (Section 3.1) and segregated during excavation (Section 3.3.4.3) for appropriate treatment and disposal..

Several of the HWMUs are approximately the size of, and even larger than, a CU (Section 2.1.5.1), but most are smaller. For all HWMUs, a minimum of four samples will be used to demonstrate closure. For those HWMUs that represent a significant portion of a CU or are larger, closure will be demonstrated using all samples collected in the FRL certification process (Section 3.4) that fall within the footprint of the unit. For HWMUs that are smaller than a CU and have less than four certification samples within the footprint of the HWMU, additional random samples will be collected, as necessary, to achieve a total of four. This procedure will ensure a sample spacing within the footprint of the HWMU that is at least as dense as that used to demonstrate FRL attainment, as well as ensure that multiple samples are used to demonstrate closure. In all cases, closure will be demonstrated by showing that the average residual concentration of each contaminant for which the HWMU is designated hazardous (Table 2-1) is below the respective FRL.

### 2.2.5 UST Closure

As described in Section 2.1.1.2, 14 USTs are to be closed under the CERCLA remedial response action. In some cases, this closure may be demonstrated using existing data collected at the time the tank was removed. For the remainder, the procedures outlined in this subsection will be used to demonstrate closure.

Unlike HWMUs, all of these USTs are relatively small and shallow with respect to the anticipated depth of excavation to achieve FRLs. Therefore, where required, four random samples will be collected from within the footprint of the UST following completion of excavation. This will provide a higher density of sampling than that used to demonstrate FRL attainment, as well as ensure that multiple samples are used to demonstrate closure. To the extent possible, samples collected for FRL certification will also be used for UST closure purposes. These samples will be analyzed for the constituents of materials stored in the UST (Table 2-2). Closure will be demonstrated by showing that the average residual concentration of each contaminant is below the respective FRL.

## 2.3 GENERAL IMPLEMENTATION GUIDELINES

As discussed in Section 1.1, one of the purposes of the SEP is to establish guidelines for the implementation of remediation activities at the FEMP. Issues in terms of implementation include remediation priorities, procedures for implementation, sequencing and coordination, planning for unexpected conditions, tracking of data, audit and assessment procedures, reporting requirements, and health and safety. Each of these is discussed in the following paragraphs.

### 2.3.1 Remediation Priorities

As discussed in Sections 2.1 and 2.2, there are a variety of issues that drive and influence remediation activities at the FEMP. To avoid potential conflicts and unacceptable mixing of materials during the excavation, segregation, handling, and disposal processes, these issues have been prioritized as follows for FEMP soil remediation activities:

1. Health and safety (Section 6.0)
2. WAC attainment (Section 3.3.4.1)
3. FRL attainment (Section 3.3.4.2)
4. ALARA (Section 3.3.1.4).

The health and safety of personnel associated with remediation activities has to be the prime consideration during remediation activities. After that, removal, segregation, and proper disposal of material with the highest levels of contamination is of major importance. This priority is followed by removal, segregation and proper disposal of material with lower levels of contamination. The final

priority is the demonstration that long-term residual risk is minimized. Achievement of these goals following this prioritization will satisfy other issues, including meeting ARARs and complying with DOE orders.

### 2.3.2 Implementation Procedures

Remedial action implementation under the scope of the SCEP includes all activities associated with planning, design, excavation, management, and disposition of at- and below-grade soil, structures, and debris at the FEMP. As described in Section 7.0, implementation plans, design, and construction specifications will be used to prepare area-specific integrated remedial design packages (IRDPs). Lessons learned during the Area 1, Phase I remediation project have been incorporated into the SEP. All future IRDPs developed pursuant to the SEP will incorporate lessons learned from previous projects. Based on the information contained in the IRDPs, construction contractor(s) will be selected to complete the excavation. The general construction implementation and material handling procedures are detailed in Appendix F.

### 2.3.3 Sequencing and Coordination

Effective sequencing and coordination of remediation activities at the FEMP depend on a complex relationship between a wide variety of activities, including:

- Decontamination and dismantlement (D&D) of above-grade facilities
- Construction of the OSDF
- Excavation of soil and at- and below-grade structures and debris
- Placement, and proper mix ratios of soil and debris, in the OSDF
- Schedules for waste pit and silo remediation activities
- Availability of storm water and remediation wastewater treatment capacity.

The objective of excavation activities is to remediate the FEMP in a safe, timely and cost-effective manner that is protective of human health and the environment. The purpose of sequencing and coordination is to facilitate this objective. The following paragraphs describe how sequencing and coordination will occur on both a sitewide basis and within each remediation area during remediation activities.

2.3.3.1 Sitewide Sequencing Approach

As detailed in Appendix B, sitewide sequencing and coordination will be protective of human health and the environment by minimizing potential exposure to contamination during remediation. In addition, sequencing will minimize the potential for cross-contamination and recontamination. These goals will be achieved by:

- Prioritizing the excavation of contamination source areas
- Excavating from upgradient toward downgradient surface drainage areas to prevent cross contamination and recontamination
- Controlling haul routes to minimize cross-contamination of all areas and recontamination of clean areas
- Using paved roads and dust control methods, to the extent practical, to minimize dust generation, avoid cross-contamination between areas, and prevent recontamination of clean areas.

Also as detailed in Appendix B, sitewide sequencing and coordination activities will be cost effective by:

- Minimizing double handling of material
- Establishing large work areas to provide efficient utilization of equipment
- Minimizing haul distances, to the extent possible
- Minimizing unneeded treatment of water from excavation activities
- Minimizing sheeting and shoring of excavated slopes.

The remediation areas and subareas shown on Figure 1-3 and described in Appendix B were established to achieve the stated objective and implementation strategies.

2.3.3.2 Sequencing Within a Remediation Area

Excavation within each remediation area will, in general, be governed by the same objectives and implementation strategies upon which sitewide activities are based. In addition, excavation within each remediation area will generally, as appropriate, progress by:

- Removing at- and below-grade foundations and structures and transferring them to the Waste Disposition Program for decontamination, size reduction and disposition
- Removing material that exceeds WAC for the OSDF
- Removing underground utilities and plugging potential pathways for the migration of contaminants
- Removing material that exceeds FRLs.

This sequence is necessary to efficiently address remediation and to minimize the mixing of contaminated material that requires segregation because of different handling and disposition requirements . Specific details regarding the sequencing and coordination of activities within each remediation area, as well as other site activities, will be included in the IRDPs (Section 7.1). Additional discussion in this regard is provided in Sections 3.0 and 4.0.

### 2.3.4 Contingency Plans

Contingency plans are required for unexpected conditions. The three general categories of unexpected events are:

1. Unearthing of materials that require special handling
2. Discovery of unexpected cultural or historic resources
3. Encountering environmental or material conditions that may pose a risk to human health or the environment if standard excavation practices are used.

Typically, these circumstances cannot be managed through standard excavation guidelines. The procedures to be used in these circumstances are described in Appendix F.

### 2.3.5 Material Data Tracking

It is important to track excavated material to provide an audit trail demonstrating proper handling and disposition. The Integrated Information Management System (IIMS) will be used to track excavated material, including its characteristics, from its original location, through interim staging/storage, to final disposition. IIMS interfaces with the SED to retain connections to RI/FS, historical, and newly generated data when excavated material is moved from the source location. The data tracking system

currently used at the FEMP is summarized in Section 2.5.2 and described in further detail in Appendix F.

### 2.3.6 Quality Assurance

The programmatic QA controls that are applicable to the implementation of the SEP are described in the "Sitewide CERCLA Quality Assurance Project Plan" (DOE 1993a) and SEP Quality Assurance Project Plan (QAPP) in Appendix E. The objective of the QAPP is to ensure FEMP and EPA QA/QC programmatic requirements flow down to IRDPs, data quality objectives (DQOs), project-specific plans (PSPs), procedures, subcontracts and other documents necessary to control soil excavation activities. Independent assessments will be conducted by auditing, surveillance, inspections, and surveying to measure quality, performance, and process compliance. Objective evidence of assessment activities will be part of project records.

### 2.3.7 Report Requirements

The record keeping and reporting requirements for remedial activities at the FEMP are listed in Table 2-11, along with the document that will fulfill the requirement. Reporting requirements will be met through submission of four documents:

1. A Certification Report, demonstrating attainment of all remediation drivers for each remediation area
2. A Remedial Action Report, to be completed upon completion of remedial activities in each operable unit and transferring further closeout responsibilities
3. A Site Closeout Report, which will summarize all of the Remedial Action Reports and certify that site remedial goals specified in the RODs have been achieved
4. The Natural Resource Restoration Plan, the final revision of which will also serve as the final land use plan for the site.

Details regarding the contents of these documents are included in Section 7.0.

### 2.3.8 Health and Safety

Health and safety is a priority at the FEMP at all times, and especially during construction activities. To emphasize this, the subcontractor for each project will prepare a Safe Work Plan, which will describe how the work is to be performed, including training requirements, an analysis of hazards,

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procedures for exposure monitoring, and radiological requirements. The Safe Work Plan will be prepared in accordance with the contract documents utilizing the Project-Specific Health and Safety Requirements Matrix (PSHSRM). The PSHSRM is prepared by Fluor Daniel Fernald (FDF), DOE's site management contractor, as an aid in identifying hazards associated with the project. It includes a hazard analysis for each project task and required mitigators, such as personal protective equipment, engineering and administrative controls, planning and permits, personnel and air monitoring, medical monitoring and surveillance, and decontamination and disposal procedures. In addition, FDF will prepare a Project-Specific Health and Safety Plan (PSHASP), which will specify health and safety procedures to be used by the subcontractor and his subcontractors, as well as all personnel on the project site, including visitors, vendors, and FDF and DOE employees (DOE 1995b). More discussion regarding project health and safety is included in Section 6.0.

## 2.4 MEASUREMENT APPROACHES

One important task during a soil remediation project is to identify contaminated soil and accurately quantify the amount of contamination present. An array of technologies will be used to accomplish this task at the FEMP.

Each of these technologies has advantages and disadvantages, and a given technology's efficacy for a specific task is related to the ASCOC (Section 2.1.3.3) and the task's DQOs. At the FEMP, measurement technologies and tasks will be carefully matched to ensure data is collected in a correct and cost-effective manner.

### 2.4.1 Remedial Action Applications

Soil remediation of the FEMP requires collection of additional data on specific contaminants for many purposes. Some of the more important phases of data collection supporting excavation are listed below:

- Pre-excavation Surveys - The nature and extent of contamination at the site must be quantified. This allows the delineation of the an excavation footprint and estimation of the excavation volume. This data will be used to plan the ultimate disposition of material removed by identifying soil requiring special handling. Examples include soil containing more than 30 pCi/g technetium-99, soil with RCRA characteristics from the seven areas, and soil containing ASCOC concentrations that might exceed the OSDF WAC.

- Excavation Control Surveys - As surface soil is removed, the soil beneath it is exposed. In areas where the depth profiles of contaminant concentrations cannot be efficiently determined before excavation, information on the status of this residual soil must be gathered to determine whether the soil is above or below the removal and/or special-handling criteria for that task. This information will be used in the decision to continue excavating or to stop at the current grade level.
- Pre-certification Surveys - Once excavation is complete in an area, the residual soil concentrations of the contaminants that governed the excavation can be determined. This information will be used to verify that the remediation objectives for the area have been met, and final certification activities may begin.
- Certification Surveys - After the pre-certification survey has indicated the remedial objectives have been met, additional data will be collected to confirm this. This confirmatory data will be the data of record that defines the area's final status and will be used to certify that the area is suitable for release to its final land use.

Each of the phases listed above requires characterization of the concentrations and extent of ASCOCs in soil and sediment. Data collection during each of these phases will be supported through a coordinated and integrated combination of direct instrument measurements in the field, and sampling and laboratory analysis. Table 2-12 presents a list of the data collection phases and the measurement methods that can be efficiently used during each phase.

Instrumentation and survey methods will be selected on an area-specific basis and presented in each IRDP depending on area-specific physical conditions and ASCOCs. Section 2.4.5 presents a summary of design considerations that will be incorporated into the selection process.

### 2.4.2 Field Measurements

Certain technologies provide information about contamination in the field. Some of these technologies are only suitable for rudimentary field screening, whereas others can be used to accurately quantify ASCOC levels in surface soil. The following sections introduce some of these technologies. The discussion is divided into two parts. The first part discusses gamma spectroscopy, which can be used to relate gamma activity to uranium and thorium concentrations in soil, and to provide quantitative information on uranium and thorium. The second part introduces the other technologies that may be used for various screening-level applications . Specific application of these technologies is discussed in Sections 3.0 and 4.0.

2.4.2.1 Gamma Spectroscopy

When radioisotopes decay, they release energy. This energy sometimes takes the form of gamma rays. Each gamma-emitting radioisotope produces a unique spectrum of gamma rays that can be used to discriminate that isotope from other isotopes. If information on the density of the subject material is available, this spectrum can be used to determine the concentration of the isotope in environmental media. The equipment required to measure the gamma rays produced by radioisotopes in soil is small enough to be carried to the field and used to perform in-situ measurements of radioisotopes. Two such systems have been developed for use and tested at the FEMP. The one field measurement system, intended for wide-area screening, consists of a mobile, low-resolution gamma spectrometer. The other system is a stationary, high-resolution gamma spectrometer and is used for locations requiring more complete quantitative characterization. The systems have two advantages over discrete soil sampling techniques: they can provide a complete coverage of the surface areas and they have the ability to assess the data promptly following the measurements.

Both mobile and stationary gamma spectrometry systems are capable of monitoring uranium. The systems can also monitor thorium-228, thorium-232, radium-226 and radium-228 under conditions of secular equilibrium.[1] Some of the secondary radiological ASCOCs (e.g. technetium-99) are not gamma emitters and require laboratory analysis of samples. However, the most common condition requiring remediation of secondary ASCOCs at the FEMP is an area contaminated with uranium accompanied by other primary and secondary ASCOCs. In most cases, characterization of the uranium contamination footprint is inclusive of other ASCOCs.[2] As specifically indicated in Section 4.0, there will be sufficient sampling and analysis to assume characterization of relevant ASCOCs in the relatively rare situations where uranium is not the dominant ASCOC.

[1]Secular equilibrium describes a situation when the activity of a radionuclide and the activity of its radioactive decay product(s) are the same. Once this occurs, it is a stable condition unless some physical or chemical process separates the members of the decay chain.

[2]One notable exception is soil contaminated with concentrations of technetium-99 that exceed its FRL of 30 pCi/g. Because the FRL and the WAC for technetium-99 are essentially the same number care must be taken to excavate technetium contaminated soil separately and send it off-site for disposal.

Large-Volume NaI Spectroscopy

Initial scanning of surface areas can be accomplished using mobile gamma spectrometry configurations built around a large 4-inch by 4-inch by 16-inch, NaI (Tl) gamma scintillation detector. Two mobile configurations are used in a very similar fashion. The mobile, real-time radiation tracking system (RTRAK) is an enclosed agricultural tractor fitted with a NaI detector positioned perpendicular to the direction of travel, global positioning system (GPS), and on-board computers. The second system is mounted on a three-wheeled, bicycle-tired platform for manual movement over areas that are inaccessible to the tractor. The latter system has the long axis mounted in the direction of travel. Other than the conveyance, both systems utilize similar hardware and software for data accumulation and reduction. Both systems have the detectors mounted with the center of the detector at a height of 31 cm (1 ft) above the surface; calibration and response are essentially identical. The "field of view" for a single, stationary measurement of characteristic gamma ray energies by these systems covers a radius of approximately two meters, equivalent to an area of 12.6 $m^2$ (136 $ft^2$).

The combination of the rate of travel and timing of successive data accumulation assures complete area coverage. Parallel runs are spaced to afford some detection field overlap for complete coverage.

Field trials at the FEMP have demonstrated the sensitivity and accuracy for this mobile screening. Performance is currently characterized by mean levels less than 3-times the FRL for total uranium, thorium-232, and radium-226. A more detailed description of these systems is provided in Appendix H.

The large-volume NaI systems described above can effectively scan nearly 100 percent of an area that is being radiologically surveyed. They provide quantitative information on specific radionuclides as well as gross activity measurements. These systems can be used when seeking information on the magnitude and areal distribution of gamma emitters in surface soil. Examples of suitable RTRAK applications include mapping areas of soil where concentrations of specific gamma emitters exceed the respective WAC, surveying post-excavation terrain to determine whether hot spots exist after excavation, and identifying areas where additional surveys should be conducted using more sensitive technologies like the HPGe discussed below (DOE 1997d).

Stationary, High-Purity Germanium

The portable, in-situ, high-purity germanium detector spectrometry system (HPGe) used at the FEMP provides quantitative, isotope-specific measurement capabilities. It is built around a tripod-mounted, high-resolution, HPGe n-type detector that is rated at 90 percent efficiency [relative to NaI (Tl)]. The energy resolution is better than 2 percent at 1.332 Mev. The field package tested at the FEMP includes a high-speed, multi-channel analyzer and laptop computer.

Correlation of the HPGe results to soil concentrations has been established through the use of test plots of on-site contaminated areas. The HPGe results have been correlated with scores of laboratory-analyzed soil samples from those test plots. A complete assessment of these correlations has been reported in the Characterization Comparability Study (DOE 1997e). Performance is characterized by Minimum Detectable Concentrations (MDC) that are less than the FRLs and with demonstrated statistical confidence below the FRL concentrations. A more detailed description of the system is provided in Appendix H.

The recent comparability study conducted at the FEMP indicates the HPGe system is capable of conducting screening measurements (ASL A) for uranium, thorium-232, and radium-226 concentrations in soil that are equal to or less than the radionuclide's FRL. The same study indicates that uranium, thorium-232, and cesium-137 meet all acceptance criteria for ASL B and D. Based on this information, HPGe can be used to delineate excavation footprints for gamma-emitting radionuclides; to characterize hot spots detected by scanning, and to quantify uranium, cesium-137, thorium-232, radium-228, and thorium-228 concentrations as part of the FRL attainment certification [3] (DOE 1997d). When HPGe is used to certify FRL attainment, discrete soil samples will be taken for 10 percent of the locations where measurements are performed. This QA/QC program will provide added assurance that the HPGe system continues to provide high quality data, and will contribute additional data on the relationship between radium-226 concentrations as measured by HPGe and laboratory analysis.

[3]Assuming secular equilibrium exists between members of the thorium-232 chain.

HPGE is the preferred method for certification of uranium, thorium-232 and its daughters, and cesium-137 radionuclides because of its rapid turn-around time and its comparatively large field of view. For example, if final certification in an area is based on information gained from discrete 16 soil samples, the total surface area represented by the soil samples is approximately 0.22 $m^2$ (2.4 $ft^2$). Sixteen HPGe measurements would provide concentration data on an area of approximately 314 $m^2$ (3380 $ft^2$).

2.4.2.2 Other Field-Capable Technologies

Other technologies exist that can detect the presence of some of the ASCOCs at the FEMP. In their current form, these technologies cannot be used to accurately determine soil concentrations at the FEMP. They can be used on a more rudimentary level for field screening tasks. Although screening measurements cannot be related to soil concentrations, screening measurements will permit instant recognition of elevated contamination levels and will also serve to support proper controls for radiation safety and industrial hygiene. As such, they may be used on an area- and task-specific basis, depending on site conditions and the task's DQOs.

Field screening technologies include portable radiation detectors such as alpha scintillation detectors, thin-window G-M detectors, gas-flow proportional detectors, and gamma scintillation detectors. Portable x-ray fluorescence detectors can be used for high concentrations of metals. Photoionization detectors and time-of-flight mass spectrometers can be used to monitor some airborne organics (NRC 1995a and 1995b).

2.4.3 Road Transportable Analytical Laboratory

A limited-capacity, road-transportable analytical laboratory (RTAL) can be considered to provide analyses for sample screening. This capability is particularly attractive if it is anticipated that a large number of samples will be generated in a short time period. Since RTALs contain the same equipment found in a typical fixed laboratory, results of comparable quality can be produced while reducing sample shipping time, handling losses, and other delays. RTALs have two primary advantages over large commercial or institutional laboratories: they can be dedicated to a single project and afford a faster turn-around time because they are located close to the sampling locations. This enhanced analytical response time will expedite field decisions. An RTAL can also be used to screen materials

sent to full service analytical laboratories to ensure they are handled properly as radioactive or nonradioactive samples.

A field laboratory can be equipped to have capabilities for low-resolution gamma spectrometry, high-resolution gamma spectrometry, and low-background alpha and beta counting. Other possible supplemental analytical capabilities can also be considered. For example, it would be advantageous to analyze for technetium-99 through chemical separation and liquid scintillation counting. Also, liquid scintillation alpha spectrometry is also possible through chemical separation and the use of unique, metal-specific extractants. Another potential procedure utilizes filter media packed with ion exchange resin for capture of specific radionuclides for analysis. Similarly, other analytical methods have been assessed for analysis of organics and metals among the secondary COCs. Based on existing RI/FS data, none of these analytical technologies appear to be appropriate for the field laboratory. This is because they are not necessary and/or the constraints attendant to a limited analytical setting. If a need is perceived in specific areas, these and other new technologies will be assessed during the development of future IRDPs.

The FEMP currently owns three RTAL modules, originally used for the DOE-FETC field demonstration. If deployed, the RTAL would include facilities to properly weigh, dry, and homogenize samples in preparation for gamma spectrometry. Sample preparation facilities would be segregated and controlled from analytical instrument spaces to minimize potential cross contamination.

The instrument systems, sample sizes and analytical geometries would be configured to permit pragmatic and optimized sensitivity with relatively short count times (i.e. less than one hour). The associated level of quality assurance support will be ASL B. However, the procedures will be capable of ASL C support if required. More detailed information describing the field laboratory is contained within Appendix H.

### 2.4.4 Discrete Sampling and Laboratory Analysis

Although effective guidance is provided by field measurements and the field laboratory, final remedial and certification decisions for most ASCOCs will be linked directly to analytical laboratory

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determinations. Field data will help ensure the optimum use of laboratory analysis, including identification of the appropriate analytical requirements and performance.

The number of laboratory samples and the ASCOCs to be analyzed will be determined in the area specific IRDPs and Certification Design Letters. In accordance with the requirements of the Sitewide CERCLA Quality Assurance Plan (SCQ), the sampling plans will specify the appropriate number and type of QA/QC samples to be collected, based on the analytical methods and number of samples. Samples collected for analysis will be submitted to an approved laboratory and analyzed for the indicated contaminants at ASL B, with 10 percent validated at ASL D.

It is currently planned that on-site laboratory will analyze 90 percent of the samples collected during remediation. The remaining 10 percent of the samples will be sent off-site to a qualified full service laboratory.

The scope of the soil remediation project, coupled with demands from Operable Units 1 and 2, indicates a large number of soil samples will require gamma spectral analyses. At present, the on-site laboratory's radiological capabilities are adequate to perform small numbers of alpha and gamma spectroscopy. To meet this 90 percent desire, the on-site laboratory will be upgraded to afford a large throughput of radiological analyses.

Two of the methods commonly used to determine the concentrations of uranium and thorium-232 are gamma spectroscopy and alpha spectroscopy. Gamma spectroscopy involves physical preparation of the sample, which is then sealed in a container and analyzed with a gamma spectrometer. The spectrum of gamma rays produced can then be analyzed to determine the activity of gamma-emitting radionuclides present in the sample. Alpha spectroscopy involves chemical dissolution of the sample, plating of the material onto a planchet, and analysis with an alpha spectrometer. The resulting alpha spectrum can then be evaluated to determine the activities of the alpha-emitting radionuclides in the sample.

Experience with these two methods gained during the Area 1 Phase I activities indicates that the two methods produce similar results at the range of concentrations encountered under normal environmental

conditions at the FEMP. However, the ratio of the gamma spectroscopy results to the alpha spectroscopy results for the sample soil sample are generally greater than one. This creates uncertainty about the results produced by both methods. For this reason, the FEMP has chosen gamma spectroscopy as the analysis of choice for uranium and thorium-232 in soil.

The on-site lab will also have to be upgraded to allow it to analyze soil for technetium. In addition, it is envisioned that the capabilities of the lab will be expanded to allow a large number of samples to be analyzed for both metals and organic constituents.

A complete listing of the analytical services that will be utilized is beyond the scope of the SEP. However, sample preparation, analytical methods, and reporting requirements are already well established and documented at the FEMP. Performance requirements for contracted analytical laboratory services are explicit and are contained within bid packages and contracts that constitute the Basic Ordering Agreements. The Basic Ordering Agreements will document the specific analytical procedures to be employed, specific features to be followed within these procedures, and the performance required. These specifications have evolved after several years of development. Contributors included experts from both inside and outside of the DOE analytical community. Through subsequent experience, including data validation and quality assurance surveillance, the original requirements have been extended to cover greater and more specific details for analytical procedures and performance, as documented in the SCQ. This does not guarantee performance. However, it does help ensure that data validation at the analytical laboratories, and again within FEMP data validation process, can qualify any non-performance or questionable performance.

### 2.4.5 Design Considerations for Area-Specific Measurement Approach

The selection of the instrumentation and measurement approach will depend on a number of considerations including:

- Which COCs are in the area? Certain analytical techniques are better suited to quantify some COCs, while other technologies will be better for others. For example, uranium concentrations can be well characterized in soil using gamma spectroscopy, but gamma spectral analysis not an acceptable method to measure technetium-99.

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- What is the lowest detection limit that is acceptable? If the purpose of the measurements are to determine if uranium concentrations in surface soil are above or below the WAC, a large-volume NaI system like the RTRAK will be sufficient. If the purpose is to delineate areas of soil containing uranium with concentrations exceeding the FRL, then measurements using a large are NaI will not be sufficient because the MDL for the system is too high. In the latter case, HPGe or discrete soil sampling and analysis would be indicated.
- What are the physical conditions in the area? Very rough terrain, trees, structures, and steep slopes may preclude the use of vehicle mounted measurement systems like the RTRAK. Gamma spectroscopy systems calibrated for planar (flat) geometries will not give reliable results in trenches or pits unless properly calibrated for those geometries.
- What are the data quality objectives of the data collection program? The data quality objectives of a program will determine which methods are acceptable. For example, if the purpose of the data collected is to screen samples to determine if they require special handling, ASL A quality data will be sufficient. If the purpose of the program is to provide certification of WAC or FRL attainment, all data must meet acceptance criteria for ASL B, and 10 percent of the data collected must be validated to ASL D.
- How quickly will the analytical results be needed? A rapid turn-around time may limit the number of analytical options available.

When the COCs have been selected, the method detection limits (MDLs) are determined, and validation criteria have been set, the SCQ will specify which analyses are acceptable and set the sampling and analytical criteria. Table E-2 in Appendix E of this Plan provides a quick reference guide to pertinent sections of the SCQ.

The number of samples required to satisfy the sampling program's objectives is determined by the specific COCs expected in the area and their projected distribution. As a general rule, areas with a history of past contamination, or areas with a heterogeneous concentration distribution will require more samples per unit area to characterize them than will areas with no history of contamination or with a homogeneous distribution. This is described in more detail in Appendix G.

Once the number of samples and the types of analyses are known, the equipment and analytical methods needed to satisfy the requirements of the sampling program can be selected. As noted above, in many cases the SCQ will dictate what equipment and methods are acceptable for the various ASLs. However, in some cases, more than one method will be allowed and then cost, response time, and laboratory capacity can be considered.

## 2.5 LOGISTICS

Several logistical issues are important to implementing soil remediation activities at the FEMP. These include:

- Accounting for area-specific conditions
- Usability and data gaps associated with the RI/FS database
- Handling perched water, deep pile foundations, and subsurface utility lines
- Cross-contamination/recontamination
- Handling special materials
- The capacity of the OSDF
- Concerns with off-site shipments
- Weather
- Access to off-property areas
- Grading and restoration.

Each of these issues is discussed in the following paragraphs.

### 2.5.1 Area-Specific Conditions

Because of its size and complexity, the SEP cannot address all of the area-specific conditions anticipated at the FEMP. Therefore, as discussed in Section 1.1, the SEP only provides programmatic guidance and area-specific conceptual approaches for completion of excavation activities. The IRDPs for individual excavation projects, for which the SEP provides guidance, will provide details of project-specific activities, issues, and conditions (Section 7.1).

### 2.5.2 RI/FS Database

The SED was initially used to manage data generated during RI/FS activities at the FEMP. Tables were added which include soil data from diverse site sources, including but not limited to construction/maintenance projects and material evaluation form (MEF) files. Coordinates for this additional data were estimated from log books and other field sketches. Coordinate-associated data generated during remediation activities, as well as data located through additional file searches, will be entered into the SED.

The IIMS interfaces with the SED. It will be used during remediation to retain connections to sample data when excavated material is moved from the source location to either an interim or final disposition location. IIMS is designed to utilize SED data to accommodate the characterization of bulk waste streams, demonstration of OSDF WAC attainment, and manifesting of material to be dispositioned to the OSDF. IIMS also interfaces with the Site-Wide Information Forecasting and Tracking System (SWIFTS) to allow electronic transfer of bulk waste inventory to the container management system, when containerization is required. Further details regarding the system to track data are included in Section 3.6.4.1.

### 2.5.3 Data Gaps

As demonstrated in the RI/FS reports and RODs for the various operable units, the RI/FS data are sufficient for determining the nature and extent of contamination at the FEMP and for selecting the remedy. However, there are known deficiencies associated with these data that will affect remedial design. For instance:

- Data for previously sampled material that has been moved or removed through removal actions and other activities remain in the SED, inaccurately indicating that original levels of contamination have not changed.
- Data from many areas of the site, including areas where cut and fill activities are known to have occurred, are not included.

As such deficiencies are identified, they are being corrected. In addition, such data gaps will be used to focus pre-design investigations (Section 3.1), the results of which will then supplement the existing RI/FS data, and thus to fill in these data gaps and deficiencies. Revisions and additional data will be presented in the area-specific IRDPs and reflected in the remedial designs.

### 2.5.4 Perched Water

Perched water will be encountered during excavation in most areas of the FEMP, depending on the depth of excavation. In addition, as described in Section 1.3.2.2, some contaminated, perched water zones present an unacceptable threat to the underlying aquifer. Remediation activities will involve excavation of soil in these zones. All perched water, including surface water and rainfall that is mixed with perched water, will be treated at the AWWT facility. Therefore, the quantity and quality of water

expected must be compared to the waste acceptance criteria for the AWWT facility. Of particular concern are organics, since the ability of the AWWT facility to handle organics is limited. If perched water exceeds any of the flow or chemical acceptance criteria, it may need to be flow equalized and/or pretreated prior to discharge to the AWWT facility. In addition, perched groundwater that has potentially come in contact with listed hazardous wastes, such as at the STP Sludge Drying Beds and Fire Training Facility (FTF), will receive pretreatment prior to discharge to the AWWT facility.

The IRDPs will describe expected locations, depth, quantity, quality, and pretreatment requirements for perched water, as well as procedures to minimize potential impacts to the underlying Great Miami Aquifer during excavation activities, for each project.

### 2.5.5 Deep Pile Foundations

Several buildings in Remediation Areas 3 and 4 (Section 1.2.2) have pile foundations that extend to a considerable depth below grade and below any known soil contamination. In Area 3, Building 1A (Preparation Plant) and the Plant 1 Conveyor Pit have sheet piles potentially extending to 33 feet below grade. Similarly, in Area 3, Building 10A (Boiler House) has pile foundations extending approximately 40 feet below the surface, as well as a multi-level basement at least 30 feet below grade. In Area 4, the former Plant 8A Thorium Silos (silos removed) have pile foundations that potentially extend 22 feet below grade.

Because of their depth, none of these pile foundations are expected to be readily removable. If the piles can be removed, it will not be feasible to obtain measurements or collect samples to the full depth of excavation, because the sands of the Great Miami Aquifer will collapse as the piles are removed. In addition, removal of the pile foundations could provide an enhanced pathway for contaminant transport. Finally, any groundwater contamination in the Great Miami Aquifer associated with the piles will be remediated by the aquifer restoration project.

Therefore, the general approach will be to cut the pile foundations off two feet below the excavation elevation dictated by FRLs and leave the portions below that level in place. However, potential impacts associated with this approach will be reviewed during the remedial design phase, and any necessary modifications will be made at that time and described in the appropriate IRDP (Section 7.1).

### 2.5.6 Subsurface Utility Lines

Subsurface utility lines include storm, sanitary, water, electric, gas, and sump lines. Excavation of utilities will include the utility lines themselves and backfill material, which typically consists of sand or gravel and extends below the lines. As described in Appendix F, active utilities within excavation areas will be either permanently shut off and/or rerouted prior to any excavation activities.

### 2.5.7 Cross-Contamination/Recontamination

Cross-contamination is defined as elevated levels of contamination from one location being transported to another area where the contamination did not previously exist or was not previously present at the elevated concentration. Recontamination is the cross-contamination of remediated locations. The transport of this contamination can occur through wind erosion, wind-blown dust generated by excavation-related activities, vehicular traffic, and/or storm water run-on. As described in Section 2.3.3.1, a major consideration in the sequencing of remediation activities is to minimize cross-contamination and recontamination. In addition, as discussed in Section 5.0, precautions will be taken during excavation activities to minimize the generation of dust and to control run-on and run-off.

### 2.5.8 Special Materials

The following materials, if encountered during excavation activities, will require special handling because of operational or health and safety concerns:

| | |
|---|---|
| Asbestos | Transformers |
| Lead acid batteries | Medical/infectious waste |
| Miscellaneous debris | Pressurized containers |
| Piping | Tires |
| Nonpressurized containers | Uranium metal |
| Non-soil residues | Construction debris |

Some special materials will be eligible for disposition in the OSDF but may first require physical processing, sampling and analysis, or interim containerization. The remainder will be dispositioned off site. Protocols for handling special materials are described in the conceptual waste disposition process described in Section F.5 of Appendix F.

### 2.5.9 OSDF Capacity

The capacity of the OSDF is limited. Therefore, care must be taken during excavation activities to minimize the amount of soil and debris being dispositioned to the OSDF, while attaining FRLs in a cost-effective manner. These goals will be accomplished by

- Supplementing, as necessary, RI/FS characterization data with pre-design investigation data (Section 3.1) to allow, as much as practical, the extent of excavation to be sufficiently defined during remedial design (Section 3.2)
- Excavating to the levels defined by the remedial design (Section 3.3), then using field measurement methods, as much as practical, to control additional excavation
- Pre-certifying the attainment of FRLs (Section 3.3.3) to identify areas of elevated levels of contaminants that may require further attention (i.e., additional localized excavation) before certification sampling (Section 3.4).

The area-specific excavation approaches presented in Section 4.0 are designed to attain FRLs in as cost-effective and timely manner as possible. This will be accomplished by minimizing the amount of below-FRL material that is dispositioned to the OSDF and by minimizing the amount of costly re-excavation and certification activities that would be required by initial failure to attain FRLs.

### 2.5.10 Off-Site Shipments

It is expected that a certain amount of material will be transported to one or more off-site facilities for final disposition and/or treatment and final disposition. This is material that exceeds the WAC for the OSDF (Tables 2-4 and 2-5). This is anticipated to include material that has one or more of the following characteristics:

- Is prohibited from disposal in the OSDF.
- Does not meet the physical criteria of the OSDF.
- Is toxicity-characteristic waste from one of the seven areas shown on Figure 1-5 that cannot be cost-effectively treated for disposal in the OSDF.
- Exceeds one or more of the other OSDF chemical or radiological WAC.

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The primary issues regarding off-site shipments are:

- Obtaining in advance of initiating transportation off site, and optimally prior to making off-site treatment/storage/disposal contract arrangements, a determination of acceptability under the CERCLA Off-Site Rule (40 CFR §300.400) for a potential receiving facility.
- Obtaining in advance an exemption from DOE Order 5820.2A for disposal of low-level waste at other than a DOE facility; no such exemption is needed for mixed waste.
- Meeting the LDR requirements for any hazardous waste, or the hazardous components of mixed waste.
- Meeting the waste acceptance criteria of the receiving facility, and attendant information and documentation to demonstrate such [e.g., sampling in conformance with off-site facility requirements, completion of the off-site facility's waste profile form(s) and other coordination with the off-site facility for waste stream acceptance in advance of preparing the waste for transport.
- Properly manifesting, packaging, labeling, marking, and placarding waste, in accordance with EPA and/or U.S. Department of Transportation (DOT) requirements, before transporting low-level, mixed, or hazardous waste off site for either treatment or disposal.
- Contracting with a transportation firm(s) with the proper license(s) and/or permit(s).

### 2.5.11 Weather

The wide range of potential weather conditions at the FEMP can pose operational concerns during remediation activities. Such conditions include heat, cold, heavy rain, drought, snow and ice, high winds, and tornadoes. In general, construction operations during or pursuant to these conditions will be addressed in the FDF subcontractor's Safe Work Plan, which is required by the contract documents. Health and safety issues regarding these conditions will be addressed in the PSHSRM and PSHASP prepared for each project (Section 6.0).

In addition to these conditions, some winterization activities may be required. Winterization encompasses those activities necessary to ensure that an excavation area can be re-entered with minimal time needed for construction to restart. Winterization requirements are described in Appendix F.

### 2.5.12 Access to Off-Property Areas

Access to off-property areas will be required to obtain samples during pre-design investigations (Section 3.1) and may be required during remedial action. Such areas include, but are not limited to:

- The area adjacent to the STP, where samples will be collected, excavation will be required in support of deep excavation requirements at the STP, and remediation of contamination may be required.
- The area east of the STP to the Great Miami River, where samples will be collected, excavation will be required to remove the abandoned outfall line, and excavation may be required to remediate contamination.
- The area adjacent to the northeast corner of the site, where samples will be collected and remediation may be required (Figure 1-4).

Procedures for access to off-property areas are included in Site Procedure CT-3.4.7, "Review of Constructions Requirements for Private Property Access and for NEPA Compliance" (FERMCO 1995). In general, these procedures require that all off-property work:

1. Be cleared through the FDF Real Estate Department, who will acquire the proper permits.
2. Be cleared through FDF Regulatory Programs, who will ensure that NEPA requirements are met for all areas designated for ground disturbing activities.
3. Be cleared through the Advisory Council on Historic Preservation if there will be adverse effects on historic properties.
4. Be reviewed by FDF Construction, Engineering, Planning, and Bidding.

The applicable IRDP will, as appropriate, describe the need for access to off-property areas and account for necessary permitting and approval times in the schedule. As described in Section 1.2.2, off-property areas will be handled as part of the remediation of the adjacent, on-site area, to the extent possible. As necessary, separate IRDP(s) for off-property areas will be prepared.

### 2.5.13 Grading and Restoration

The DOE has made the commitment to accelerate the restoration of natural resources into the remediation process whenever possible. The development of restoration guidelines is generally a three-phase process that will end with establishing vegetation to develop the proposed habitat for the final land use. The three major phases include:

1. Rough or interim grading, to be performed after certification (Section 3.5.1).
2. Final grading, to include the use of borrow material, additional excavation, placement of topsoil, and construction of required drainage features.

3. Habitat development, to include planting vegetation for the proposed land use.

The last two steps will be guided by the NRRP. Each of these phases is detailed in Appendix F.

## TABLE 2-1

## HAZARDOUS WASTE MANAGEMENT UNITS TO BE CLOSED UNDER CERCLA

| HWMU | IDENTIFICATION | DESCRIPTION[1, 2, 3] | REMEDIATION AREA(s)[4] | HWMU COCs OR RCRA CHARACTERISTICS[3,8] | FINAL REMEDIATION LEVEL COCs[5] | OSDF WAC[6] OR RCRA TC COCs |
|---|---|---|---|---|---|---|
| | | **INACTIVE HWMUs** | | | | |
| 1 | Fire Training Facility | Land-based miscellaneous unit; fire training exercise area, used oil and listed spent solvents were spread on ground and ignited. Spills are recorded. Soil contamination previously excavated under Removal Action 28. | FTF | 1,1,1-Trichloroethane | 1,1,1-Trichloroethane[8] | N/A[8] |
| | | | | Toluene | Toluene[8] | N/A[8] |
| 4 | Drum Storage Area Near Lab Bldg. Loading Dock | Outdoor unpaved (during active life) container storage area without secondary containment system. Managed containers with free liquids. No spills are recorded. Unit has documented soil contamination from roofing tar. Area is presently overlain by concrete due to loading dock expansion. | 4b | Corrosive (low pH) | N/A[8] | N/A[8] |
| | | | | Benzene | Benzene[8] | N/A[8] |
| | | | | Tetrachloroethene | Tetrachloroethene[8] | Tetrachloroethene[8] |
| | | | | Toluene | Toluene[8] | N/A[8] |
| 5 | Drum Storage Area South of W-26 | Outdoor unpaved container storage area without secondary containment system. Managed containers with free liquids. No spills are recorded. Unit has documented soil contamination from roofing tar. | 4b, 5 | Lead | Lead[8] | N/A[8] |
| | | | | Mercury | Mercury[8] | Mercury[8] |
| 10 | Nitric Acid Recovery (NAR) System Components | Tank system, primarily indoor with single outdoor tank; indoor and outdoor components have secondary containment system. Stored waste nitric acid. Spills are recorded. | 4b | Corrosive (low pH) | N/A[8] | N/A[8] |
| | | | | Chromium | Chromium IV[8] | N/A[8] |
| 11 | Tank Farm Sump | Land-based surface impoundment unit. Spills (from leaking drums stored in area) are recorded. | 3 | Corrosive (low pH) | N/A | N/A |
| 14 | Box Furnace | Outdoor furnace/ incinerator unit; has structurally sound flooring pad, but no secondary containment berm system. Managed only solid materials; burned rags and gloves contaminated by spent solvents. No spills are recorded. | 4b | Tetrachloroethene | Tetrachloroethene[8] | Tetrachloroethene[8] |
| | | | | 1,1,1-Trichloroethane | 1,1,1-Trichloroethane[8] | N/A[8] |
| | | | | Trichloroethene | Trichloroethene[8] | Trichloroethene[8] |
| | | | | Barium | Barium[8] | N/A[8] |
| | | | | Chromium | Chromium IV[8] | N/A[8] |
| | | | | Lead | Lead[8] | N/A[8] |
| | | | | Silver | Silver[8] | N/A[8] |

# TABLE 2-1

## (Continued)

| HWMU | IDENTIFICATION | DESCRIPTION[1, 2, 3] | REMEDIATION AREA(s)[4] | HWMU COCs OR RCRA CHARACTERISTICS[3,8] | FINAL REMEDIATION LEVEL COCs[5] | OSDF WAC[6] OR RCRA TC COCs |
|---|---|---|---|---|---|---|
| 15 | Oxidation Furnace #1 | Indoor furnace/miscellaneous unit with cracked, pitted and heavily stained flooring pad but only a partial secondary containment diking system (where two ancillary scrubber liquid pumps were located). Managed materials with free liquids. No spills are recorded. | 4b | 1,1,1-Trichloroethane | 1,1,1-Trichloroethane[8] | N/A[8] |
| 17 | Plant 8 East Pad | Outdoor paved container storage area with secondary containment system. Managed containers with free liquids. Spills are recorded. | 4b | Ignitable (Xylene) | Xylene[8] | N/A[8] |
| | | | | Methyl Ethyl Ketone | N/A[8] | N/A[8] |
| | | | | Lead | Lead[8] | N/A[8] |
| 18 | Plant 8 West Pad | Outdoor paved container storage area with secondary containment system. Managed containers with free liquids. Spills are recorded. | 4b | Ignitable (Xylene) | Xylene[8] | N/A[8] |
| | | | | Methyl Ethyl Ketone | N/A[8] | N/A[8] |
| | | | | Lead | Lead[8] | N/A[8] |
| 22 | Abandoned Sump West of Pilot Plant | Tank system. Sump contents failed TCLP for metals. Spills (leakage from the sump) are recorded. | 4b | Benzene | Benzene | N/A |
| | | | | Tetrachloroethene | Tetrachloroethene | Tetrachloroethene |
| | | NOTE: Also identified as an area where the soils may be RCRA toxicity characteristic hazardous for barium and lead. | | Barium | Barium | Barium (by TCLP) |
| | | | | Chromium | Chromium IV | N/A |
| | | | | Lead | Lead | Lead (by TCLP) |
| | | | | Mercury | Mercury | Mercury |
| 25 | Plant 1 Storage Building | Indoor paved container storage area without secondary containment system. Managed containers with free liquids. No spills are recorded. | 4b | Ignitability | N/A[8] | N/A[8] |
| | | | | Corrosivity | N/A[8] | N/A[8] |
| | | | | Chromium | Chromium IV[8] | N/A[8] |
| | | | | Lead | Lead[8] | N/A[8] |
| 27 | Waste Pit 4 | Land-based land disposal unit. No spills are recorded. | 6 | Barium | Barium | N/A |

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## TABLE 2-1

## (Continued)

| HWMU IDENTIFICATION | | DESCRIPTION[1, 2, 3] | REMEDIATION AREA(s)[4] | HWMU COCs OR RCRA CHARACTERISTICS[3,8] | FINAL REMEDIATION LEVEL COCs[5] | OSDF WAC[6] OR RCRA TC COCs |
|---|---|---|---|---|---|---|
| 28 | Trane Thermal Liquid Incinerator | Indoor incinerator unit, with outdoor ancillary above-ground one-tank tank system and two outdoor paved container storage areas. Indoor components with structurally sound flooring pad; outdoor tank system and one container storage area with secondary containment system, other without. Stored then burned oil containing lead and listed spent solvents. No spills are recorded; however, potential yellow cake in immediate area. | 4b | 1,1,1-Trichloroethane | 1,1,1-Trichloroethane[8] | N/A[8] |
| | | | | Lead | Lead[8] | N/A[8] |
| 36 | Storage Pad North of Plant 6 | Outdoor paved container storage area without secondary containment berm system. Managed containers with free liquids. No spills are recorded. | 4a | 1,1,1-Trichloroethane | 1,1,1-Trichloroethane[8] | N/A[8] |
| | | | | Lead | Lead[8] | N/A[8] |
| 41 | Sludge Drying Beds | Land-based surface impoundments that are part of the sanitary wastewater treatment system; managed sludges from wastewater treatment, where wastewater contained listed spent solvent. No spills are recorded. | STP | Tetrachloroethene | Tetrachloroethene[8] | Tetrachloroethene[8] |
| 42 | Waste Pit 5 | Land-based land disposal unit. No spills are recorded. | 6 | 1,1,1-Trichloroethane | 1,1,1-Trichloroethane | N/A |
| | | | | Possible characteristic to be determined during removal of waste pit contents[8] | TBD[7] | TBD[7] |
| 46 | UNH Tanks - NFS Storage Area | Outdoor five-tank above-ground tank system with secondary containment system. Stored corrosive uranyl nitrate hexahydrate (UNH). Spills are recorded. | 4b | Corrosive (low pH) | N/A | N/A |
| | | | | Barium | Barium | N/A |
| | | | | Chromium | Chromium IV | N/A |
| | | | | Lead | Lead | N/A |
| | | | | Mercury | Mercury | Mercury |
| 47 | UNH Tanks - North of Plant 2A | Outdoor three-tank above-ground tank system with secondary containment system. Stored corrosive uranyl nitrate hexahydrate (UNH). Spills are recorded. | 4b | Corrosive (low pH) | N/A | N/A |
| | | | | Barium | Barium | N/A |
| | | | | Chromium | Chromium IV | N/A |
| | | | | Lead | Lead | N/A |

## TABLE 2-1

## (Continued)

| HWMU IDENTIFICATION | | DESCRIPTION[1, 2, 3] | REMEDIATION AREA(s)[4] | HWMU COCs OR RCRA CHARACTERISTICS[3,8] | FINAL REMEDIATION LEVEL COCs[5] | OSDF WAC[6] OR RCRA TC COCs |
|---|---|---|---|---|---|---|
| | | | | Mercury | Mercury | Mercury |
| 48 | UNH Tanks - Southeast of Plant 2A | Outdoor one-tank above-ground tank system with secondary containment system. Stored corrosive uranyl nitrate hexahydrate (UNH). Spills are recorded. | 4b | Corrosive (low pH) | N/A | N/A |
| | | | | Barium | Barium | N/A |
| | | | | Chromium | Chromium IV | N/A |
| | | | | Lead | Lead | N/A |
| | | | | Mercury | Mercury | Mercury |
| 49 | UNH Tanks - Digestion Area (2 locations) | Indoor eight-tank above-ground tank system with secondary containment system. Stored corrosive uranyl nitrate hexahydrate (UNH). Spills are recorded. | 4b | Corrosive (low pH) | N/A | N/A |
| | | | | Barium | Barium | N/A |
| | | | | Chromium | Chromium IV | N/A |
| | | | | Lead | Lead | N/A |
| | | | | Mercury | Mercury | Mercury |
| 50 | UNH Tanks - Raffinate Building (2 locations) | Indoor four-tank above-ground tank system with secondary containment system. Stored corrosive uranyl nitrate hexahydrate (UNH). Spills are recorded. | 4b | Corrosive (low pH) | N/A | N/A |
| | | | | Barium | Barium | N/A |
| | | | | Chromium | Chromium IV | N/A |
| | | | | Lead | Lead | N/A |
| | | | | Mercury | Mercury | Mercury |
| 54 | Thorium Nitrate Tank (T2) | Outdoor one-tank above-ground tank system with secondary containment system. Stored corrosive thorium nitrate. Spills are recorded. | 4b | Corrosive (low pH) | N/A | N/A |
| | | | | Cadmium | Cadmium | N/A |
| | | | | Chromium | Chromium IV | N/A |
| **ACTIVE HWMUs** | | | | | | |
| 19 | CP Storage Warehouse (Butler Building) | Indoor container storage area with secondary containment system. Manages containers with and without free liquids. Spills are recorded. | 3 | All documented hazardous waste codes previously stored; constituents depend on documented waste codes stored[8] | TBD[7] | TBD[7] |

000113

## TABLE 2-1

## (Continued)

| HWMU IDENTIFICATION | | DESCRIPTION[1, 2, 3] | REMEDIATION AREA(s)[4] | HWMU COCs OR RCRA CHARACTERISTICS[3,8] | FINAL REMEDIATION LEVEL COCs[5] | OSDF WAC[6] OR RCRA TC COCs |
|---|---|---|---|---|---|---|
| 20 | Plant 1 Storage Pad | Outdoor and indoor container storage area. Paved outdoor portion with partial secondary containment berm system presently only manages containers without free liquids; indoor portion with secondary containment system manages containers with free liquids. Spills are recorded. | 3, 4b | Methylene Chloride | Methylene Chloride[8] | N/A[8] |
| | | | | Tetrachloroethene | Tetrachloroethene[8] | Tetrachloroethene[8] |
| | | | | 1,1,1-Trichloroethane | 1,1,1-Trichloroethane[8] | N/A[8] |
| | | | | Xylene | Xylene[8] | N/A[8] |
| | | | | Barium | Barium[8] | N/A[8] |
| | | | | Lead | Lead[8] | N/A[8] |
| | | | | All documented hazardous waste codes previously stored; constituents depend on documented waste codes stored[8] | TBD[7] | TBD[7] |
| 29 | Plant 8 Warehouse | Indoor container storage area with secondary containment system. Manages containers with and without free liquids. Spills are recorded. | 4b | All documented hazardous waste codes previously stored; constituents depend on documented waste codes stored[8] | TBD[7] | TBD[7] |
| 33 | Pilot Plant Warehouse | Indoor container storage area with secondary containment system. Manages containers with and without free liquids. Spills are recorded. | 4b | All documented hazardous waste codes previously stored; constituents depend on documented waste codes stored[8] | TBD[7] | TBD[7] |
| 34 | KC-2 Warehouse | Indoor container storage area with secondary containment system. Manages containers with and without free liquids. Spills are recorded. | 3 | All documented hazardous waste codes previously stored; constituents depend on documented waste codes stored[8] | TBD[7] | TBD[7] |
| 35 | Plant 9 Warehouse | Indoor container storage area with secondary containment system. Manages containers with and without free liquids, equipped for storage of ignitible liquids. Spills are recorded. | 3 | All documented hazardous waste codes previously stored; constituents depend on documented waste codes stored[8] | TBD[7] | TBD[7] |

## TABLE 2-1

## (Continued)

| HWMU IDENTIFICATION | | DESCRIPTION[1, 2, 3] | REMEDIATION AREA(s)[4] | HWMU COCs OR RCRA CHARACTERISTICS[3,8] | FINAL REMEDIATION LEVEL COCs[5] | OSDF WAC[6] OR RCRA TC COCs |
|---|---|---|---|---|---|---|
| 37 | Plant 6 Warehouse | Indoor container storage area with secondary containment system. Manages containers with and without free liquids, equipped for storage of ignitible liquids. Spills are recorded. | 4a | All documented hazardous waste codes previously stored; constituents depend on documented waste codes stored[8] | TBD[7] | TBD[7] |

**NOTES:**

(1) Source: Status of Closure and Field Activities of HWMUs from the U.S. EPA Approval Letters of Final Reports for 13 FEMP Removal Actions and Ohio EPA Acceptance Letters for 13 RCRA Closure Certifications at the FEMP, December 1, 1996; File G:|CRU3T76\MISC\1996\SCHD12-11.WK1

(2) Sources: Table 1-1, HWMU Identification, OU5 FS (FEMP-05FS-5 DRAFT FINAL, March 22, 1995); and Terry Hagen, October 30, 1995 letter, M:EC:95-0071, titled "Hazardous Waste Management Unit/CERCLA Constituents of Concern" and its attached table entitled "RCRA COCs for Active and Inactive Units to be Closed Under CERCLA/RCRA Integrated Process (October 17, 1995)".

(3) Source: HWMU Release History, T. Spradlin to M. Strimbu Memorandum, June 24, 1997; based upon retrieval from Release History file.

(4) Source: Construction Remediation Area Project Boundaries identified by the OU5 Near Term Restoration Projects drawing, April 7, 1997; File /USR1/RES/RES3256/SKGB.DGN.

(5) Source: Table 9-3, Final Remediation Levels for Soil, OU5 ROD (FEMP-05ROD-6 FINAL, December 15, 1995).

(6) Source: Table 4-1, On-Site Disposal Facility Waste Acceptance Criteria (WAC), FEMP OSDF Impacted Materials Placement Plan (IMPP, 20100-PL-007, Rev. G, October 1996); else, "(by TCLP)" means by concern for RCRA Toxicity Characteristic (TC), where TCLP is the Toxicity Characteristic Leaching Procedure.

(7) TBD refers to RCRA-listed wastes having been stored in those HWMUs but specific constituents are yet to be determined based upon documented waste codes managed/stored.

(8) Potential for waste constituent to be present in soil is low. Source: Table 4-68, Hazardous Constituents in (Hazardous Waste Management Units (HWMUs) and Soil, OU5 RI (FINAL, March 17, 1995); supported by Terry Hagen, October 30, 1995 letter, M:EC:95-0071, titled "Hazardous Waste Management Unit/CERCLA Constituents of Concern" and its attached table entitled "RCRA COCs for Active and Inactive Units to be Closed Under CERCLA/RCRA Integrated Process (October 17, 1995)".

000115

# TABLE 2-2

## UNDERGROUND STORAGE TANKS TO BE CLOSED UNDER CERCLA

| TANK ID | LOCATION | SPECIFICATIONS | CONTENTS | STATUS & DESCRIPTION OF CLOSURE ACTIVITIES |
|---|---|---|---|---|
| **TANKS REMOVED - ADDITIONAL ACTION REQUIRED TO DEMONSTRATE ATTAINMENT OF SOIL FRLs** | | | | |
| UST-1 | **Remediation Area:** 5<br><br>**Location:** Centerline approx. 51 ft. E of Garage (Bldg. 31) - buried approx. 18 inches beneath a 6 inch concrete slab<br><br>(Source: 6/90 UST Content Removal Task Specific Health and Safety Plan) | **Volume:** 1,500 gal.<br><br>**Size:** 8 ft. diameter spherical tank<br><br>**Material:** Fiberglass<br><br>**Accessories:** Piping from top of UST 1 to aboveground gasoline pumps and a 2 inch vent line from UST 1 to UST 2 and to Bldg. 31 (Source: 6/90 UST Content Removal Task Specific Health and Safety Plan) | **Material:** Gasoline (unleaded)<br><br>**COCs:**<br>Benzene . . . . . (FRL; no OSDF WAC)<br>Ethylbenzene . . . . . (FRL; no OSDF WAC)<br>Toluene . . . . . (FRL; no OSDF WAC)<br>Xylene . . . . . (FRL; no OSDF WAC)<br>Barium . . . . . (FRL; no OSDF WAC)<br>Lead . . . . . (FRL; no OSDF WAC)<br>Mercury . . . . . (FRL; OSDF WAC)<br><br>**Reference MEFs:** 181, 60053 | **REMOVED — UST Removal Action appears to meet FRL criteria; Additional Sampling Required to Demonstrate FRL Attainment.**<br><br>USTs 1, 2, 8, 9, 10 removed in concert. Soil excavated to maximum depth of 11 ft within footprint of the 5 tank cluster. Horizontal excavation continued until a physical constraint was encountered. Final excavation covered approx. 6,000 sf. of surface area. Excavated volume estimated at 2,500 cy. of soil.<br><br>9 soil samples (based on highest PID levels) were collected in 1990 when the tanks were removed but prior to final soil excavation. Results: TPH (656 ppm), Benzene (1,210 ppb), Toluene (382 ppb), Ethyl benzene (1,190 ppb), Xylene (1,1300 ppb) and Lead (35.6 ppm). Concentrations are below FRLs for BTEX and Lead, no FRL established for TPH. *No samples were collected during excavation; no post-excavation samples were collected.*<br><br>6/93 UST 1,2,8,9 and 10 Closure Report concluded that only minor residual petroleum contamination remained after excavation. Since USTs were located in an area with significant U contamination and further excavation was impractical, any additional remediation would be conducted under CERCLA. State Fire Marshal approved UST closure on 12/3/93. |

## TABLE 2-2

## (Continued)

| TANK ID | LOCATION | SPECIFICATIONS | CONTENTS | STATUS & DESCRIPTION OF CLOSURE ACTIVITIES |
|---|---|---|---|---|
| UST-2 | **Remediation Area:** 5<br><br>**Location:** Centerline approx. 51 ft. E of Garage (Bldg. 31) - buried approx. 18 inches beneath a 6 inch concrete slab (Source: 6/90 UST Content Removal Task Specific Health and Safety Plan) | **Volume:** 1,500 gal.<br><br>**Size:** 8 ft. diameter spherical tank<br><br>**Material:** Fiberglass<br><br>**Accessories:** Piping from top of tank to aboveground gasoline pumps and 2 inch vent line from UST 2 to UST 1 (Source: 6/90 UST Content Removal Task Specific Health and Safety Plan) | **Material:** Gasoline (Unleaded)<br><br>**COCs:**<br>Benzene . . . . . (FRL; no OSDF WAC)<br>Ethylbenzene . . . . . (FRL; no OSDF WAC)<br>Toluene . . . . . (FRL; no OSDF WAC)<br>Xylene . . . . . (FRL; no OSDF WAC)<br>Barium . . . . . (FRL; no OSDF WAC)<br>Lead . . . . . (FRL; no OSDF WAC)<br>Mercury . . . . . (FRL; OSDF WAC)<br><br>**Reference MEFs:** 181, 60053 | **REMOVED -- UST Removal Action appears to meet FRL criteria; Additional Sampling Required to Demonstrate FRL Attainment.**<br><br>See entry for UST-1. |

## TABLE 2-2

## (Continued)

| TANK ID | LOCATION | SPECIFICATIONS | CONTENTS | STATUS & DESCRIPTION OF CLOSURE ACTIVITIES |
|---|---|---|---|---|
| UST-8 | **Remediation Area:** 5<br><br>**Location:** 12 ft. NE of Garage (Bldg. 31)<br><br>Tank buried under 8 inch concrete slab with 2 ft. x 2 ft. 8 in. concrete dispensing pump foundation extending above pavement at N end of tank. (Source: 6/90 UST Content Removal Task Specific Health and Safety Plan) | **Volume:** 1,000 gal.<br><br>**Size:** 4 ft. diameter x 12 ft. length<br><br>**Material:** Steel<br><br>**Accessories:** Remote fill line runs from tank to 10 ft. W of tank | **Material:** Leaded Gasoline<br><br>**COCs:**<br>Acetone . . . . . (FRL; no OSDF WAC)<br>Benzene . . . . . (FRL; no OSDF WAC)<br>Ethylbenzene . . . . . (FRL; no OSDF WAC)<br>Methyl Ethyl Ketone . . . (no FRL; no OSDF WAC)<br>Toluene . . . . . (FRL; no OSDF WAC)<br>Xylene . . . . . (FRL; no OSDF WAC)<br>Arsenic . . . . . (FRL; no OSDF WAC)<br>Selenium . . . . . (FRL; no OSDF WAC)<br><br>**Reference MEFs:** 183, 487 | **REMOVED — UST Removal Action appears to meet FRL criteria; Additional Sampling Required to Demonstrate FRL Attainment.**<br><br>See entry for UST-1. |

## TABLE 2-2

## (Continued)

| TANK ID | LOCATION | SPECIFICATIONS | CONTENTS | STATUS & DESCRIPTION OF CLOSURE ACTIVITIES |
|---|---|---|---|---|
| UST-9 | **Remediation Area:** 5<br><br>**Location:** 8 ft. 6 in. from NE corner of Garage (Bldg. 31)<br><br>3/4 of tank was buried under an 8 inch concrete pad (Source: 6/90 UST Content Removal Task Specific Health and Safety Plan) | **Volume:** 1,000 gal.<br><br>**Size:** 4 ft. diameter x 12 ft. length<br><br>**Material:** Steel<br><br>**Accessories:** Remote fill line - tank to E wall of garage | **Material:** Diesel Fuel<br><br>**COCs:**<br>Acetone . . . . . (FRL; no OSDF WAC)<br>Benzene . . . . . (FRL; no OSDF WAC)<br>Ethylbenzene . . . . . (FRL; no OSDF WAC)<br>Methyl Ethyl Ketone . . . (no FRL; no OSDF WAC)<br>Toluene . . . . . (FRL; no OSDF WAC)<br>Xylene . . . . . (FRL; no OSDF WAC)<br>Arsenic . . . . . (FRL; no OSDF WAC)<br>Selenium . . . . . (FRL; no OSDF WAC)<br><br>**Reference MEFs:** 131, 487, 60331 | **REMOVED — UST Removal Action appears to meet FRL criteria; Additional Sampling Required to Demonstrate FRL Attainment.**<br><br>See entry for UST-1. |
| UST-10 | **Remediation Area:** 5<br><br>**Location:** Centerline approx. 43 ft. 6 in. E of Garage (Bldg. 31) - buried beneath 2 gas pumps on concrete pad. (Source: 6/90 UST Content Removal Task Specific Health and Safety Plan) | **Volume:** 3,000 gal.<br><br>**Size:** 5.5 ft. diameter x 18 ft. length<br><br>**Material:** Steel<br><br>**Accessories:** Concrete pump island w/ 2 pumps directly over tank | **Material:** Leaded Gasoline<br><br>**COCs:**<br>Acetone . . . . . (FRL; no OSDF WAC)<br>Methylene Chloride . . . . . (FRL; no OSDF WAC)<br>Trichlorofluoromethane . (no FRL; no OSDF WAC)<br>Barium . . . . . (FRL; no OSDF WAC)<br>Lead . . . . . (FRL; no OSDF WAC)<br><br>**Reference MEFs:** N/A; See MSDS | **REMOVED — UST Removal Action appears to meet FRL criteria; Additional Sampling Required to Demonstrate FRL Attainment.**<br><br>See entry for UST-1. |

# TABLE 2-2

(Continued)

| TANK ID | LOCATION | SPECIFICATIONS | CONTENTS | STATUS & DESCRIPTION OF CLOSURE ACTIVITIES |
|---|---|---|---|---|
| UST-3 | **Remediation Area:** 3<br><br>**Location:** 25 ft. NE of Railroad Engine House (Bldg. 24B) | **Volume:** 12,500 gal.<br><br>**Size:** 10 ft. diameter x 21 ft. length<br><br>**Material:** Steel<br><br>**Accessories:** Pump located immediately S of tank | **Material:** Diesel Fuel<br><br>**COCs:**<br>Benzene . . . . . (FRL; no OSDF WAC)<br>Ethylbenzene . . . . . (FRL; no OSDF WAC)<br>Toluene . . . . . (FRL; no OSDF WAC)<br>Xylene . . . . . (FRL; no OSDF WAC)<br>Barium . . . . . (FRL; no OSDF WAC)<br>Lead . . . . . (FRL; no OSDF WAC)<br>Mercury . . . . . (FRL; OSDF WAC)<br><br>**Reference MEFs:** 203, 584 | **REMOVED — UST Removal Action appears to meet FRL criteria; Additional Sampling Required to Demonstrate FRL Attainment.**<br><br>Tank removed; clean-closed under Subtitle I; received letter for no further action from State Fire Marshal on 5/15/92.<br><br>Soil samples taken during tank removal had elevated conc. BTEX, TPH and Lead. An additional 530 cu. yds. of soil was removed from the UST 3 pit based on visual staining, petroleum odors and headspace analysis vs. background. Hydrocarbon contamination also found under train tracks in upper 3 ft. of soil (tracks ran to W side of pit to engine house and E side pit) and soil was excavated to headspace criteria. Excavation was backfilled with clean gravel.<br><br>Results from post-excavation soil sampling conducted at 20 ft. intervals indicated Lead conc. - < 4.7 to 12 ppm, which is below the FRL. BTEX constituents were not detected. TPH conc. - 28 to 112 ppm (no established FRL). (Source: 4/92 Tank Closeout Report). |

# TABLE 2-2

## (Continued)

| TANK ID | LOCATION | SPECIFICATIONS | CONTENTS | STATUS & DESCRIPTION OF CLOSURE ACTIVITIES |
|---|---|---|---|---|
| UST-5 | **Remediation Area:** 5<br><br>**Location:** Approx. 10 ft. east of Garage (Bldg. 31) | **Volume:** 200 gal.<br><br>**Size:** 2.5 ft. diameter x 6 ft. length<br><br>**Material:** Steel<br><br>**Accessories:** N/A | **Material:** Wastewater from Oil/Water Separator - contained hydraulic oil, motor oil, gasoline, diesel fuel and cleaning solvents such as 1,1,1-trichloroethane (5/95 Closeout Report: Tank contents - 6.3 - 6.9 ppm 1,1,1 -Trichloroethane)<br><br>**COCs:**<br>Acetone . . . . . (FRL; no OSDF WAC)<br>Aroclors/PCBs . . . . . (FRL; no OSDF WAC)<br>Benzene . . . . . (FRL; no OSDF WAC)<br>Carbon Tetrachloride . . . . (FRL; no OSDF WAC)<br>Cyclohexanone . . . . . (no FRL; no OSDF WAC)<br>1,2-Dichloroethane . . . . . (FRL; no OSDF WAC)<br>1,1-Dichloroethene . . . . . (FRL; OSDF WAC)<br>Ethylbenzene . . . . . (FRL; no OSDF WAC)<br>Ethyl Ether . . . . . (no FRL; no OSDF WAC)<br>Methylene Chloride . . . . . (FRL; no OSDF WAC)<br>Methyl Ethyl Ketone . . . . . (FRL; no OSDF WAC)<br>Methyl Isobutyl Ketone . (no FRL; no OSDF WAC)<br>Tetrachloroethene . . . . . (FRL; OSDF WAC)<br>Toluene . . . . . (FRL; no OSDF WAC)<br>1,1,1-Trichloroethane . . (no FRL; no OSDF WAC)<br>Trichloroethene . . . . . (FRL; OSDF WAC)<br>Trifluorochloromethane . (no FRL; no OSDF WAC)<br>Xylene . . . . . (FRL; no OSDF WAC)<br>Arsenic . . . . . (FRL; no OSDF WAC)<br>Barium . . . . . (FRL; no OSDF WAC)<br>Cadmium . . . . . (FRL; no OSDF WAC)<br>Chromium . . . . . (FRL as VI; no OSDF WAC)<br>Lead . . . . . (FRL; no OSDF WAC)<br>Mercury . . . . . (FRL; OSDF WAC)<br>Selenium . . . . . (FRL; no OSDF WAC)<br>Silver . . . . . (FRL; no OSDF WAC)<br><br>**Reference MEFs:** 386, 1616, 1618, 1672, 1832, 10026, 10031, 30046, 60115, 60329, 60342 | **REMOVED — UST Removal Action appears to meet FRL criteria; Additional Sampling Required to Demonstrate FRL Attainment.**<br><br>Tank reclassified from HWMU to SWMU (based on Waste Water Treatment Unit exemption); tank removed; soil removed during tank excavation was placed back into hole because no visibly contaminated soils were present (5/95 UST Closeout Report)<br><br>Soil samples were collected on 3/90 after rainwater flowed into the tank after it had been uncovered. These sampling results were erroneously summarized in 8/93 RSE and 5/95 UST 5, 7, 14 and 17 Closeout Report. Review of analytical data indicates that results for rain water in tank and soil were switched in Table 1 of RSE (and carried over into Closeout Report). As a result, these reports state that 1,1,1-Trichloroethane was detected in soils when the analytical data from the laboratory reports (included as Attachment 1 of the RSE) indicates that it was not detected. Xylene (32 ppb), Barium (100 ppm), Arsenic (5.50 ppm), Cadmium (0.285 ppm), Chromium (20.7 ppm), Lead (11.1 ppm), and Silver (0.119 ppm) (all totals) were detected but are all below FRLs. Benzene, Ethyl benzene and Toluene were not detected. Methanol (195 ppb) was detected but has no established FRL. No other semi-volatile or volatile organic compounds were detected in the soil. |

000121

# TABLE 2-2

## (Continued)

| TANK ID | LOCATION | SPECIFICATIONS | CONTENTS | STATUS & DESCRIPTION OF CLOSURE ACTIVITIES |
|---|---|---|---|---|
| UST-6 | **Remediation Area:** 3<br><br>**Location:** 1 foot north of Maintenance Shop (Bldg. 12) | **Volume:** 1,000 gal.<br><br>**Size:** 4 ft. diameter x 12 ft. length<br><br>**Material:** Steel<br><br>**Accessories:** N/A | **Material:** Gasoline<br><br>**COCs:**<br>Acetone . . . . . (FRL; no OSDF WAC)<br>Benzene . . . . . (FRL; no OSDF WAC)<br>Carbon Tetrachloride . . . . (FRL; no OSDF WAC)<br>1,2-Dichloroethane . . . . . (FRL; no OSDF WAC)<br>1,1-Dichloroethene . . . . . (FRL; OSDF WAC)<br>Ethylbenzene . . . . . (FRL; no OSDF WAC)<br>Methyl Chloride . . . . . (no FRL; no OSDF WAC)<br>Methyl Ethyl Ketone . . . (no FRL; no OSDF WAC)<br>Tetrachloroethene . . . . . (FRL; OSDF WAC)<br>Toluene . . . . . (FRL; no OSDF WAC)<br>1,1,1-Trichloroethane . . (no FRL; no OSDF WAC)<br>Trichloroethene . . . . . (FRL; OSDF WAC)<br>Xylene . . . . . (FRL; no OSDF WAC)<br>Arsenic . . . . . (FRL; no OSDF WAC)<br>Cadmium . . . . . (FRL; no OSDF WAC)<br>Chromium . . . . . (FRL as VI; no OSDF WAC)<br>Lead . . . . . (FRL; no OSDF WAC)<br>Mercury . . . . . (FRL; OSDF WAC)<br>Selenium . . . . . (FRL; no OSDF WAC)<br><br>**Reference MEFs:** 501, 1616, 1618, 1672, 2746, 10026 | **REMOVED — UST Removal Action appears to meet FRL criteria; Additional Sampling Required to Demonstrate FRL Attainment.**<br><br>Tank removed; clean-closed under Subtitle I; received letter for no further action from State Fire Marshal on 4/7/92.<br><br>Analytical results from 3 soil samples collected (selected based on highest PID levels) from the excavation indicated elevated levels of Lead (5.98-8.85 ppm), Toluene (5.4 ppb) and Xylene (11.8 ppb); however, the concentrations of these 3 constituents are below FRLs. Benzene (< 5.0 ppb), Ethyl benzene (<5.0 ppb) and TPH conc. (<10.0 ppm) were below detection limits, and below established FRLs. (Source: 1/22/91 Closure Assessment Report for Petroleum USTs). |

## TABLE 2-2

## (Continued)

| TANK ID | LOCATION | SPECIFICATIONS | CONTENTS | STATUS & DESCRIPTION OF CLOSURE ACTIVITIES |
|---|---|---|---|---|
| UST-11 | **Remediation Area:** 4b<br><br>**Location:** Buried under gravel approx. 6 ft. E of Plant 1 Truck Dock and S of Bldg. 1. Also 2 ft. N of UST 12 and 2 ft. S of Plant 1 cyclone fence. (Source: 6/90 UST Content Removal Task Specific Health and Safety Plan) | **Volume:** 3,000 gal.<br><br>**Size:** 5.5 ft. diameter x 18 ft. length<br><br>**Material:** Steel<br><br>**Accessories:** Tank piping runs N under cyclone fence, then approx. 10 ft. to gas pump. | **Material:** Kerosene, Gasoline<br><br>**COCs:**<br>Benzene . . . . . (FRL; no OSDF WAC)<br>Ethylbenzene . . . . . (FRL; no OSDF WAC)<br>Methyl Isobutyl Ketone . (no FRL; no OSDF WAC)<br>Toluene . . . . . (FRL; no OSDF WAC)<br>1,1,1-Trichloroethane . . (no FRL; no OSDF WAC)<br>Xylene . . . . . (FRL; no OSDF WAC)<br>Arsenic . . . . . (FRL; no OSDF WAC)<br>Barium . . . . . (FRL; no OSDF WAC)<br>Chromium . . . . . (FRL as VI; no OSDF WAC)<br>Lead . . . . . (FRL; no OSDF WAC)<br>Mercury . . . . . (FRL; OSDF WAC)<br>Selenium . . . . . (FRL; no OSDF WAC)<br><br>**Reference MEFs:** 345, 492, 1408 | **REMOVED — Sampling Required to Demonstrate FRL Attainment.**<br><br>Tank in poor condition upon removal (3/91 UST RSE) - No further action required under Subtitle I (11/1/93 State Fire Marshal's letter).<br><br>Soils surrounding Tanks 11, 12, and 13 were sampled in 1990 upon completion of tank removal. Results: Benzene - 342 ppb, Toluene - 519 ppb, Ethylbenzene - 2,920 ppb, Xylene - 11,400 ppb, Lead - 19.7 ppm; all conc. below FRLs. Maximum TPH conc. was 1,810 ppm (no FRL established). In 1991, excavation extended to approx. 11 ft. deep and horizontally until structural constraints or non-petroleum hydrocarbon contamination discovered - 5,000 sf. with est. vol. of 2,000 cu. yds. of soil. *No soil sampling conducted following 1991 excavation.* (8/93 UST Closure Report).<br><br>The following is from 2/11/92 letter to BUSTR: During 1991 excavation, pocket of fly ash and rubble found approx. 50 ft. E of tank cluster at 9 ft. depth. Inconsistent organic vapor reading led to soil sampling. Results indicated presence of acetone and methanol (could not find results in file) [NOTE: Acetone—FRL; no OSDF WAC; Methanol—no FRL; no OSDF WAC]. Also evidence of petroleum-contaminated soils underneath Plant 1 Truck Dock. |

## TABLE 2-2

## (Continued)

| TANK ID | LOCATION | SPECIFICATIONS | CONTENTS | STATUS & DESCRIPTION OF CLOSURE ACTIVITIES |
|---|---|---|---|---|
| UST-12 | **Remediation Area:** 4b<br><br>**Location:** Approx. 6 ft. E of Plant 1 Truck Dock and S of Bldg. 1. Also 2 ft. S of UST 11). (Source: 6/90 UST Content Removal Task Specific Health and Safety Plan) | **Volume:** 3,000 gal.<br><br>**Size:** 5.5 ft. diameter x 18 ft. length<br><br>**Material:** Steel<br><br>**Accessories:** Tank piping runs across UST 11, under cyclone fence, then approx. 10 ft. to gas pump. | **Material:** Gasoline<br><br>**COCs:**<br>Benzene . . . . . (FRL; no OSDF WAC)<br>Lead . . . . . (FRL; no OSDF WAC)<br><br>**Reference MEFs:** 492, 6055 | **REMOVED — Sampling Required to Demonstrate FRL Attainment.**<br><br>Tank in poor condition upon removal (3/91 UST RSE) - No further action required under Subtitle I (11/1/93 State Fire Marshal's letter).<br><br>See UST 11 entry for information on soil contamination. |
| UST-13 | **Remediation Area:** 4b<br><br>**Location:** Approx. 25 ft. E of Plant 1 Truck dock and 40 ft. S of Bldg. 1 cyclone fence. (Source: 6/90 UST Content Removal Task Specific Health and Safety Plan) | **Volume:** 3,000 gal.<br><br>**Size:** 5.5 ft. diameter x 18 ft. length<br><br>**Material:** Steel<br><br>**Accessories:** Pump and remote fill at N end of paved road S of tank | **Material:** Kerosene, Gasoline<br><br>**COCs:**<br>Benzene . . . . . (FRL; no OSDF WAC)<br>Ethylbenzene . . . . . (FRL; no OSDF WAC)<br>Methyl Isobutyl Ketone . (no FRL; no OSDF WAC)<br>Toluene . . . . . (FRL; no OSDF WAC)<br>1,1,1-Trichloroethane . . . . (FRL; no OSDF WAC)<br>Xylene . . . . . (FRL; no OSDF WAC)<br>Arsenic . . . . . (FRL; no OSDF WAC)<br>Barium . . . . . (FRL; no OSDF WAC)<br>Chromium . . . . . (FRL; no OSDF WAC)<br>Lead . . . . . (FRL; no OSDF WAC)<br>Mercury . . . . . (FRL; OSDF WAC)<br>Selenium . . . . . (FRL; no OSDF WAC)<br><br>**Reference MEFs:** 345, 492, 1408 | **REMOVED — Sampling Required to Demonstrate FRL Attainment.**<br><br>Tank in poor condition upon removal (3/91 UST RSE) - No further action required under Subtitle I (11/1/93 State Fire Marshal's letter).<br><br>See UST 11 entry for information on soil contamination. |

# TABLE 2-2

## (Continued)

| TANK ID | LOCATION | SPECIFICATIONS | CONTENTS | STATUS & DESCRIPTION OF CLOSURE ACTIVITIES |
|---|---|---|---|---|
| UST-17 | **Remediation Area:** 5<br><br>**Location:** Approx. 10 ft. N of Heavy Equipment Building (Bldg. 46) (Per UST Program Evaluation Report, 11/92) | **Volume:** 200 gal.<br><br>**Size:** 2.5 diameter x 6 ft. length<br><br>**Material:** Steel<br><br>**Accessories:** N/A | **Material:** Waste Oil from Oil/Water Separator<br><br>**COCs:**<br>Acetone . . . . . (FRL; no OSDF WAC)<br>1,1,1-Trichloroethane . . . . (FRL; no OSDF WAC)<br>Barium . . . . . (FRL; no OSDF WAC)<br>Selenium . . . . . (FRL; no OSDF WAC)<br><br>**Reference MEFs:** 123, 124, 60035<br><br>**SWMU - Not regulated by BUSTR** | **REMOVED — Sampling Required to Demonstrate FRL Attainment.**<br><br>Tank and concrete slab above tank was removed (slab was at 8 ft. depth) - tank was in very poor condition and, upon removal, water inside tank emptied into the excavation (water accumulated after tank was emptied of its contents). Water in excavation was immediately removed and drummed. Soils that came into contact with water or that were discolored were excavated — 3 drums w/ Lot code W050-741-P011-0395. (Source: May 1995 UST 5,7,14 and 17 Closeout Report).<br><br>Soil samples were collected prior to excavation: Xylene (27 ppb) and Lead (29.7 ppm) were detected but at conc. below FRLs. Benzene, Toluene and Ethylbenzene were not detected. Note that one soil sample collected prior to excavation did contain 12.9 ppm Chromium (EP Tox); the total conc. of Chromium in this sample was 10.9 ppm (conc. is below Chromium VI FRL of 300 mg/kg or ppm). Concentrations of other metals analyzed in soil samples (Barium, Mercury, Arsenic, Cadmium, Selenium and Silver) were below FRLs. 1,1,1- Trichloroethane was detected in the oil-separator (1,050 ppb) but was not detected in the soil (no FRL established). The maximum TPH conc. in the soil was 3,300 ppm (no FRL established). No other volatile or semi-volatile organic compounds were detected in the soil samples. *No post-excavation soil samples were collected.* (Source: May 1995 UST 5,7,14 and 17 Closeout Report; 7/93 UST 17 RSE) |
| Kerosene Tank | **Remediation Area:** 3<br><br>**Location:** Tank Farm | **Volume:** 13,525 gal.<br><br>**Size:** Unspecified<br><br>**Material:** Steel<br><br>**Accessories:** N/A | **Material:** Kerosene<br><br>**COCs:** (estimated)<br>Benzene . . . . . (FRL; no OSDF WAC)<br>Ethylbenzene . . . . . (FRL; no OSDF WAC)<br>Toluene . . . . . (FRL; no OSDF WAC)<br>Xylene . . . . . (FRL; no OSDF WAC)<br><br>**Reference MEFs:** N/A; See MSDS | **REMOVED — Sampling Required to Demonstrate FRL Attainment.**<br><br>Tank removed from service and excavated in 1988 prior to effective date of state and federal regs (so not included in list of tanks registered with State Fire Marshal). |

000125

## TABLE 2-2

## (Continued)

| TANK ID | LOCATION | SPECIFICATIONS | CONTENTS | STATUS & DESCRIPTION OF CLOSURE ACTIVITIES |
|---|---|---|---|---|
| **TANK HAS NOT BEEN REMOVED - TO BE REMEDIATED UNDER CERCLA** | | | | |
| UST-14 | **Remediation Area:** 4a<br><br>**Location:** Buried under concrete floor in former scrap melting area (S end) of Plant 6 (Source: 6/90 UST Content Removal Task Specific Health and Safety Plan) | **Volume:** 3,000 gal.<br><br>**Size:** 5.5 diameter x 18 ft. length<br><br>**Material:** Steel<br><br>**Accessories:** N/A | **Material:** Waste Soluble Machining Oil - a heavy napthenic petroleum oil.<br><br>**COCs:**<br>Methanol . . . . . (no FRL; no OSDF WAC)<br><br>**Reference MEFs:** N/A; see MSDS<br><br>Analysis of tank residues:<br>Methanol conc. - 40 ppm. No other volatile or semi-volatile compounds or metals were detected. (Source UST 14 Closure Report, 6/92). | **ABANDONED IN PLACE — UST to be removed and Sampling Required to Demonstrate Closure and FRL Attainment.**<br><br>Removed perched water from tank, disconnected process piping and filled tank with grout. To sample the soil beneath the UST, a hole was cut in the bottom of the tank. Perched water began flowing into the tank. *The presence of water precluded the sampling of underlying soils.* (Source: 5/95 UST 14 Closeout Report). Two soil samples were collected at a total depth of 2 ft. below the base of the oil supply line - BTEX not detected, Lead conc. (17.8 ppm) was below the FRL, TPH conc. was 139 - 174 mg/kg (no FRL established). (Source: 6/92 UST 14 Closure Report). An inspector from the State Fire Marshal's office inspected and approved tank abandonment in place on March 16, 1995 (5/95 UST 14 Closeout Report). |

## TABLE 2-3

## AREAS CONTAINING POTENTIALLY HAZARDOUS LEVELS OF CONTAMINANTS

| Description of Potentially Hazardous Area | Remediation Area | Potentially Hazardous Constituent(s) |
|---|---|---|
| Area between the KC-2 Warehouse and adjacent to railroad tracks | 3 | Lead |
| Trap Range | 1 | Lead |
| Paddys Run streambank fill materials west of the Silos | 7 | Chromium<br>Lead |
| Scrap Metal Pile | 3 | Lead |
| Area north of the Maintenance Building | 3 | Lead |
| Abandoned Sump west of the Pilot Plant [a] | 4b | Barium |
| South Field Firing Range | 2 | Lead |

Note: [a] Also designated as HWMU No. 22.

## TABLE 2-4

## CHEMICAL AND RADIONUCLIDE WASTE ACCEPTANCE CRITERIA FOR ON-SITE DISPOSAL FACILITY (1)

| Constituent | Concentration/Activity | Units |
|---|---|---|
| Neptunium-237 | $3.12 \times 10^{9}$ | pCi/g |
| Strontium-90 | $5.67 \times 10^{10}$ | pCi/g |
| Technetium-99 | $2.91 \times 10^{1}$ | pCi/g |
| Uranium-238 | $3.46 \times 10^{2}$ | pCi/g |
| Total Uranium | $1.030 \times 10^{3}$ | mg/kg |
| Carbazole | $7.27 \times 10^{4}$ | mg/kg |
| Bis(2-chlorisopropyl)ether | $2.44 \times 10^{-2}$ | mg/kg |
| Alpha-chlordane | $2.89 \times 10^{0}$ | mg/kg |
| Bromodichloromethane | $9.03 \times 10^{-1}$ | mg/kg |
| 4-Nitroaniline | $4.42 \times 10^{-2}$ | mg/kg |
| Chloroethane | $3.92 \times 10^{5}$ | mg/kg |
| Vinyl chloride | $1.51 \times 10^{0}$ | mg/kg |
| Tetrachloroethene | $1.28 \times 10^{2}$ | mg/kg |
| Trichloroethene | $1.28 \times 10^{2}$ | mg/kg |
| 1,1-Dichloroethene | $1.14 \times 10^{1}$ | mg/kg |
| 1,2-Dichlorethene | $1.14 \times 10^{1}$ | mg/kg |
| Toxaphene | $1.06 \times 10^{5}$ | mg/kg |
| Boron | $1.04 \times 10^{3}$ | mg/kg |
| Mercury | $5.66 \times 10^{4}$ | mg/kg |

(1) This table is based on information contained in the OSDF Impacted Material Placement (IMP) Plan.

i:\scep\wpm\3_12.tbl

## TABLE 2-5

## PHYSICAL WASTE ACCEPTANCE CRITERIA FOR THE ON-SITE DISPOSAL FACILITY [1]

| Profile No.[2] | Impacted Material Category No.[3] | Category Description | Physical Requirements | Examples | Decision Process |
|---|---|---|---|---|---|
| | | | Category Wastes | | |
| 91000 | Category 1 | Soil and soil-like | o Compactible using standard construction equipment<br>o Any hard agglomerations <12"<br>o Other than till or ash, <1" particle size<br>o Able to be compacted using standard soil compaction equipment/procedures<br>o Moisture content: Liquid limit defines excessive liquids (P) | o Fly ash<br><br>o Majority of OU2 and OU5 soils | [1] Evaluate impacted soil and soil-like material for Category 1. If it fails, proceed to Category 2. |
| 92000 | Category 2 | Materials that can be transported, placed, spread and compacted *en masse* | o Moderately compactible using Caterpillar D-8 dozer or 815C compactor type equipment<br>o Irregularly shaped metals & finish/superstructure components <10' long and 18" thick<br>o Concrete reinforcement bars cut within a nominal 12 inches of the mass<br>o General building rubble (concrete, masonry, similar materials) - <10' long and 18" thick<br>o Equipment - drained of all oils and liquids<br>o Piping >12" diameter - split in half<br>o Moisture content: Liquid limit defines excessive liquids (P)<br>o Intact drums must be empty and crushed (P)<br>o Debris may not include acid brick (P)<br>o Transformers must be crushed or filled with grout (P) | o Broken-up concrete foundations<br><br>o Soil mixed with broken-up concrete<br><br>o Other debris not requiring individual placement (see Category 3)<br><br>o General building rubble, e.g., wood, drywall, HVAC systems, electrical systems, plumbing systems, minor equipment | [2.a] Evaluate impacted soil and soil-like materials for Category 2. If it fails, proceed to Category 5.<br><br>[2.b] Evaluate impacted debris for Category 2. If it fails, proceed to Category 3. |
| 93000 | Category 3 | Materials that require individual handling and placement | o Suitable for having soil/soil-like material placed around/against them<br>o Height <4'<br>o Rectangular shaped<br>o Concrete protrusions <18"<br>o Void spaces >1 $ft^3$ filled with cohesionless material or a quick set grout<br>o Not compactible with standard compaction equipment<br>o Concrete reinforcement bars cut within a nominal 12 inches of the mass<br>o Equipment - drained of all oils and liquids<br>o Transformers must be crushed or filled with grout (P) | o Equipment | [3] Evaluate impacted deris for Category 3. If it fails, proceed to Category 5. |

000429

**TABLE 2-5**

**(Continued)**

| Profile No.[2] | Impacted Material Category No.[3] | Category Description | Physical Requirements | Examples | Decision Process |
|---|---|---|---|---|---|
| 94000 | Category 4 | Materials with high organic content (e.g., humus or vegetation) | o Highly compressible<br>o Moisture content: Liquid limit defines excessive liquids (P) | o Vegetation, i.e., trees, limbs, underbrush<br><br>o Materials from the solid waste landfill | [4] Evaluate organic materials for Category 5.<br><br>Note: Soils which contain organic materials should not be classified as Category 4. See Category 1. |
| 95000 | Category 5 | Materials that require special handling due to their special nature | o Regulated ACM - Double-bagged (or equivalent) and delivered unmixed with other material<br>o ACM brick and commingled debris - double-contained and segregated from other materials<br>o ACM insulated piping - delivered unmixed with other material<br>o Equipment - drained of all oils and liquids<br>o Transformers must be crushed or filled with grout (P) | o Double bagged asbestos<br><br>o ACM insulated pipe<br><br>o Sludges | [5] Submit a request for disposal (RFD) to OSDF.<br>Note: At this time, the OSDF does not anticipate accepting oversized debris under Category 5. |

**Prohibited Items**

| PROHIBITED ITEM[2] | EXAMPLES / COMMENTS |
|---|---|
| Materials not accompanied by the required manifest | IIMS system provides either electronic or paper manifest. |
| Material received from off site | OSDF is designated for Fernald material only. |
| RCRA characteristic waste [3], [5] | Treat to below characteristic level |
| Equipment >4' height | Cut equipment to meet Category 3, or request approval for disposition as Category 5. |
| Pressurizable gas cylinders | Cylinders must be emptied and sized/filled to meet Category 2 or 3. |
| Process related metals | Examples include derbies, ingots, billets, and uranium scrap. |
| Product, residues, other special material | Examples include green salt, black oxide, and sump sludges from process facilities. |
| Materials containing free liquids | Liquid limit defines free liquids. |
| Intact drums | Drums must be empty and crushed. |
| Acid brick | |
| Transformers | Transformers must be crushed or filled with grout. |
| Tires | |
| Used oils | |

**TABLE 2-5**

**(Continued)**

(1) This table is based on information in the OSDF Impacted Material Placement (IMP) Plan.
(2) Each of the listed Profile numbers represents a root Impacted Material Category waste stream. Numeric extension Profiles (e.g. 91001, 91,002...95,999) will be used to facilitate further delineation of waste streams, on an as-needed basis.
(3) The selection of the appropriate category is a process of elimination beginning with Category 1. The majority of impacted material will be Category 1, second largest volume being Category 2, with the majority of the remainder being Category 3. Category 4 has limited applicability. Category 5 is for material that requires a Request For OSDF Disposal (RFD).
(4) Items marked with "(P)" reflect specific OSDF IMP Plan prohibitions. (P) indicates a high probability of applicability to the identified category.
(5) Only includes material from the seven geographic areas identified in Section 1.3.2.7

000131

## TABLE 2-6

## SCREENING OF WASTE ACCEPTANCE CRITERIA APPLICABLE TO SOIL REMEDIATION

| WAC Constituent of Concern [a] | Units | Waste Acceptance Criteria | Detections Above Backround/Total Number of Samples [b] | Range of Positive Detections [b] |
|---|---|---|---|---|
| **Radionuclides** | | | | |
| Neptunium-237 | pCi/g | $3.12 \times 10^{7}$ | 14/874 | 0.214-2.63 |
| Strontium-90 | pCi/g | $5.67 \times 10^{10}$ | 314/995 | 0.510-47.6 |
| Technetium-99 | pCi/g | 2.91 [c] | 164/1,074 | 1.02-602 |
| Total Uranium | mg/kg | 1,030 | 2,769/4,227 | 0.500-69,300 |
| **Inorganics** | | | | |
| Boron | mg/kg | 1,040 | 1/1 | 14.3 - 14.3 |
| Mercury [d] | mg/kg | 56,600 | 22/768 | 0.040-6.30 |
| **Organics** | | | | |
| Bromodichloromethane | mg/kg | 0.9 | 2/725 | 0.007-0.013 |
| Carbazole | mg/kg | 72,700 | 11/271 | 0.007-0.57 |
| Alpha-chlordane | mg/kg | 2.89 | 4/583 | 0.0021-0.0097 |
| Bis(2-chloroisopropyl)ether [e] | mg/kg | 0.22 | 2/601 | 0.044-0.048 |
| Chloroethane | mg/kg | 3,920 | 3/745 | 0.002-0.21 |
| 1,1-Dichloroethene [d] | mg/kg | 11.4 | 29/745 | 0.001-0.460 |
| 1,2-Dichloroethene | mg/kg | 11.4 | 56/726 | 0.001-4.3 |
| 4-Nitroaniline [e] | mg/kg | 0.9 | 1/619 | 0.33-0.33 |
| Tetrachloroethene [d] | mg/kg | 128 | 83/749 | 0.001-48.00 |
| Toxaphene [b] | mg/kg | 106,000 | 0/600 | |
| Trichloroethene [d] | mg/kg | 128 | 97/753 | 0.001-150.0 |
| Vinyl Chloride [d] | mg/kg | 1.51 | 6/745 | 0.002-0.110 |

Notes:

[a] From Operable Unit 5 Record of Decision.

[b] Combination of surface and subsurface soil samples from Operable Unit 5 RI.

[c] Additionally, maximum total mass in debris is limited to 105 g.

[d] RCRA-based constituent of concern.

[e] Detected values are estimated (J qualifier). Practical Quantitation Limit (PQL) is above the WAC, so PQL is listed in WAC column. Presence at concentrations above the WAC will be determined during pre-design investigations. Shading indicates contaminant was not detected above the respective WAC.



00011322

## TABLE 2-7

## SCREENING OF FINAL REMEDIATION LEVELS APPLICABLE TO SOIL REMEDIATION

| FRL Constituent of Concern [a] | Units | Final Remediation Level for On-Property Soil [b] | Detections Above Backround/Total Number of Samples [c] | Range of Positive Detections [b] |
|---|---|---|---|---|
| **Radionuclides** | | | | |
| Cesium-137 | pCi/g | 1.40 | 122/1481 | 0.209-4.26 |
| Lead-210 | pCi/g | 38.0 | 36/51 | 0.56-168.58 |
| Neptunium-237 | pCi/g | 3.20 | 14/874 | 0.214-2.63 |
| Plutonium-238 | pCi/g | 78.0 | 47/995 | 0.207-158 |
| Plutonium-239/240 | pCi/g | 77.0 | 50/992 | 0.215-12.9 |
| Radium-226 | pCi/g | 1.70 | 381/1738 | 0.3-2950 |
| Radium-228 | pCi/g | 1.80 | 208/1236 | 0.51-558 |
| Strontium-90 | pCi/g | 14.0 | 314/995 | 0.510-47.6 |
| Technetium-99 | pCi/g | 30.0 | 164/1,074 | 1.02-602 |
| Thorium-228 | pCi/g | 1.70 | 360/1473 | 0.2-315 |
| Thorium-230 | pCi/g | 280 | 561/1514 | 0.2-7901 |
| Thorium-232 | pCi/g | 1.50 | 435/1976 | 0.18-283 |
| Total Uranium | mg/kg | 82.0 [d] | 2,769/4,227 | 0.500-69,300 |
| **Inorganics** | | | | |
| Antimony | mg/kg | 96.0 | 51/374 | 1.2-59.8 |
| Arsenic [e] | mg/kg | 12.0 | 94/692 | 0.03-81.9 |
| Barium [e] | mg/kg | 68,000 | 193/774 | 9.9-3610 |
| Beryllium | mg/kg | 1.50 | 378/746 | 0.28-5.7 |
| Boron | mg/kg | 7,400 | 1/1 | 14.3 - 14.3 |
| Cadmium [e] | mg/kg | 82.0 | 321/749 | 0.49-12.4 |
| Chromium VI [e] | mg/kg | 300 | 256/754 | 1.6-115 |
| Cobalt | mg/kg | 740 | 74/755 | 1.8-105 |
| Copper | mg/kg | 220,000 | 377/753 | 3.8-695 |
| Cyanide | mg/kg | 120,000 | 91/688 | 0.11-22.8 |
| Fluoride [f] | mg/kg | 78,000 | | |
| Lead [e] | mg/kg | 400 | 186/734 | 0.47-2180 |

000133

**Table 2-7**

**(Continued)**

| | | | | |
|---|---|---|---|---|
| Manganese | mg/kg | 4,600 | 44/740 | 9.9-12,200 |
| Mercury [e] | mg/kg | 7.50 | 22/768 | 0.040-6.30 |
| Molybdenum | mg/kg | 2,900 | 242/730 | 0.6-13.3 |
| Nickel | mg/kg | 15,000 | 213/736 | 3.8-186 |
| Selenium [e] | mg/kg | 5,400 | 44/646 | 0.23-7.7 |
| Silver [e] | mg/kg | 29,000 | 325/733 | 0.41-36.4 |
| Thallium | mg/kg | 91.0 | 7/751 | 0.11-0.75 |
| Vanadium | mg/kg | 5,100 | 89/755 | 4.3-190 |
| Zinc | mg/kg | 120,000 | 203/745 | 6.2-2150 |
| **Organics** | | | | |
| Acetone | mg/kg | 43,000 | 106/750 | 0.003-0.45 |
| Aroclor-1254 | mg/kg | 0.13 | 103/588 | 0.011-14 |
| Aroclor-1260 | mg/kg | 0.13 | 20/589 | 0.01-2.8 |
| Benzene [e] | mg/kg | 850 | 7/761 | 0.001-1.3 |
| Benzo(a)anthracene | mg/kg | 20.0 | 100/656 | 0.001-61 |
| Benzo(a)pyrene | mg/kg | 2.00 | 78/654 | 0.001-69 |
| Benzo(b)fluoranthene | mg/kg | 20.0 | 94/656 | 0.034-39 |
| Benzo(k)fluoranthene | mg/kg | 200 | 78/656 | 0.019-69 |
| Bis(2-chloroisopropyl)ether | mg/kg | 420 | 2/601 | 0.044-0.048 |
| Bis(2-ethylhexyl)phthalate | mg/kg | 820 | 198/648 | 0.003-11 |
| Bromodichloromethane | mg/kg | 4.00 | 2/725 | 0.007-0.013 |
| Bromoform | mg/kg | 31.0 | 0/725 | |
| Bromomethane | mg/kg | 8,200 | 1/726 | 0.72-0.72 |
| Carbazole | mg/kg | 12.0 | 11/271 | 0.007-0.57 |
| Carbon disulfide | mg/kg | 5,000 | 111/748 | 0.002-0.79 |
| Carbon tetrachloride [e] | mg/kg | 2.10 | 4/754 | 1.1-1.2 |
| Chlordane [e] | mg/kg | 0.19 | 4/583 [g] | 0.0021-0.015 [g] |
| Chlorobenzene [e] | mg/kg | 340 | 7/754 | 0.001-.01 |
| Chloroform [e] | mg/kg | 45.0 | 22/726 | 0.001-0.28 |
| Chrysene | mg/kg | 2,000 | 99/655 | 0.001-18 |
| Dibenzo(a,h)anthracene | mg/kg | 2.00 | 31/655 | 0.046-23 |

**Table 2-7**

**(Continued)**

| | | | | |
|---|---|---|---|---|
| 3,3'-Dichlorobenzidine | mg/kg | 0.55 | 1/650 | 0.19-0.19 |
| 1,1-Dichloroethene [e] | mg/kg | 0.41 | 29/745 | 0.001-0.460 |
| 1,2-Dichloroethene | mg/kg | 0.16 | 56/726 | 0.001-4.3 |
| Dieldrin | mg/kg | 0.015 | 5/583 | 0.00055-0.02 |
| Di-n-octyl phthalate | mg/kg | 1,100 | 8/656 | 0.007-0.63 |
| Ethylbenzene | mg/kg | 5,100 | 14/760 | 0.0008-0.747 |
| Heptachlorodibenzofuran | mg/kg | 0.00088 | 0/20 | |
| Heptachlorodibenzo-p-dioxin | mg/kg | 0.00088 | 2/70 | 0.00065-0.0009 |
| Indeno(1,2,3-cd)pyrene | mg/kg | 20.0 | 59/656 | 0.035-49 |
| 4-Methyl-2-pentanone | mg/kg | 2,500 | 68/576 | 0.001-2.6 |
| Methylene chloride | mg/kg | 37.0 | 105/756 | 0.001-5.5 |
| 4-Methylphenol | mg/kg | 250 | 5/650 | 0.05-0.19 |
| 4-Nitroaniline | mg/kg | 150 | 1/619 | 0.33-0.33 |
| N-nitrosodiphenylamine | mg/kg | 51.0 | 5/648 | 0.043-1.3 |
| N-nitrosodipropylamine | mg/kg | 0.20 | 1/301 | 0.19-0.19 |
| Octachlorodibenzofuran | mg/kg | 0.0088 | 3/24 | 0.00024-0.0015 |
| Octachlorodibenzo-p-dioxin | mg/kg | 0.0088 | 36/70 | 0.00005-0.013 |
| Pentachlorophenol [c] | mg/kg | 2.30 | 4/308 | 0.049-0.26 |
| Tetrachloroethene | mg/kg | 3.60 | 83/749 | 0.001-48 |
| Toluene | mg/kg | 100,000 | 119/760 | 0.0007-0.794 |
| Tributyl phosphate | mg/kg | 250 | 8/56 | 0.046-1.2 |
| 1,1,2-Trichloroethane | mg/kg | 4.30 | 7/754 | 0.001-0.014 |
| Trichloroethene | mg/kg | 25.0 | 97/753 | 0.001-150 |
| Vinyl Chloride [e] | mg/kg | 0.13 | 6/745 | 0.002-0.110 |
| Xylenes, total | mg/kg | 920,000 | 24/750 | 0.002-31 |

000135

**Table 2-7**

**(Continued)**

Notes: [a] From Operable Unit 5 Record of Decision.

[b] From Operable Unit 5 ROD.

[c] Combination of surface and subsurface soil samples from Operable Unit 5 RI.

[d] FRL for total uranium is 20 mg/kg in certain portions of the site.

[e] RCRA-based constituent of concern.

[f] Fluoride was retained because there is no RI/FS data to support screening it out.

[g] Chlordane results were estimated using results for α-chlordane and γ-chlordane. Number of positive detects is the sum of positive detects for α-chlordane in surface and subsurface soil. The minimum detect is the minimum of α-chlordane in subsurface soil and the maximum detect is the sum of the maximum detect of α-chlordane and γ-chlordane in surface soil.

Shading indicates contaminant was not detected above the respective FRL.

TABLE 2-8

SUMMARY OF SITEWIDE CONSTITUENTS OF CONCERN

| Constituent of Concern | Driver [a] | Constituent of Concern | Driver [a] |
|---|---|---|---|
| **Primary COCs** | | | |
| Uranium, total | WAC, FRL | Thorium-228 [b] | FRL |
| Radium-226 | FRL | Thorium-232 | FRL |
| Radium-228 [b] | FRL | | |
| **Secondary COCs** | | | |
| Aroclor-1254 | FRL | Heptachlorodibenzo-p-dioxin | FRL |
| Aroclor-1260 | FRL | Indeno(1,2,3-cd)pyrene | FRL |
| Arsenic | FRL | Lead | FRL |
| Benzo(a)anthracene | FRL | Lead-210 | FRL |
| Benzo(a)pyrene | FRL | Manganese | FRL |
| Benzo(b)fluoranthene | FRL | Neptunium-237 | FRL |
| Beryllium | FRL | 4-Nitroaniline | WAC |
| Bis(2-chloroisopropyl)ether | WAC | Octachlorodibenzo-p-dioxin | FRL |
| Bromodichloromethane | FRL | Plutonium-238 | FRL |
| Cesium-137 | FRL | Strontium-90 | FRL |
| Dibenzo(a,h)anthracene | FRL | Technetium-99 | WAC, FRL |
| 1,1-Dichloroethene | FRL | Tetrachloroethene | FRL |
| Dieldrin | FRL | Thorium-230 | FRL |
| Fluoride | FRL | Trichloroethene | WAC, FRL |
| **Constituents of Ecological Concern** [c] | | | |
| Antimony | BTV | | |
| Cadmium | BTV | | |
| Silver | BTV | | |

Notes:

[a] WAC and FRLs will drive remediation, but BTVs will be evaluated in the certification process.
[b] Thorium-232 will be used to assess FRL attainment (DOE 1997e).

## TABLE 2-9

### PRIMARY AND SECONDARY COCs AND BTV COECs ASSIGNED TO REMEDIATION AREAS

| RA 1 | RA 2 | RA 3 | RA 4 | RA 5 | RA 6 | RA 7 | RA 8 |
|---|---|---|---|---|---|---|---|
| PRIMARY COCs | PRIMARY COCs | PRIMARY COCs | PRIMARY COCs | PRIMARY COCs | PRIMARY COCs | PRIMARY COCs | PRIMARY COCs |
| radium-226 | radium-226 | radium-226 | radium-226 | radium-226 | radium-226 | radium-226 | radium-226 |
| radium-228 [a] | radium-228 [a] | radium-228 [a] | radium-228 [a] | radium-228 [a] | radium-228 [a] | radium-228 [a] | radium-228 [a] |
| thorium-228 [a] | thorium-228 [a] | thorium-228 [a] | thorium-228 [a] | thorium-228 [a] | thorium-228 [a] | thorium-228 [a] | thorium-228 [a] |
| thorium-232 | thorium-232 | thorium-232 | thorium-232 | thorium-232 | thorium-232 | thorium-232 | thorium-232 |
| uranium-total | uranium-total | uranium-total | uranium-total | uranium-total | uranium-total | uranium-total | uranium-total |
| SECONDARY COCs | SECONDARY COCs | SECONDARY COCs | SECONDARY COCs | SECONDARY COCs | SECONDARY COCs | SECONDARY COCs | SECONDARY COCs |
| aroclor-1254 | aroclor-1254 | aroclor-1254 | aroclor-1254 | aroclor-1254 | aroclor-1254 | aroclor-1254 | to be determined |
| aroclor-1260 | aroclor-1260 [b] | aroclor-1260 | aroclor-1260 | aroclor-1260 [b] | aroclor-1260 | aroclor-1260 [b] | |
| arsenic | arsenic | arsenic | arsenic | arsenic | arsenic | arsenic | |
| beryllium | benzo(a)pyrene | benzo(a)anthracene | benzo(a)pyrene | beryllium | benzo(a)pyrene | beryllium | |
| cesium-137 | beryllium | benzo(a)pyrene | beryllium | dieldrin [b] | benzo(b)fluoranthene | cesium-137 | |
| dieldrin [b] | bromodichloromethane [b] | benzo(b)fluoranthene | bromodichloromethane [b] | | beryllium | dieldrin [b] | |
| heptachloradibenzo-p-dioxins | cesium-137 | beryllium | cesium-137 | | bromodichloromethane [b] | lead | |
| lead | dibenzo(a,h)anthracene | bromodichloromethane [b] | dieldrin | | cesium-137 | lead-210 | |
| manganese [b] | 1,1-dichloroethene [b] | cesium-137 | fluoride | | dibenzo(a,h)anthracene | manganese | |
| neptunium-237 | dieldrin | dibenzo(a,h)anthracene | lead | | 1,1-dichloroethene | technetium-99 | |
| technetium-99 | lead | 1,1-dichloroethene | plutonium-238 | | dieldrin | thorium-230 | |
| thorium-230 | neptunium-237 | dieldrin [b] | strontium-90 | | fluoride | | |
| | technetium-99 | fluoride | technetium-99 | | heptachloradibenzo-p-dioxins | BTV COECs | |
| | thorium-230 | indeno(1,2,3-cd)pyrene | tetrachloroethene | | indeno(1,2,3-cd)pyrene | antimony | |
| | | lead | thorium-230 | | octachlorodibenzo-p-dioxin | | |
| | BTV COECs | technetium-99 | | | technetium-99 | | |
| | antimony | tetrachloroethene | | | tetrachloroethene | | |
| | silver | thorium-230 | | | thorium-230 | | |
| | | trichloroethene | | | | | |
| | | BTV COECs | | | BTV COECs | | |
| | | cadmium | | | silver | | |
| | | silver | | | | | |

Notes:
[a] Thorium-232 will be used to assess FRL attainment.
[b] Not detected above the FRL in the RA, but the non-detect value is greater than the FRL
BTV = biological toxicity value
COCs = constituents of concern
COECs = constituents of ecological concern
RA = remediation area

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## TABLE 2-10

## CROSSWALK BETWEEN RCRA CLOSURE GUIDANCE REQUIREMENTS AND CERCLA DOCUMENTATION

| OEPA Closure Guidance Item | CERCLA Documentation for Above-Grade Structural Components | CERCLA Documentation for At- and Below-Grade Structural Components |
|---|---|---|
| Description/Detailed Drawings of Waste Management Units (Item 3.2/3.4) | Figure 2-2 and Table 3-10 of OU3 Integrated RD/RA WP, Implementation Plans for Above-Grade Decontamination and Dismantlement | OU5 RI Report |
| List of Hazardous Waste Managed in Units (Item 3.5) | Implementation Plans for Above-Grade Decontamination and Dismantlement | OU3 RI/FS Report; OU5 RI and FS Reports |
| Removal of Waste (Item 3.6) | OU3 Integrated RD/RA Work Plan (Secs. 3.2.3, 3.3, and 3.5.3); Implementation Plans for Above-Grade Decontamination and Dismantlement | SEP and Integrated Remedial Design Packages |
| Schedule for Closure (Item 3.7) | OU3 Integrated RD/RA Work Plan (Sec. 6); Implementation Plans for Above-Grade Decontamination and Dismantlement | Integrated Remedial Design Packages |
| Health & Safety Issues (Item 3.9) | OU3 Integrated Remedial Action HASP (Appendix E); Project-Specific HASP | SEP and Integrated Remedial Design Packages |
| Decontamination Efforts (Item 3.10) | OU3 Integrated RD/RA Work Plan (Secs. 3.2.3, 3.5.3); Implementation Plans for Above-Grade Decontamination and Dismantlement | SEP and Integrated Remedial Design Packages |
| Remediation Standard for Soil & Ground Water (Item 3.11/23.12) | N/A | OU5 Record of Decision |
| Sampling Plan and Analytical Procedures (Item 3.13) | N/A | SEP and Integrated Remedial Design Packages |
| Description of Removal Efforts/Treatment Processes (Item 3.14) | Implementation Plans for Above-Grade Decontamination and Dismantlement | SEP and Integrated Remedial Design Packages |
| Landfill Closure Requirements (Item 3.15) | N/A | OU5 ROD, SEP, Integrated Remedial Design Packages |
| Certification (3.16) | Project Completion Reports for Above-Grade Decontamination and Dismantlement; Remedial Action Report | Certification Reports and Remedial Action Report |
| Status of Facility After Closure (Item 3.17) | OU3 IROD | SEP |

# TABLE 2-11

## RECORDKEEPING AND REPORTING REQUIREMENTS/METHODS

| Record/Report | Method | Post-Remediation Document |
|---|---|---|
| Chronology - Activities Log | • Field log/WP log | |
| Performance Standards and Construction QA/QC<br>• Design criteria<br>• Construction specifications<br>• Field log | • Field log/WP log<br>• As-built drawings<br>• Change order summary<br>• IIMS | CR, RAR, SCR |
| Certification - Area Operational/Functional<br>• Certification data for in-place materials (lab and field)<br>• Certification of substantive RCRA closures of HWMUs, i.e., CERCLA FRLs met<br>• Certification of characteristic WAC areas (TCLP/SW-846)<br>• OSDF manifesting requirements<br>• Maintain characterization of excess soil from point of generation through final disposition<br>• Accountability for volumes of excavated materials (estimated) | • Certification, in-place: IIMS<br>• Certification, HWMUs: IIMS<br>• Certification, WAC: IIMS<br>• OSDF Manifesting: IIMS<br>• Excess material: IIMS | CR, RAR, SCR |
| Monitoring Results: Groundwater (GMA) Remediation Standards | | CR, RAR, SCR |
| Site-wide Risk Assessment | | SCR |
| Other OU documentation | | |
| Institutional Controls Documentation | | NRRP, SCR |

CR = Certification Report
GMA = Great Miami Aquifer
HWMU = Hazardous Waste Management Unit
NRRP = Natural Resource Restoration Plan
OSDF = On-Site Disposal Facility
RAR = Remedial Action Report
SCR = Site Closeout Report
TCLP = Toxicity Characteristic Leachate Procedure
WAC = Waste Acceptance Criteria
IIMS = Integrated Information Manegement System
TC = Toxicity Characteristic

## TABLE 2-12 MEASUREMENTS AND ANALYSIS

| | Field Measurements | | | | | | On-Site and Off-Site Lab | | |
|---|---|---|---|---|---|---|---|---|---|
| | Screening | | | | | Quantitative | | | |
| | Portable Instruments | | | Large Volume NaI | Field Lab | HPGe | Radiological | Metals | Organics |
| Function or Application | Radiation | Metals | Organics | | | | | | |
| 1. Pre-excavation | | | | | | | | | |
| Footprint[a] | | | | | | | | | |
| Primary COCs[b] | | | | • | • | • | • | | |
| Secondary COCs[b] | | | | | | • | • | • | • |
| Depth Profile[a] | | | | | | | | | |
| Primary COCs[b] | | | | | • | | • | | |
| Secondary COCs[b] | | | | | • | | | • | • |
| 2. Excavation Control | | | | | | | | | |
| Primary COCs[b] | • | | | • | • | • | | | |
| Secondary COCs[b] | • | • | • | | • | | | | |
| 3. Pre-Certification | | | | | | | | | |
| Primary COCs[b] | | | | • | • | • | • | | |
| Secondary COCs[b] | | | | | | • | • | | |
| 4. Certification | | | | | | | | | |
| Primary COCs[b] | | | | | | • | • | | |
| Secondary COCs[b] | | | | | | | • | • | • |

[b] Includes sampling programs for TCLP characterization and WAC attainment

[b] Primary and secondary COCs defined in Table 2-9.

000721

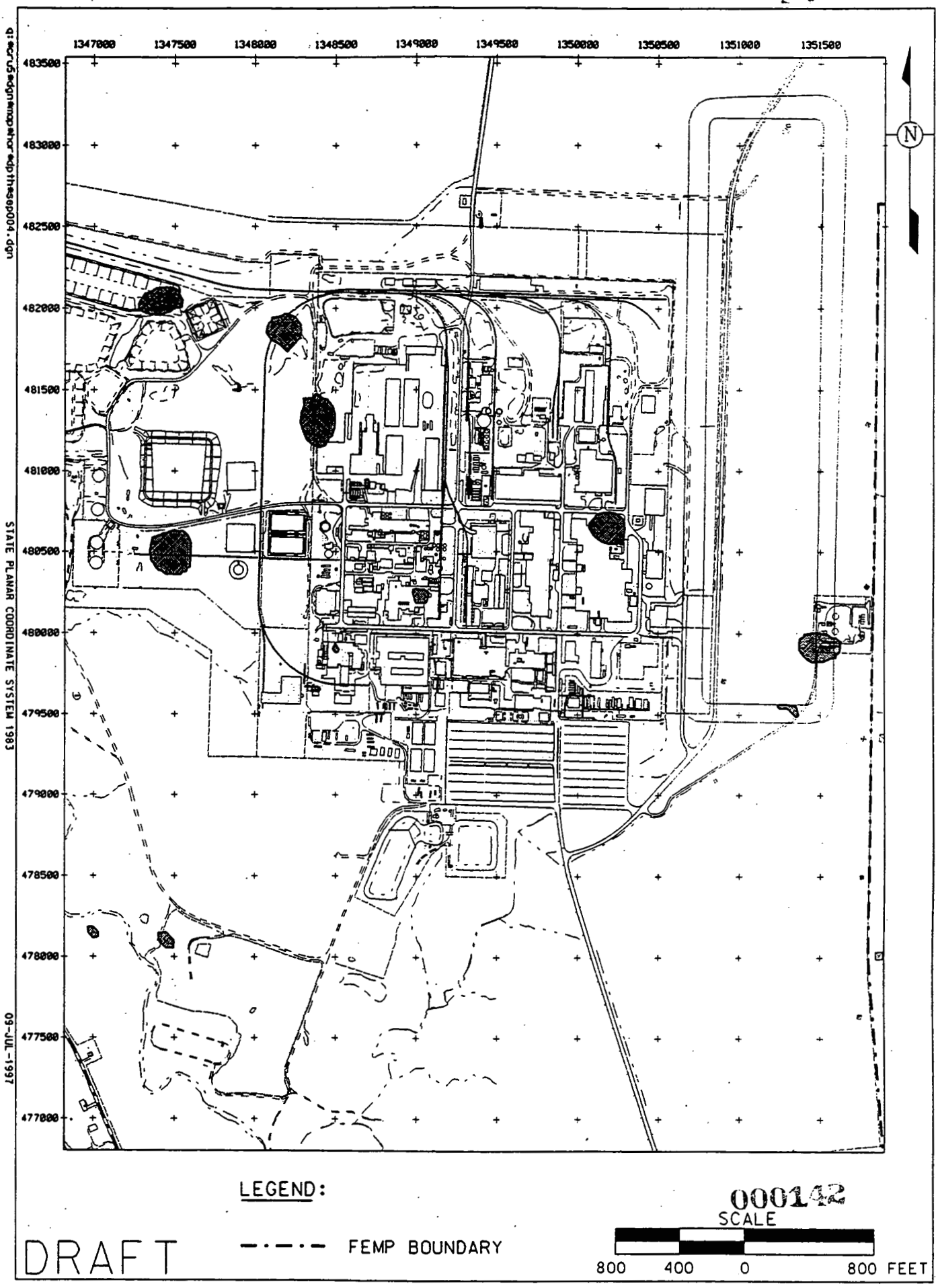


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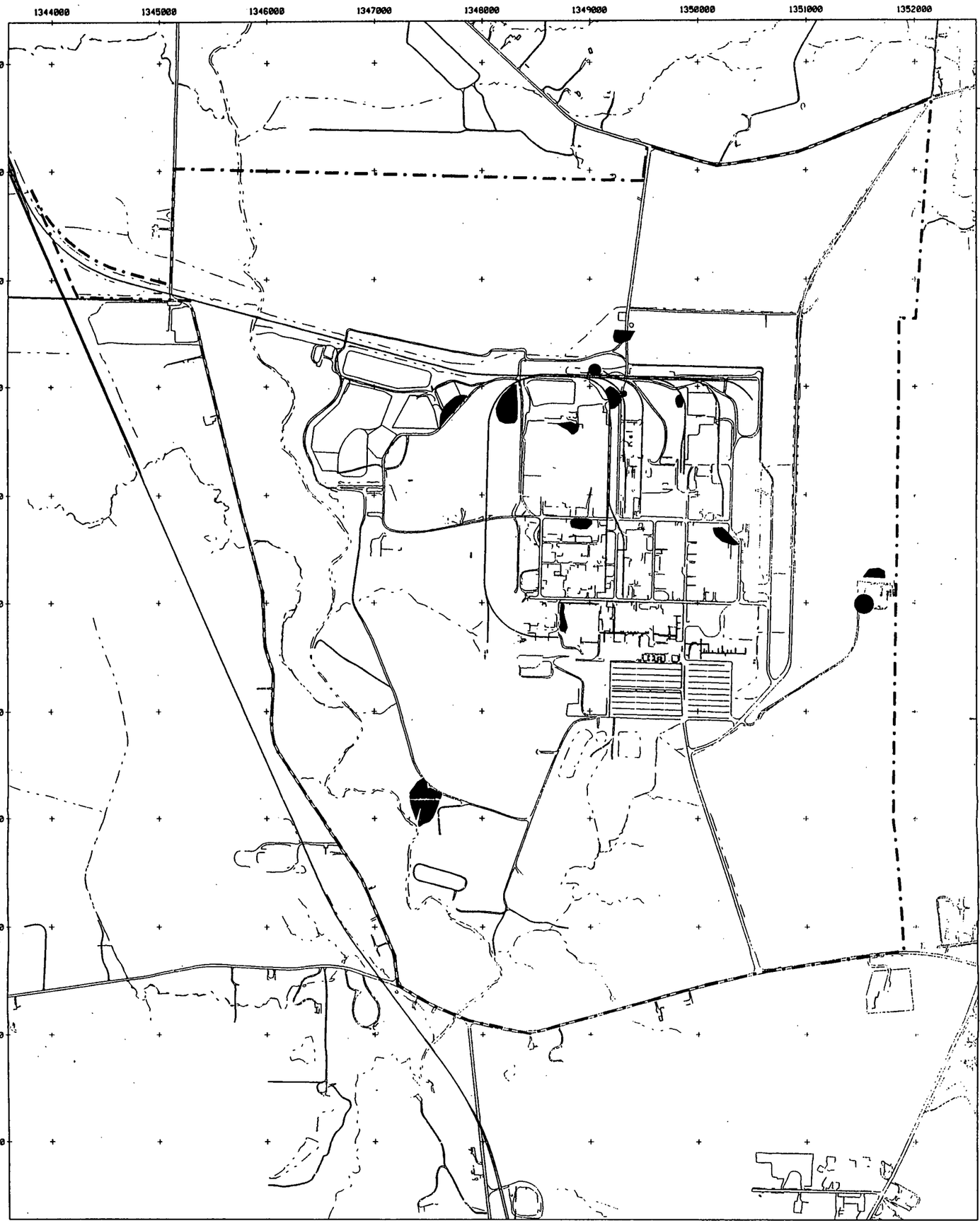
FIGURE 2-1. FEMP AREAS WITH TC-99 LEVELS GREATER THAN WAC/FRL




LEGEND:

FEMP BOUNDARY

WAC AREA

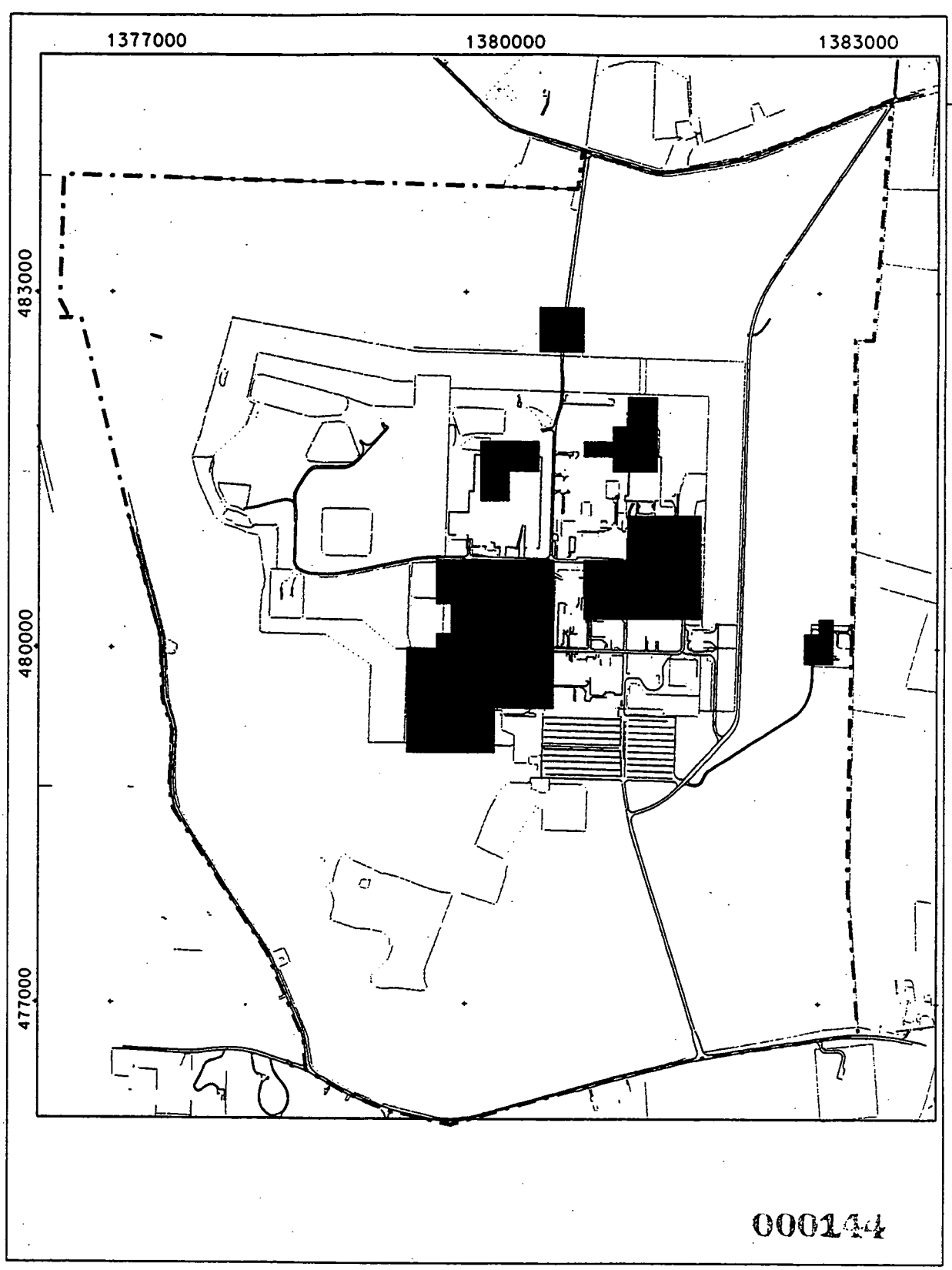
SCALE

1000 500 0 1000 FEET

DRAFT

FIGURE 2-2. FEMP AREAS WITH TOTAL URANIUM CONCENTRATIONS GREATER THAN WAC

/USR/ERMA1/CRU5/DGN/MAP/HGR/DPTH/SEP003.DGN.DGN FER 07/15/94 STATE PLANAR COORDINATE SYSTEM 1927




LEGEND:

LOW FRL AREA

FEMP BOUNDARY

SCALE

1250 625 0 1250 FEET

DRAFT

FIGURE 2-3. AREAS WITH LOWER URANIUM FRL DUE TO HIGH LEACHABILITY

## 3.0 GENERAL IMPLEMENTATION APPROACH

This section provides details on the general implementation approach in a remediation area for performing excavations during remedial activities at the Fernald Environmental Management Project (FEMP) and for completing post-remedial actions (Sections 3.1 through 3.5), as well as recordkeeping and data management (Section 3.6). The discussions provided in this section address many of the issues identified in Section 2.0 and also form the basis for presentation of the detailed area-specific excavation approaches discussed in Section 4.0. Section 3.0 also identifies the important remediation documents that will be delivered during the soil remediation process. These documents are discussed in greater detail in Section 7.0. Applicable health and safety issues are identified in Section 6.0, and quality assurance issues are noted and detailed in Appendix E. All contingency plans pertinent to the activities discussed in this section are noted and detailed in Appendix F.4.

Figure 3-1 summarizes the steps in the general soil remediation process in a remediation area and identifies their integration with three remediation documents that will be delivered to the U.S. Environmental Protection Agency (EPA) as part of the remediation process. The remediation process begins with a pre-design investigation to establish the extent of the excavation. Radiological survey and laboratory data, as needed, are forwarded to the remedial design step to prepare the first deliverable document, the integrated remedial design package (IRDP), that will guide the actual excavation of the soil. After the IRDP has been approved, soil excavation will begin and materials designated as above waste acceptance criteria (WAC) will be segregated from those destined for the on-site disposal facility (OSDF). Upon completion of the excavation, a pre-certification survey (and potential additional localized excavation) will precede commencement of certification activities.

Prior to final certification, the second deliverable document, a Certification Design Letter, will be issued. This letter will establish the boundaries of each certification unit (CU) that subdivides the remediation area, sampling locations within each CU, and a list of CU-specific constituents of concern (COCs) that require laboratory analysis (ASL D) to determine whether the certification criteria have been met (Figure 3-1).

After the Certification Design Letter has been issued to the EPA, final certification activities can begin. A fast-track regulatory review and approval cycle for the Certification Design Letter will be required to reduce the idle period between completion of excavation activities and initiation of the final certification process. After approval of the certification design is obtained, certification sampling and analysis will be implemented and the results will be evaluated against the certification criteria to demonstrate that the CUs and the remediation area can be released. Interim data will be maintained on a website for EPA access and review during the certification process. Upon successful certification of all CUs in the area, a third deliverable document, the Certification Report, will be released for the remediation area. This report will contain summary information on sampling locations, analytical results, statistical methods, certification criteria, and notification of successful certification (Section 7.3). During the review process, necessary access control and protective maintenance in the remediated area will be sufficiently maintained. After approval of the Certification Report, interim grading and restoration of the area can begin.

The remediation activities have been grouped chronologically into steps to facilitate discussion in this document. These steps are: 1) pre-design investigation (Section 3.1); 2) remedial design (Section 3.2), 3) remedial actions (Section 3.3); 4) certification (Section 3.4); and 5) post-remedial actions (Section 3.5). Recordkeeping and data management issues associated with these five steps are presented in Section 3.6.

## 3.1 PRE-DESIGN INVESTIGATION

The flow of the pre-design investigation process is shown on Figure 3-2. This process consists of:

- Data review and initial delineation of excavation areas
- Selection of area specific COCs
- Identification of potential technetium-99, characteristic waste, hazardous waste management units (HWMUs), underground storage tanks (USTs), and above-WAC areas
- Surveying, sampling, and analysis
- Final delineation of excavation areas and depth

It is expected that the sequence of events will follow this flow, but unusual or unexpected events can occur to change the order in which the steps are implemented. Nonroutine events that may occur and the contingency plans developed to deal with them are provided in Appendix F.4.

### 3.1.1 Types of Potential Excavation Areas

The remedial excavations at the FEMP will be conducted using a phased approach. Soil containing constituents that require special handling will be excavated first. When these soils have been removed, the remainder of the soils identified for remediation (if any) will be excavated. To follow this approach, the location, spatial extent, and concentrations of constituents of interest in the soil must be delineated. This will be done as part of the pre-design investigation performed on each area to be excavated.

#### Overall Excavation Extent

An area-specific pre-design investigation will open with a review of RI/FS data to identify the COCs present in the area (Figure 3-2). This will be followed by an estimate of the total excavation soil volume in the remediation area. In most cases, the areal extent of the uranium footprint is expected to encompass all other COCs. If this is true, an estimate of the excavation's extent will be determined by analyzing the uranium RI/FS characterization data collected on surface and subsurface soil samples. In some areas, the spatial distribution of other COCs, such as radium and/or thorium, will not be correlated with the uranium distribution. When this happens, the excavation footprint will be based on the combined extent of all COCs.

#### Excavation/Segregation Phases

Surface and subsurface soil characterization data (e.g., RI/FS and pre-design data) at or immediately below a COC's final remediation level (FRL) will be used to generate an excavation profile through kriging or other appropriate 3-D interpolation techniques. Once the overall excavation footprint has been delineated, RI/FS and pre-design characterization data will be used to identify soil within the

footprint that may require special handling and disposal.[1] If any such areas are identified, their extent will be delineated.

COCs selected to drive each phase of the excavation will depend on the distribution and concentration/activity of the COC in the area, the type of excavation area, applicable treatment options, and final disposition of soil for disposal (i.e., off site vs. OSDF). In most remediation areas, uranium, radium, and/or thorium concentrations will drive the remediation. Remediation of areas with technetium-99, RCRA characteristic waste (Figure 1-5), or HWMUs/USTs may be driven by technetium-99 activity or the concentrations of hazardous or listed metals and organic compounds.

Soil containing technetium-99 above the FRL/WAC limit of 30 pCi/g will be excavated and staged for off-site disposal. If soil in a RCRA excavation area exhibits the characteristic of toxicity and overlaps with the area delineated for technetium-99 excavation, this material will be staged separately and sent to the FEMP Waste Disposition Program for decisions on treatment and final off-site disposal.

In the seven areas with the potential to contain RCRA characteristic waste that can be segregated for preferential treatment (Figure 1-5), excavation of the footprint will be driven by the FRLs of all applicable area-specific COCs (ASCOCs), and TCLP tests will be conducted to determine whether treatment is required prior to disposal. Any above-WAC material excavated from a RCRA unit containing soil with the toxicity characteristic will be sent to the Waste Disposition Program for decisions regarding off-site treatment and final off-site disposal.

Excavation of soil above the non-technetium-99 WAC will be driven by any COC shown to exceed the WAC. Soil containing COCs above the WAC will be excavated, segregated, and sent to the Waste Disposition Program for decisions regarding final off-site disposal.

[1] For example, soil containing technetium-99 concentrations that exceed the FRL of 30 pCi/g and/or soil containing any radiological COC in concentrations that exceed its WAC will require segregation and off-site disposal.

For remaining excavation areas and HWMUs or UST footprints, excavation of the soil will be driven by the FRLs of all COCs present within the unit. Any above-WAC material excavated from a HWMU or UST footprint will be treated as listed waste and will be sent to the Waste Disposition Program for decisions on treatment and final off-site disposal.

Based on site history, process knowledge, and RI/FS data, potential technetium-99, RCRA, HWMU, UST, and above-WAC areas have been identified at the FEMP (Section 2.1.1). There are seven potential locations where technetium-99 excavation may take place (Figure 2-1), seven potential locations where toxicity characteristic soil may be present (Figure 1-5), 29 HWMUs (Table 2-1), six UST locations within the production area (Table 2-2), and eight locations where uranium is above the WAC in surface soil (Figure 2-2). These areas are identified and further discussed in Section 4.0.

### 3.1.2 Pre-Design Sampling and Analysis

The objective of the pre-design (or pre-excavation) sampling effort is to fill in RI/FS data gaps by collecting supplemental data using NaI surveys, HPGe measurements, and/or sampling and analysis. Prior to initiating sampling activities, the current level of access control will be determined for each area affected by sampling activities. Entry and access procedures for sampling activities will comply with the most current level of access control. Appendix F.2 contains a more complete discussion of access controls, and Section 2.4 discusses field and laboratory measurements proposed for the sampling approach.

#### Material Contaminated by Technetium-99

Where RI/FS data indicate technetium-99 is present in soil above its FRL/WAC (30 pCi/g), the RI/FS data will be reviewed to determine whether enough data exist to establish a reasonable excavation footprint to guide removal of the technetium-99. If additional information is needed, a sampling and analysis task will be initiated to define the extent of excavation for technetium-99. This task will consist of collecting discrete surface and subsurface soil samples and submitting them to a laboratory for analysis of characteristic beta radiation. Sample collection, handling procedures, sample preparation, analytical methods, and detection limits are presented in Section 2.4, Appendix H, and the QAPP (Appendix E).

RCRA Waste

In the seven potential RCRA characteristic-waste areas (Figure 1-5), a sampling and analysis task will be initiated to establish whether toxicity characteristic soil is present. Where appropriate, this task will be integrated with the technetium-99 sampling and analysis program. Discrete surface and subsurface soil samples will be collected and subjected to the TCLP test to determine whether the soil meets the characteristic of toxicity. Sample collection, handling procedures, sample preparation, analytical methods, and detection limits are presented in Section 2.4, Appendix H, and the QAPP (Appendix E).

Material Containing COCs Above WAC

Material containing COCs above the WAC will be demonstrated to fulfill the data requirements specified in the sitewide WAC Attainment Plan (scheduled to be submitted to EPA in late 1997). Potential non-technetium-99, above-WAC excavation areas will undergo radiological surveys and/or sampling and analysis to establish the extent of excavation for material remaining above WAC. Where appropriate, this task will be integrated with the technetium-99 and/or RCRA excavation characterization activities. RI/FS data and pre-design sampling and analysis will be used to determine the excavation extent for the area-specific radiological, metal, and organic COCs. If the RI/FS data are not sufficient to determine the extent of the excavation, pre-design sampling and analysis will be done to collect any additional information required. The areal extent of soil containing gamma-emitting radionuclides in concentrations that exceed the WAC can be determined by using the large-volume NaI detector or HPGe gamma spectrometry systems discussed in Section 2.4. Discrete soil samples will be collected and sent to a laboratory for analysis to generate information on the areal extent of non-gamma-emitting COCs. Additional information on the vertical extent of COCs in such areas will be obtained using the NaI detector and/or laboratory analysis of discrete subsurface samples collected with a geoprobe. In all cases, sufficient field measurements and laboratory analyses will be available to demonstrate that material placed in the OSDF meets the WAC. Survey methodology, instrument sensitivity, sample collection, handling procedures, sample preparation, analytical methods, and detection limits are presented in Section 2.4, Appendix H, and Appendix E (QAPP).

Other Considerations

Surface and subsurface NaI surveys, HPGe measurements, and/or sampling and analysis carried out to define technetium-99, RCRA, and above-WAC excavations for soil will be used to identify a representative COC that can serve to bound the overall excavation extent of all COCs. In most cases, this COC will be uranium and the excavation extent will be the applicable area-specific uranium FRL along with as low as reasonably achievable (ALARA) considerations.

HWMU and UST excavations will require no characterization outside of that carried out to identify above-WAC and above-FRL boundaries, as all listed waste may be placed in the OSDF under the corrective action management rule (CAMU) rule if it meets WAC.

After the analytical results for all ASCOCs have been used to determine the extent of excavation (Section 3.1.3), geotechnical samples needed to design the construction aspects of the excavation will be obtained.

### 3.1.3 Establish Extent of Excavation

Radiological surveys, HPGe measurements, and sampling and analysis will be executed as needed to establish the extent of excavation for technetium-99, RCRA characteristic waste, above WAC and/or above-FRL areas. The specific number of samples needed to establish the excavation extent will depend on the nature and extent of ASCOCs and the balancing of cost between laboratory analysis and soil excavation. A large number of samples will result in very accurate delineation of excavation volumes, which may be too precise to follow during excavation. Conversely, too few samples will result in delineation of excavation volumes that overestimate the soil volume above the FRL, and unneeded excavation will take place. Therefore, this section is restricted to presenting a conceptual model that can be used to develop the detailed excavation plan in the IRDP, which will finalize the appropriate area-specific number of pre-design samples.

The approach used to establish the extent of a given excavation type will be similar to the conceptual model outlined on Figure 3-3. This approach sets the excavation type (e.g., technetium-99, RCRA, etc), selects COCs and appropriate analytical methods, and uses data from the SED in a three-

dimensional (3-D) interpolation model to determine the initial excavation volume. A unit volume not to exceed one-fourth of the total estimated volume is then selected to determine the cell size of the overlying grid. Using the above-FRL excavation type as an example, the grid is surveyed to locate any potentially elevated activity areas to ensure the grid nodes lie on these areas. HPGe measurements and/or samples are collected from the grid nodes and the analytical results evaluated to determine whether all nodes lie below the FRLs of applicable COCs. If the perimeter nodes are greater than the FRL criteria, the sampling grid is extended until all soil above the FRL is captured. When the lateral extent of COCs is determined, geoprobe borings are placed at the nodes exhibiting the most elevated levels of COCs, and a core soil boring sample is obtained to a depth of 3 feet to determine the vertical distribution of the COCs. At least one subsurface sample is collected in every 1-foot interval, and if the deepest sample contains ASCOCs above their respective FRL, the geoprobe boring is extended an additional 3 feet to obtain at least three additional samples. Sampling will continue until the depth of excavation is established at the location of the deepest sample with ASCOCs less than their respective FRL. The excavation volume is than refined based on the depth of excavation established at each geoprobe boring location. Additional excavation types (e.g., technetium-99, RCRA, above WAC, etc.) are established in a similar manner concurrently with the FRL volume. After the excavation volumes have been established for all excavation types, the collected data will be used to finalize the excavation profiles that will be presented in the IRDP.

The data collected from the pre-design characterization will be used to generate an excavation profile through kriging or other appropriate 3-D interpolation techniques. The kriged profile will be forwarded to remedial design so that a final volume and slope of excavation can be determined from the kriged profile of each excavation type (e.g., technetium-99, above WAC, etc.). In all cases, the final engineered slope of excavation will be located outside the profile estimated from the kriging data, owing to standard construction practices for slope stability. This approach will provide added assurance that the WAC will be attained for soil placed in the OSDF and that soil left in place is below the FRL established for each COC. The final engineered design will appear in the IRDP.

## 3.2 REMEDIAL DESIGN AND THE IRDP

After completion of pre-design investigation activities and prior to the start of excavation activities, a remedial design will be developed and documented in the IRDP (Figure 3-1), following the technical guidelines and requirements provided in the SEP. The remedial design details have been assigned to the IRDP so that flexibility can be maintained to integrate upgraded methods and lessons learned on preceding excavation activities to the next scheduled excavation. Area-specific interim and/or final grading and restoration requirements will also be provided in the IRDP. The IRDP will be reviewed and approved by the OEPA and EPA before excavation activities begin.

An IRDP will be developed for each remediation area or a combination of remediation areas when similar ASCOCs and excavation approaches are used. All area-specific information (e.g., RI/FS and additional pre-design investigation data) required to delineate excavation areas and conduct soil remediation, as outlined by the SEP general technical guidelines and appropriate area-specific excavation approaches (Section 4.0), will be presented in each IRDP. Each IRDP will also include an area-specific implementation plan that incorporates area-specific elements of a remediation work plan, such as coordination of soil excavation with D&D activities in the Former Production Area, applicable waste disposition program procedures, excavation controls, interim/final grading, and restoration design. All design drawings and specifications for the remediation elements will be provided in the IRDP. The need for wastewater and/or soil treatment (at either an on-site or off-site facility) will be specified. Remediation wastewater will be sent to the on-site AWWT facility after potential pre-treatment for organic contaminants. The IRDP will also include protocols for design change control and updating contingency plans in the SEP (Appendix F). Additional details on the content of the IRDP are provided in Section 7.1.

## 3.3 REMEDIAL ACTION

Upon approval of the IRDP by the EPA and completion of other applicable FEMP administrative actions (Appendix F.1), remedial activities can begin. This remedial action discussion is divided into three elements: 1) implementation of construction, excavation, and material-handling activities; 2) pre-certification activities; and 3) demonstration of attainment of remediation goals. Excavation activities are the principal actions executed during the remedial action, with pre-certification activities providing

the verification that the actions were executed properly. An important closing aspect of the remediation is demonstrating that attainment of remediation goals and disposal constraints have been met.

### 3.3.1 Implementation of Construction, Excavation, and Material-Handling Activities

Figure 3-4 summarizes the soil excavation, segregation, and disposal process. After the site is prepared and surface water controls have been established, an excavation hierarchy is implemented to segregate soil types for the appropriate disposal option. Excavation begins with removal of soil containing technetium-99 above its FRL, then proceeds through the various combinations of TCLP/WAC excavations to FRL/ALARA excavations. Finally, each excavation type is traced to the appropriate treatment and disposal options.

#### 3.3.1.1 Site Preparation

Following submission and approval of the IRDP, site-preparation activities will commence. Site boundaries, access controls, support areas, and excavation staging areas will be established. Wheel wash and decontamination facilities will be installed and isolated from storm water. Storm water controls will conform to applicable rainwater and land-development guidelines. Appendix F.2 provides a comprehensive discussion of site preparation procedures, with a summary of pertinent information given below.

A surface water management system will be installed to control run-off/run-on and soil erosion. Run-off/run-on controls will consider the layout of support areas within the remediation area and the natural drainage pattern when integrating the drainage of local areas with sitewide drainage channels. Conditions in the FEMP NPDES Permit (EPA Permit No. 1IO00004*ED) lead to the development of the FEMP Storm Water Pollution Prevention Plan (SWPPP) (DOE 1996f). The SWPPP identifies potential pollution sources, practices that will be employed to reduce pollutant discharges, and provisions of the inspection program that will be implemented to ensure compliance with the requirements of the NPDES Permit. Section 5.1.3 provides additional details on implementation of these controls.

If excavation activities involve removal of soil from perched water zones, an appropriate area will be established for the pumping equipment and holding tanks required to remove and store the perched water prior to treatment at the AWWT facility. In the event perched water is recovered from a RCRA excavation unit, sampling and analysis will be carried out during the pre-design investigation to determine whether RCRA COCs are present in sufficient quantity to warrant pre-treatment prior to sending the water to the AWWT facility for final treatment.

Following the establishment of support areas and surface water control, final surveying will be conducted to determine the excavation layout and monitoring design. In general the layout will delineate the excavation types in the hierarchy illustrated on Figure 3-4. However, if applicable, this survey will also consider removal of at- and below-grade structures, special material areas, and excavation of impacted material. The survey will also identify the appropriate areas for project-specific environmental monitoring stations to ensure that excavation activities will not destroy monitoring equipment.

3.3.1.2 Excavation Hierarchy

The conceptual excavation hierarchy shown on Figure 3-4 follows a step-by-step approach to illustrate the need to segregate soil piles based on the type and concentration of ASCOCs. Figure 3-4 is for illustrative purposes only and is not intended to imply that all technetium-99 soil must be removed before non-technetium, above-WAC soil is excavated. In large excavation areas, specialized crews may be used in a sequential manner; where a technetium-99 crew begins excavation and as it proceeds through the excavation area, it is followed by a non-technetium above-WAC crew. In this fashion, various excavation types will be performed simultaneously, when possible.

Excavation begins with the removal and segregation of any identified soil containing technetium-99 above its FRL. If the excavation of soil containing technetium-99 above its FRL includes soil that has failed the TCLP test, the excavated technetium-99 soil will be segregated into non-treatment and treatment piles, as needed. If on-site treatment of characteristic waste is selected, the treatment will be performed and the soil is given to the Waste Disposition Program for decisions on final disposal. Soil

designated for off-site treatment will be given to the Waste Disposition Program for proper packaging and decisions on locations for treatment and final disposal.

After technetium-99 excavations are completed, excavation areas delineated as above WAC and failing TCLP will be excavated and segregated to indicate treatment will be required prior to disposal. Removal of above-WAC soil that fails the TCLP test is followed by removal of soil that is below the WAC but fails the TCLP test. If on-site treatment of characteristic waste is selected, the treatment will be performed and the soil will be given to the Waste Disposition Program for decisions on final disposal, based on the pre-treatment concentrations of radiological COCs. Soil designated for off-site treatment will be given to the Waste Disposition Program for proper packaging and decisions on locations for treatment and final disposal. A final, above-WAC excavation will then be performed on all soil not exhibiting the toxicity characteristic.

Following removal of all above-WAC and toxicity-characteristic soil in the seven areas on Figure 1-5, soil delineated as above the FRLs of ASCOCs driving the excavation will be removed and passed to the Waste Disposition Program for disposal in the OSDF. For excavations driven by uranium FRLs, excavation will take place to within the area-specific uranium FRL, with consideration given to the ALARA concept (Section 3.3.1.4).

All debris, USTs, and special materials encountered during excavation activities will be removed and segregated from the staged soil piles. Debris will be handled as Category 2 or Category 3 materials (Section 3.6.4.1), whereas tanks, pipes and associated pumping are considered special materials (Section 3.3.2.2). All special materials encountered during excavation activities will be handled, treated (as needed), and disposed in accordance with the waste disposition procedures described in Appendix F.5.

3.3.1.3 Treatment, Special Handling, and Disposal Options

Treatment will be required for all soil from the seven areas discussed in Section 1.3.2.7 that fails the TCLP test and becomes classified as RCRA toxicity characteristic waste (Figure 3-5). Soil failing the TCLP test and containing technetium-99 or other radiological COCs above their WAC will be given to

the off-site Waste Disposition Program for decisions on treatment and final off-site disposal. For soil below the radiological WAC that fails the TCLP test, a decision will be made to treat the soil on site or off site, and the material will be given to the appropriate Waste Disposition Program. Regardless of where the material is treated, no treated material with pre-treatment radionuclide concentrations above WAC can be placed in the OSDF. Soil removed from FRL/ALARA excavations will not require treatment and will be placed in the OSDF.

Material placed in the off-site Waste Disposition Program for off-site treatment will be segregated and treated based on its classification as a listed waste (i.e., from within a HWMU) or a RCRA toxicity characteristic waste (i.e., soil from the seven areas that fails the TCLP) (Figure 3-5). Listed wastes will be treated for organic COCs and then evaluated and treated, as needed, for RCRA organic and inorganic COCs prior to mixed waste disposal. If the waste is not listed, it will be evaluated and treated, as needed, for RCRA organic and inorganic COCs prior to low-level waste disposal (i.e., the hazardous component has been removed through treatment).

RCRA toxicity characteristic waste that is given to the on-site Waste Disposition Program will undergo low-temperature thermal desorption treatment if organic COCs are present and/or cement stabilization if inorganic COCs are present (Figure 3-5). The treated material will than be placed in the OSDF. In all cases, decisions regarding soil disposition will follow the procedures of the currently in place FEMP Waste Disposition Program, as summarized in Appendix F.5, or future revisions to the program approved by the EPA.

3.3.1.4 ALARA Implementation

ALARA is a philosophy that states potential exposures should be kept As Low As Reasonably Achievable. Implementing this philosophy requires for executing a reasonable excavation approach that will strive to achieve the release criteria in each remediation area as set forth during the CERCLA process. In addition to this goal, ALARA advocates removal of any additional contaminated material present that is easily discernible and reasonably accessible during the excavation. This application of ALARA only serves to modify the extent of excavations that are scheduled to occur because COC soil concentrations in an area exceed the appropriate FRL. ALARA will not serve as a generic justification

to initiate remediation of an area that does not require excavation or in areas that meet FRL attainment criteria.

The human-health-derived FRL for total uranium in more than 80 percent of the on-site soil at the FEMP is 82 mg/kg. The HPGe instrument used for field measurements during the pre-excavation survey can identify areas of soil containing 50 ppm of uranium. Because this material is readily discernible and easily excavated, HPGe measurements will be used in the IRDP to establish the extent of excavation at 50 ppm uranium. The ALARA goal of 50 ppm is only used to guide the excavation plan development in areas where excavation is required as a result of human-health derived FRLs, and is not intended to replace the certification requirement, which will remain set at the FRL of 82 mg/kg in these areas.

### 3.3.2 Impacted Materials Handling and Tracking

Impacted materials will be handled and tracked under the FEMP Waste Disposition Program. The Waste Disposition Program will be implemented as an integrated effort during remediation by the SCEP, as defined in site procedures (e.g., WAC Attainment Plan). Protocols for disposition of excavated soil and waste materials currently in place are summarized in Appendix F.5. Programmatic controls begin with waste planning during the pre-design investigation, at which time volume estimates per matrix and source location will be prepared, characterization protocols are specified, treatment options noted, and tentative interim and final disposition identified.

#### 3.3.2.1 Disposition Categories

During excavation, waste streams are segregated by disposition categories and managed in the context of the following characterization, storage, and disposal options:

- Bulk Waste Streams: On-Site Disposition
  - Physical matrix allows bulk management
  - Meets the OSDF chemical, radiological, and physical WAC
- Bulk Waste Streams: Off-site Disposition
  - Physical matrix allows bulk management

- Exceeds the OSDF radionuclide WAC (rail transport)
- Exceeds the OSDF chemical WAC (truck transport)

- Containerized Waste Streams: Off-Site Disposition
  - Exceeds OSDF chemical, radiological, or physical WAC
  - Cannot be processed to meet OSDF WACs
- Containerized Waste Streams: On-site Disposition
  - Physical matrix or nature of waste does not allow bulk management
  - Requires processing in a controlled area, to meet OSDF WAC
  - Requires confirmatory sampling for OSDF WAC
  - Special Material that meets the OSDF WAC, but requires special handling for health and safety concerns

Physical, chemical, and radiological requirements for the OSDF WAC are summarized in Table 2-4. Note that some of the RCRA constituents identified in Table 2-4 apply only to the seven areas identified in the Operable Unit 2 and Operable Unit 5 Records of Decision (RODs) (DOE 1995d, 1996d) as suspect RCRA toxicity characteristic areas with cost-effective treatment opportunities (Figure 1-5). Protocols specific to containerized special materials are provided in Appendix F.5. Containers will be managed in an interim storage area pending completion of characterization, treatment, WAC confirmation, and other activities specific to the selected on- or off-site facility. As additional on-site treatment options are developed, off-site designated waste streams will be reevaluated to allow on-site treatment of selected off-site designated materials. The waste disposition program will also be updated accordingly.

3.3.2.2 Special Materials

When excavation activities encounter special materials or unexpected high levels of contamination, contingency plans may be implemented to address pertinent health and safety concerns. Special materials are defined as:

- Asbestos
- Nonpressurized containers
- Pressurized containers
- Piping and sumps
- Non-soil residues
- Transformers

- Lead acid batteries
- Uranium metal
- Medical/infectious waste
- Miscellaneous debris
- Tires

Portions of these waste streams will be eligible for OSDF disposition after physical processing, sampling and analysis, or interim containerization. Materials that do not meet OSDF WAC will be evaluated for off-site disposition. Protocols currently in place for managing and treating special materials are provided in Appendix F.5.

### 3.3.3 Pre-Certification Activities

The general activities to be followed for pre-certification of a remediation area are outlined on Figure 3-6. Large-volume NaI instruments will be used to survey 100 percent of the remediation area, when possible and practical. This area survey will be used to establish the residual pattern of uranium, radium, and thorium distribution. Survey results will be used with historical knowledge, RI/FS data, and an understanding of the physical conditions of the area to determine the location of CU boundaries and the appropriate size of the CUs that will subdivide the remediation area (Section 3.3.3.2).

After the CU grid has been established for the remediation area, CU-specific ASCOCs will be identified and HPGe measurements will be taken above areas designated as elevated by the NaI survey. If HPGe measurements indicate any single location to be above the hot-spot criterion (Section 2.2.3 and Appendix G) or the average concentration of individual ASCOCs is likely to exceed their FRL, additional excavation, scanning, and measurements will be conducted until each CU in the remediation area is considered to be ready for certification (i.e., a high possibility for success is indicated). A Certification Design Letter (Section 7.2) will be issued prior to conducting final certification sampling and analysis to present the EPA with the boundaries of each CU, the list of CU-specific COCs to be evaluated, and the certification sampling approach.

#### 3.3.3.1 Field Survey to Evaluate Residual Radionuclide Distributions

Following excavation of all areas to established FRL depths, a scanning survey will be conducted on the excavated surfaces to establish the distribution pattern of residual gamma emitters. This survey will

be conducted with a large-volume NaI detector. Vehicle-mounted detectors like the RTRAK may be used in areas where excavations are not deep and the excavation depth is uniform over a large area. A large-volume NaI detector mounted on a cart (BTRAK) may be used when the excavation depth is not uniform over a large area and surveying is required for each excavation layer. Regardless of the configuration used, the selected equipment configuration will have the sensitivity to provide a threshold response to radioactivity from soil containing uranium, thorium, or radium at concentrations exceeding three times the FRL (Section 2.4 and Appendix H).

The scanning survey will cover 100 percent of the excavated and unexcavated areas to the extent possible. Areas will be marked with paint, chalk, flags, or other appropriate method when instrument readings indicate a gamma emitter is present above three times its FRL. Where possible, a rough estimate of the areal extent of the residual affected area will be delineated in the field to facilitate follow-up measurements with the HPGe instrument, meet applicable health and safety protocol, and to identify potential access control areas. The presence and location of these areas will be recorded in pre-certification field notebooks and reported to appropriate management and oversight personnel. The area-wide radiological activity pattern will be contoured using scanning results and the GIS.

3.3.3.2 Determination of CU Size, Area-Wide CU Delineation, and CU-Specific COCs

FEMP remediation areas are classified as either impacted or nonimpacted areas using historical knowledge and RI/FS data (Figure 3-6). Impacted areas (i.e., areas that contain known and/or expected hot spots) primarily include the former production area, waste storage/management areas (e.g.,Waste Pits, Silos, Flyash Piles, etc.), and other localized areas with significant contamination (e.g., STP and FTF). Nonimpacted areas (i.e., areas where hot spots are believed to be absent) are outside the impacted areas and include the area west of Paddys Run, the wooded area north of the production area, and much of the area southeast of the Former Production Area. However, some of the nonimpacted areas may require local excavation in order to satisfy the certification requirements.

The size of the CU will be determined by the type of area in which it is located. Impacted areas are expected to have a greater diversity of COCs, a higher reported residual concentration or activity, and/or a greater variability in reported concentrations than nonimpacted areas. Experience has shown

that these areas have a higher potential to exhibit a complex distribution of contamination. This, in turn, requires CUs located in impacted areas to have a greater number of sample locations per unit area than areas with a more homogeneous distribution of contamination. To reflect the need for a more detailed characterization of these areas, the initial CU size in impacted areas will be smaller than those in nonimpacted areas. The nominal CU size for impacted areas will be set as 250-ft by 250-ft (62,500 $ft^2$) and referred to as a Group 1 CU. For nonimpacted areas, a 500-ft by 500-ft (250,000 $ft^2$)[2] CU will be set as a Group 2 CU.

The delineation of CU boundaries is postponed until after the pre-certification survey and/or sampling activities are complete to optimize the placement of boundary lines using the most updated information about the distribution of residual COCs. Based on the most current data on COC distribution[3], CU boundaries will be delineated in a manner that minimizes the number of COCs that must be certified in each area. For example, if the residual distribution of arsenic is limited to 50,000 $ft^2$ in a remediation area, this area will be contained within a single CU to minimize the number of CUs that must be certified for arsenic. In this way, each CU may have a subset of the entire set of ASCOCs distributed throughout the remediation area. The delineated CU boundaries, list of CU-specific COCs, and certification sampling approach will be stated in the Certification Design Letter. Following a fast-track EPA review cycle, EPA approval of the certification design will be received prior to conducting certification sampling activities (Section 7.2).

3.3.3.3 Final Field Measurements and Excavation, As Needed

After establishing the CU boundaries and specifying the CU-specific COCs, HPGe measurements will be made over areas designated as elevated by the NaI scan. If the HPGe measurements indicate that uranium, radium, and thorium concentrations in soil exceed three times the FRL or the average concentration of a COC in the CU is above its FRL, additional excavation will take place to remove the elevated material. The contamination can be removed by re-excavating the entire CU or by excavating the elevated areas (i.e., hot spots). If the entire CU is excavated, the CU will be resurveyed with NaI

[2] There are no standard areas defined for RCRA, HWMU, and UST areas.

[3] This will include RI/FS data, process knowledge, and data collected during the pre-excavation, excavation, and pre-certification phases of the remediation.

detectors as described in Section 3.3.3.1. If the excavation is selective in nature, excavation will continue until the HPGe measurements indicate that the certification criteria will be met.

If nonradiological COCs are driving the excavation in a CU, the decision may be made to collect discrete samples for laboratory analysis of metal or organic COCs. Should discrete sampling and analysis be conducted, the samples will be collected in a manner that will allow them to be used for final certification in the event that the laboratory analysis confirms the COCs are below CU release criteria (Section 3.4.4).

Upon completion of all HPGe measurements, additional excavations, and optional sampling activities, a Certification Design Letter (Section 7.2) will be issued prior to conducting final sampling and analysis activities for certification. The Certification Design Letter will contain figures depicting the boundaries of the CU proposed for certification, the basis for delineating the boundaries shown on the figures, the list of CU-specific COCs that will be analyzed to demonstrate certification, and the certification sampling approach. CU boundaries are delineated in the Certification Design Letter rather than in the IRDP to allow use of pre-certification data to optimize the location of boundary lines, as discussed in Section 3.3.3.2. Submittal of the Certification Design Letter will indicate that the CU is ready for final sampling and analysis activities to commence. Because the Certification Design Letter will provide detailed certification procedures developed according to the approved SEP technical guidelines, a formal review process will not be necessary. However, EPA concurrence will be received prior to conducting final certification activities.

### 3.3.4 Attainment of Remediation Goals

The remediation goals established for soil excavation activities at the FEMP include: 1) WAC attainment, 2) FRL and hot-spot attainment, 3) RCRA-characteristic-waste compliance, 4) HWMU closure, and 5) UST closure. These goals are expected to be met when the Certification Design Letter is submitted and will be shown to be met when the Certification Report is issued.

3.3.4.1 WAC Attainment

WAC attainment refers to demonstrating that soil to be placed in the OSDF does not exceed WAC levels for applicable COCs. This will be demonstrated with RI/FS data, pre-design characterization data, real-time excavation-control monitoring of gamma radioactivity and organic vapor levels, and by verifying that the excavations were carried out in accordance with the conservative design specifications. Each excavation approach (Section 4.0) will use a unique combination of excavation sequence, field measurements, and analytical testing to demonstrate WAC attainment.

RI/FS and pre-design characterization data will establish the area and depth extent of above-WAC material in all remediation areas, if present (Section 3.1.3). The data will be collected using in-situ HPGe, laboratory gamma-spectrometry techniques for uranium, radium, and thorium as well as laboratory analysis of discrete samples for technetium-99 and metal and organic COCs. Therefore, analytical data will be of sufficient quality (i.e., ASL B or higher) to demonstrate that all ASCOCs in soil are below WAC values. The number of analytical samples needed to establish the excavation extent will be determined by the nature and extent of ASCOCs and by balancing the cost between laboratory analysis and soil excavation (Section 3.1.3). Area-specific sampling and analysis plans that address pre-excavation and excavation activities will be presented in the IRDPs (Section 7.1).

HPGe measurements and analytical results will be used to set the area and depth of excavation at the first sample location showing all ASCOCs in soil to be below their respective WAC values. For determining the area boundary, the first sample location with all ASCOCs below the WAC values means the nearest perimeter sample along a radial line to the center of the area. In determining the depth of excavation, the shallowest sample showing all ASCOCs below the WAC values will be used to establish the excavation floor.

After selection of the samples which bound the excavation volume (Figure 3-3), the analytical results for these samples will be used in a kriging or appropriate 3-D interpolation model to develop an excavation boundary. The modeled boundary will be provided to engineering design to prepare a final construction drawing of the excavation. Final construction drawings will show the excavation as a series of cut steps located outside the modeled boundary. Because the modeled boundary will be based



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on sample results shown to be below the WAC values and the final construction drawing steps outward from this boundary, a very high level of confidence is placed in the approach to remove all above-WAC material prior to excavating material destined for the OSDF.

After excavation is completed, a survey with NaI instruments or discrete measurements with the field HPGe will be conducted to demonstrate that the remaining soil is below WAC levels for primary radiological COCs. Based on the removal of primary COCs and the use of RI/FS and pre-excavation characterization data, secondary COCs will be assumed to be below WAC levels when primary COCs are below WAC levels.

In summary, WAC attainment means demonstrating that all ASCOCs are below their established WAC. For uranium and thorium, WAC attainment pertains to measurements made in a 215 square-foot area and/or laboratory measurements made on discrete soil samples obtained from an approximate 6-cubic-inch volume of soil. WAC attainment for radium, technetium-99, and metal and organic COCs is also based on laboratory measurements made on discrete soil samples collected from a similar volume of soil.

3.3.4.2 FRL Attainment

FRL attainment refers to demonstrating that the average concentration of individual COCs in soil left in place after excavation activities does not exceed its respective FRL and no radiological hot spots remain. This will be demonstrated with RI/FS and pre-design characterization data, post-excavation NaI surveys and HPGe measurements, certification samples, and by verifying that the excavations were carried out in accordance with the conservative design specifications in a manner analogous to establishing the WAC excavation boundaries (Section 3.3.4.1). FRL attainment for primary COCs will be demonstrated with HPGe measurements prior to the final certification process.

3.3.4.3 RCRA Characteristic Waste Compliance

There are seven RCRA locations delineated where the potential exists for preferential treatment of soil exhibiting the toxicity characteristic (Section 1.3.2.7). Characteristic waste compliance under the SEP means that excavated soil exhibiting the characteristic of toxicity derived from the seven designated site

areas (Figure 1-5) will be segregated and treated prior to disposal. In these seven areas, the subsurface FRL excavation boundary will be established, and the footprint of the RCRA area will be extended to the subsurface FRL boundary to establish the volume of soil requiring TCLP screening for the toxicity characteristic.

In each of the seven RCRA locations, discrete surface- and subsurface-soil samples will be collected as described in Section 3.1.3. Collected samples will undergo TCLP testing, and samples that fail the TCLP test will be used to determine the excavation depth of the characteristic material. The excavation depth will be set at the first sample location below the deepest sample failing the TCLP test or the FRL boundary, whichever is shallower. The established depth will be extrapolated to the lateral extent of the waste characteristic footprint determined by surface samples to set the volume of RCRA soil requiring treatment. If a portion of this designated volume contains radiological ASCOCs above the WAC, it will be excavated first and set aside for off-site treatment and disposal. The options of treatment and disposal of characteristic waste from the seven areas are shown in Figure 3-5. If all samples pass the TCLP test, the excavation of soil in the RCRA unit will be driven by WAC and FRL criteria, and no special treatment will be required prior to disposal.

3.3.4.4 HWMU Closure

Closure of a HWMU at the FEMP indicates that listed wastes are not present above established site-specific FRLs in soil remaining in the HWMU footprint (with the exception of HWMU #22, which will be treated as a RCRA location based on the barium concentration). Demonstration of closure will rely on excavation of soil to the depth of the FRL surface, followed by collection of the needed number of samples (i.e., the number of samples in excess of CU samples) to achieve four random samples within the HWMU footprint. If needed, the discrete soil samples will be submitted for laboratory analysis of all HWMU COCs. Analytical results will be reviewed and statistical tests will be performed to make the closure decision. The HWMU will be considered closed if the average concentration of each applicable COC is below its site-specific FRL. Section 2.2.4 provides justification for the four-sample approach.

HWMU closure will be reported as part of the Certification Report. Additionally, in accordance with the EPA final findings and orders (OEPA 1996), HWMU closures will be documented in the Remedial Action Reports submitted for former operable units. Table 2-10 summarizes the crosswalk between RCRA closure guidance requirements and CERCLA documentation for the HWMUs.

#### 3.3.4.5 UST Closure

Closure of an UST at the FEMP indicates that the tank has been removed and properly disposed of and that the former contents are not present above established site-specific FRLs in soil remaining in the UST footprint. Following removal of the UST, demonstration of closure will rely on excavation of soil to the depth of the FRL surface and collection of four random samples within the UST footprint. The discrete soil samples will be submitted for laboratory analysis of all established UST COCs. Analytical results will be reviewed and statistical tests will be performed to make the closure decision. The UST footprint will be considered closed if the average concentration of each applicable COC is below its FRL. Section 2.2.5 provides justification for the four-sample approach.

## 3.4 CERTIFICATION

The general sampling strategy and procedures proposed for certification of remediation areas are illustrated on Figures 3-7 and 3-8. Figure 3-7 summarizes the classification and delineation of CUs and the range in the number of samples to be collected and submitted for analysis. On Figure 3-8, the general certification process is outlined. This process will begin by establishing uranium and thorium concentrations with HPGe measurements and proceed with the collection and analysis of discrete samples (ASL D) followed by data review and validation prior to conducting the statistical test used to make the pass/fail decision for each CU. If there is an analytical problem identified during data review or validation, it is corrected with additional sample analysis or other appropriate action. Validated data are placed in the SED and used to perform the appropriate statistical test needed to make the pass/fail decision for each CU. When all CUs within a remediation area pass certification, a Certification Report (Section 7.3) is issued to EPA and ISOPIA for concurrence. In the event a CU fails, one of three conditions must be evaluated: 1) high variability in the data set; 2) localized contamination; or 3) widespread contamination. These conditions are discussed in detail in Section 3.4.5.

Elements of the certification process illustrated in Figures 3-7 and 3-8 that are discussed further include: 1) classification and delineation of CUs; 2) sampling design; 3) statistical analysis; 4) criteria for attainment of certification; 5) procedures for nonattainment scenarios; and 6) submittal of the Certification Report. Additional certification design rationale is provided in Appendix G.

### 3.4.1 Classification and Delineation of CUs

The CUs will be classified and delineated after the pre-certification survey (Section 3.3.3.2). To simplify data management and decisionmaking processes, only two CU sizes will be used in the certification process. No COC-specific CU delineation will be performed.

### 3.4.2 Sampling Design

The soil sampling design requires subdividing the remediated areas into Group 1 or Group 2 CUs (Section 3.3.3.2). Sixteen random soil sampling locations will be selected for each CU, regardless of its group classification (Figure 3-7). Depending on the CU-specific COCs and the group classification, 8 to 16 samples will be analyzed. In Group 1 and Group 2 CUs, all 16 sample locations will be measured with the HPGe to establish uranium and thorium concentrations in the CUs, with 2 QA/QC samples selected randomly in each CU for laboratory gamma spectroscopy analysis. As Group 1 CUs lie in impacted areas known to or suspected to contain hot spots, 12 to 16 of the samples will be selected for analysis of radiological risk-driving COCs other than uranium and thorium (e.g., radium), and 8 to 12 samples will be analyzed for all other CU-specific COCs. In Group 2 CUs there are no known and/or suspected hot spots (i.e., no radiological risk drivers); therefore, 8 to 12 samples will be selected for analysis of all remaining CU-specific COCs. Appendix G provides additional justification for the range of 8 to 16 analyses per CU. The justification is based on results obtained from conducting statistical tests with data representative of expected sitewide residual COC conditions, with a 20 percent increase in the statistical result to account for possible problems associated with sample preparation and analysis.

3.4.2.1 Soil Sampling Locations

Sampling locations in Group 1 and Group 2 CUs will be determined randomly, and a sampling grid will be plotted on a map of the CU to examine the random sample pattern. To prevent clumping of the sampling locations in one small area of the CU, two criteria must be met before the sampling locations are used. The first criterion requires that four points must be located in each quadrant of the CU. The second criterion requires that the distance between any two adjacent points will be limited to some maximum distance determined by the CU size and shape. If the first randomly generated sampling grid fails to meet these criteria it will be discarded and a new one generated. Once a grid that satisfies these criteria is generated, the sample locations will be finalized in the field and tied into the global positioning system (GPS) or appropriate site survey system.

3.4.2.2 In-Situ Soil Measurements for Gamma Emitters

HPGe measurement is the preferred method of certification for gamma-emitting radionuclides because of its rapid response time and relatively large field of view. A recent comparability study has demonstrated that HPGe measurements meet ASL B and ASL D requirements for total uranium and thorium-232. Currently, radium-226 measurements do not meet these requirements, but ongoing research is focusing on method modifications that may allow radium-226 measurement to meet ASL B and ASL D criteria. HPGe measurements will be used to certify radium-226 activity when the results can be demonstrated to meet the data quality objectives. This capability will be documented in a follow-up submittal to the USEPA and OEPA.

A tripod-mounted HPGe gamma spectrometry system will be used at the FEMP to make stationary measurements to certify the soil concentration of total uranium and activity of thorium-232 in each CU, unless operational constraints limit its deployment.[4] In the event HPGe measurements cannot be performed, certification for uranium and thorium-232 will be demonstrated using the discrete sampling method described below.

[4] Deployment may be limited by physical constraints, such as uneven terrain, or because of interference from nearby gamma sources (e.g., Operable Unit 4 silos).

For both Group 1 and Group 2 CUs, HPGe measurements will be made at all sampling locations defined in the CU. The certification measurements for uranium and thorium will be made by placing the instrument 1 meter above the surface to yield a field of view of approximately 10 meters in diameter (78.5 $m^2$). As ongoing work with the in-situ HPGe measurement of radium-226 is completed, an addendum will be developed and provided to EPA for review and approval to incorporate HPGe analysis of radium-226 into the certification process.

Two QA/QC samples will be selected at random from the soil samples collected as part of the concurrent soil sampling program (Section 3.4.2.3) and will be submitted for laboratory analysis of the gamma emitters certified with HPGe. The results of these two samples will not be used directly in the certification process but will be designated as HPGe QA/QC samples, as suggested by DOE's Environmental Measurements Laboratory (DOE 1997f).

3.4.2.3 Soil Sampling and Laboratory Analysis

For regularly shaped certification units 16 certification sample locations will be laid out within the CU (i.e., four sample locations per CU quadrant). Sampling locations in Group 1 and Group 2 certification units will be determined using a random start, fixed grid pattern. An initial location is randomly selected in the certification unit using two random numbers, one for the north-south coordinates and one for the east-west coordinates. A square sampling grid is then set up using that point as the initial reference point. The grid will be laid down on 62.5 foot centers for the Group 1 (250 ft by 250 ft) CUs and on 125 foot centers for the Group 2 (500 ft by 500 ft) CUs. This sampling design places sample locations in 16 evenly divided sub-areas of the CU. The sample locations will be tied into the GPS or appropriate site survey system. Figure G-2 presents an example of a random start sampling grid.

For irregularly shaped certification units, sampling locations will be determined randomly, and a sampling grid will be plotted on a map of the CU to examine the random sample pattern. To prevent clumping of the sampling locations in one small area of the CU, two criteria must be met before the sampling locations are used. The first criterion requires that four points must be located in each quadrant of the CU. The second criterion requires that the distance between any two adjacent points

will be limited to some maximum distance determined by the CU size and shape. If the first randomly generated sampling grid fails to meet these criteria it will be discarded and a new one generated. Once a grid that satisfies these criteria is generated, the sample locations will be finalized in the field and tied into the global positioning system (GPS) or appropriate site survey system.

For Group 1 CUs (Figure 3-7), 12 to 16 samples will be selected from the 16 collected samples and will be submitted to a laboratory for analysis of radium-226 and radium-228. Two of the submitted samples will also serve as QA/QC samples for uranium and thorium measurements carried out with the HPGe instrument. The two QA/QC samples will undergo laboratory analysis by gamma spectrometry for uranium and thorium isotopes in addition to the radium analysis. When radium analysis by HPGe is brought on line, the 12 to 16 samples will be reduced to two QA/QC samples that will be analyzed for uranium, thorium, and radium isotopes. For all secondary, CU-specific COCs, 8 to 12 samples will be selected randomly from the 16 collected samples and will be submitted to a laboratory for the appropriate analysis. The remaining samples will be archived until the holding times have been exceeded for their CU-specific COCs, or until the unit is certified as released.

For Group 2 CUs (Figure 3-7), 8 to 12 samples will be selected randomly from the 16 collected samples and will be submitted for analysis of all CU-specific COCs, except uranium and thorium. Uranium and thorium isotopes will be characterized by HPGe measurements. However, two of the submitted samples will also be used as QA/QC samples and will undergo laboratory analysis by gamma spectrometry for uranium and thorium isotopes. When radium analysis by HPGe is brought on line, the submitted QA/QC samples will also be analyzed for radium isotopes. The remaining samples will be archived until the holding times have been exceeded for their COCs, or until the unit is certified as released.

Samples collected from the CUs and submitted for laboratory analysis will meet the quality assurance requirements listed in the SEP QAPP (Appendix E). All analytical results will be verified and validated according to the SEP QAPP prior to conducting statistical tests for certification purposes.

### 3.4.3 Statistical Analysis

A statistical analysis will be conducted with the validated analytical data to determine the distribution of the data set (e.g., normal or lognormal) and to establish whether the CU passes the certification criteria (Section 3.4.4) at the specified confidence level. If the data set, or a log transformation of the data set, exhibits a normal distribution, the Student's t-Test will be used to establish the pass or fail decision for the CU. A distribution that is not normal will result in using a nonparametric approach to determine the pass or fail decision for the CU. Appendix G provides a detailed discussion of the proposed statistical analysis.

Regardless of the distribution and test used, the Type I error probability ($\alpha$) will be set at 0.05 for primary COCs and 0.1 for secondary COCs. This states that there is less than a 5 percent chance that the CU will pass certification for primary COCs when it should have failed; the chance increases to less than 10 percent for secondary COCs. Details on the statistical approach and proposed tests are provided in Appendix G.

### 3.4.4 Criteria for Attainment of Certification

A statistical analysis will be performed on the validated analytical results obtained from the certification samples to establish whether the CU passes the certification criteria at the specified confidence level. Two criteria must be met for the CU to be certified as passing. The first criterion is that each individual sample within a CU must show each of the three primary radiological COCs discussed in Section 2.2.3 to be below a value of three times its FRL. If the data distribution is normal or lognormal, the second criterion compares the 95 percent UCL of the mean of each primary COC to its FRL and the 90 percent UCL of each secondary COC to its FRL to make a pass/fail decision. When the UCL of the mean (normal or lognormal distribution) of each COC is less than its FRL, the CU is certified as passing the second criterion. If the data distribution is not normal or lognormal, the appropriate nonparametric approach (Appendix G) will be used to evaluate the second criterion. Both criteria must be met for the CU to be certified. Appendix G provides additional details on the statistical analysis and tests applied to certification.

### 3.4.5 Procedures for Nonattainment Scenarios

Both certification criteria defined in Section 3.4.4 must be met for a CU to pass certification. In the event a CU fails certification, one of three conditions must be evaluated: 1) high variability in the data set; 2) localized contamination; or 3) widespread contamination.

Condition 1, high variability in the data set, requires that another decision be made (Figure 3-8). If the high variability results from a single sample, the decision may be made to rerun the sample to check for laboratory inconsistency. Alternatively, if the confidence in the laboratory results is high, the high variability resulting from a single sample may indicate localized contamination (Condition 2). For high variability resulting from a wide range in CU-specific COC concentrations, widespread contamination may be indicated (Condition 3).

Condition 2, localized contamination, requires checking the size of the CU and repartitioning the Group 2 CU (500-ft by 500-ft) into four Group 1 CUs (250-ft by 250-ft) to evaluate each Group 1 CU independently (Figure 3-8). If the Group 1 CUs are likely to fail certification, they are reexcavated, and sampling and analysis is repeated. Group 1 CUs that are likely to pass certification simply by the analysis of archived samples without additional excavation are moved directly to analysis of archived samples. For a Group 1 CU, a decision will be made to reexcavate the entire CU or isolated hot spots, as needed, and to subject the CU to another round of sampling and analysis. In any case, a Group 1 CU is the minimum CU size.

Condition 3, widespread contamination, results in further excavation, possible CU repartitioning (i.e., from Group 2 to Group 1), and subjecting the CU to another round of sampling and analysis (Figure 3-8).

When the CU fails certification under Conditions 1 or 2, archived samples may be analyzed. Archived samples may be used to supplement the original submission to the lab for two reasons. First, if transportation, holding times, and/or events at the laboratory invalidate the sample, the archived sample from the relevant CU quadrant can be sent as a replacement. Second, if the statistical analysis of the

data indicates the mean of the COC concentration is below its FRL, but the UCL of the mean is above the FRL, then the option to analyze the available archived samples will be exercised to better estimate the average contaminant levels within the CU. In the case of a Group 2 CU, archived samples exist for all CU-specific COCs, whereas a Group 1 CU may have archived samples for only secondary CU-specific COCs. In all cases, the holding times of archived samples must be assessed prior to analysis to determine whether they will meet quality assurance protocols.

### 3.4.6 Certification Report

Certification Reports (Section 7.3) will be used to demonstrate progression of the remedial action, although the report is not required in accordance with EPA guidance or the Amended Consent Agreement (EPA 1991). The intent behind submitting a Certification Report for each phase of a remediation area is to receive acknowledgment that the pertinent operable unit remedial actions were achieved. This report will allow the natural resource restoration to proceed as rapidly as possible. Upon completion of all certification activities within a remediation area, a formal certification report will be issued for the entire remediation area. Interim grading activities will commence after EPA approval of the certification report.

An area-specific Certification Report will be prepared for each of the nine remediation areas discussed in Section 1.0. This report is the final area-specific remediation deliverable. The primary objectives of the report are to 1) document the remedial actions that occurred; 2) describe the certification process; 3) present all data supporting the certification that area-specific COCs do not exceed FRLs specified in the relevant RODs; 4) demonstrate that RCRA and Ohio hazardous waste closure regulations have been met for HWMUs and/or USTs; 5) summarize data necessary to demonstrate WAC attainment; and 6) describe access controls implemented to prevent recontamination. Section 7.3 presents additional information on the content and preparation of Certification Reports.

## 3.5 POST-REMEDIATION ACTION

Once excavation at the FEMP is complete and the results of the certification activities have been documented, the area will be developed into the final land use specified by the NRRP (Section 1.3.3). For many areas, this can be done immediately after certification. However, for some areas, final

development must wait until other remediation projects at the site are complete. Therefore, post-remedial activities can be divided into two categories: 1) interim actions taken to maintain the area and 2) actions taken to develop the area into its final land use. A general discussion follows with details provided in Appendix F.7.

### 3.5.1 Interim Actions

Interim actions are taken to stabilize the unit after certification, to prevent recontamination, and to maintain it until the unit can be developed into its final land use. A complete discussion of interim actions is provided in Appendix F.7.

#### 3.5.1.1 Access Controls

Physical hazards from traffic and construction work will exist during interim actions. In addition, the certification unit will have to be secured from trespass. For these reasons, the certification unit will be treated as a Category II controlled area (Appendix F.2) during the interim between certification and conversion to final land use. For such an area, access is restricted to authorized personnel, and no personnel or material monitoring is required to exit the area. A certification unit's access controls will be maintained at the same level as surrounding certification units until the entire area has been converted to its final land use.

#### 3.5.1.2 Surface Stabilization

Interim grading activities will be performed after each certification unit is certified. Interim grading will be performed to flatten slopes (for stability), control water drainage, and begin the process of grading the certification unit in accordance with the restoration concept. Where possible, the certification unit will be graded to the final grade level according to the sitewide restoration strategy. If final development is delayed, efforts will be made to stabilize the surface soils of the unit. For example, temporary ground cover may be planted to hold the soil in place until the final grading and development begins.

#### 3.5.1.3 Interim Monitoring

Interim monitoring of a certified unit will be limited to verifying that contamination for unremediated areas is not spreading back to the certified unit through uncontrolled run-off. Section 5.2 discusses the monitoring that will be implemented to demonstrate the needed control.

#### 3.5.1.4 Run-off Control

Run-off controls will be implemented as described in Appendix F.2. Regular inspections of the certification unit will be made to verify that it is properly drained and that run-off does not adversely affect surrounding areas and stream quality. If it is determined that either of these conditions is not the case, remedial action will be taken to correct the drainage problem.

### 3.5.2 Final Land Use Development

The current commitment for final land use is an undeveloped park. Deep excavations will be allowed to develop into ponds and will be backfilled only to the extent necessary to hold water or provide adequate surface drainage. Vegetation will be established on barren excavation surfaces. Further details are provided in Section 1.3.3.

#### 3.5.2.1 Final Grading

Final grading will include construction of drainage features, placement of topsoil, and other steps necessary to properly grade the area. This may include bringing in additional soil from other areas to restore the site (Appendix F.7).

#### 3.5.2.2 Access Controls

During the final phase of site restoration, physical hazards from traffic and construction work will exist. For this reason, the entire remediation area unit will be treated as a Category II controlled area (Appendix F.2) until the unit is released to its final land use. Consequently, access is restricted to authorized personnel, and no personnel or material monitoring is required to exit the area.

### 3.5.3 Final Land Use

The NRRP will dictate the final land use and future habitats for the remediation area. Specific design criteria for the design and development of these habitats will be identified in relevant IRDPs. After final grading is complete, vegetation will be established for the specific habitat desired using seeding, tree planting, and other methods as appropriate for the habitat. The following general guidelines were developed for wetlands, open water areas, woodlands, riparian, and grasslands. These habitats have been identified as the feasible natural environments at the FEMP.

#### 3.5.3.1 Wetlands

Wetlands require very specific environmental conditions that are affected by saturation, slopes, water depth, and other mitigating factors. Gradual shoreline slopes of 6:1 or flatter to a depth of 1 to 3 feet will encourage plant species diversity and feeding areas. Poorly drained soil types are essential to supply an impermeable substrate for holding water. For a wetland to be functional, it must have adequate amounts of water during appropriate times of the year. Subsurface tile drains must be broken or removed if they are identified in a proposed wetlands location.

#### 3.5.3.2 Open Water Areas

Open water areas require slopes of 3:1 or higher to a depth of 8 to 20 feet. Soils containing textured and silty clays are most desirable.

#### 3.5.3.3 Woodlands

A woodlands habitat can be located in any area on the FEMP that is well drained.

#### 3.5.3.4 Riparian Areas

Soil conditions that would support a riparian habitat would have to be located along a linear, topographically low area that receives surface water run-off from the surrounding area. Paddys Run currently supports the only naturally occurring riparian environment at the FEMP.

#### 3.5.3.5 Grasslands

Grassland habitat would require poorly drained soil conditions and could be located in a wide range of areas on the FEMP property.

### 3.5.4 Post-Remediation/Post-Closure Care and Inspection

Post-closure maintenance of remediation areas (other than the footprint of the OSDF) will be addressed within the NRRP as part of the site's restoration activities. Post-closure maintenance of the OSDF is specifically addressed within the "Post-Closure Care and Inspection Plan, On-Site Disposal Facility (DOE 1997b)."

## 3.6 RECORDKEEPING AND DATA MANAGEMENT

Management of existing and newly generated information is essential to economically completing a successful remediation of the FEMP. This information will be used by remediation projects for a variety of applications and consequently must be available sitewide, retrievable in diverse formats, and require minimal turn-around time to access.

The guidelines provided in this section are intended to promote consistent recordkeeping and data management associated with all excavation activities. The electronic integrated information management system (IIMS) described below will facilitate data records management and reporting, including compliance-based recordkeeping and reporting requirements. Information management objectives identified in Section 3.6.1 must be met throughout remediation. These objectives will ensure the integrity of the data used for completion of remediation under the SCEP.

### 3.6.1 Information Management Objectives

Information management and retrieval systems at the FEMP function as a central data repository that can be used in all facets of the remediation. So that this information can be readily available to all potential users, a uniform system of recordkeeping and data management has been adopted. The primary information management objective of the SEP is to ensure that the people planning, performing, surveying, and documenting remediation will have access to this centralized repository of data about the site in a timely and efficient manner.

Table 3-1 summarizes the types of analytical data that will be generated by following the general remediation process outlined in Sections 3.1 through 3.4. Other excavation data needs can be grouped into four major types:

1. Planning data
2. Excavation control, status, and general management information
3. material control and handling data
4. documentation of cleanup.

To meet these needs, the information management system employed will:

- Maintain a central repository for geological, topographical, engineering, and analytical data from all available sources in a format that promotes multiple uses
- Receive and store new data and relate it to existing data
- Provide current information simultaneously to all ongoing excavation projects at the FEMP
- Allow tracking of the handling and final deposition of excavated materials
- Comply with recordkeeping requirements that safeguard the data used to demonstrate certification and remedial action completion

As remediation progresses, additional needs will be assessed and methodologies refined accordingly.

### 3.6.2 Integrated Information Management System

Bulk waste stream information for the FEMP will be managed in the IIMS database. Relationships between IIMS and other site databases are depicted on Figure 3-9. The IIMS is designed to accommodate fast-track, bulk waste stream characterization, OSDF WAC attainment demonstration, and OSDF manifesting by using site characterization data. The system interfaces with the Sitewide Environmental Database (SED) through a grid system to retain connections to RI/FS, historical, and newly generated data when excavated material is moved from the source location. The system also interfaces with the Sitewide Waste Information Forecasting and Tracking System (SWIFTS) to allow electronic transfer of bulk waste inventory to the container management system, when containerization is required.

### 3.6.3 Operational Documents

Operational documents for the FEMP will be generated during remediation activities. Such documents include construction drawings, field logs, analytical data, manifests, and specialized waste handling documents. Figure 3-10 summarizes these documents as the communication links between the functional organizations of the SCEP. Management of each category of documents is presented in the following subsection. QA controls for these documents are discussed in the QAPP (Section E).

#### 3.6.3.1 Construction Drawings and Associated Field Logs

Construction drawings and associated field logs will be maintained by Engineering Document Control. These items will be used on an evolving basis in the GIS and, at site closeout, will reflect final-as-built drawings.

#### 3.6.3.2 Analytical Data and Associated Field Logs

Analytical data will be entered into the SED as it is generated. Hard-copy analytical reports and field scan/measurement print-out records, as well as associated field logs, will be maintained in active project files until completion of each phase of field work. At that time, these items will be turned over to Engineering Document Control. The required format and content of the field logs will be specified in the IRDP and Certification Design Letter.

#### 3.6.3.3 Miscellaneous Field Logs

Other types of field logs will be maintained in active project files until completion of each phase of field work. At that time, they will be turned over to Engineering Document Control.

#### 3.6.3.4 Manifest-Type Documents

The majority of on-site manifesting is expected to be performed electronically. The repository for transactions that reflect on-site transport of impacted materials is the SWIFTS/IIMS component. Any associated hard copies or field logs generated prior to OSDF disposition will be maintained by the responsible IIMS party. Any hard-copy manifests for transport to the OSDF will be maintained by the construction subcontractor. Upon completion of all anticipated transactions, all manifest-related documents will be turned over to Engineering Document Control.

3.6.3.5 Specialized Waste Handling Documents

Documents associated with waste streams requiring special handing will be maintained by Waste Disposition Support Services (WDSS). Information specific to RCRA hazardous waste will be maintained in the site Operating Record. Key information from these documents will be stored electronically in SWIFTS.

3.6.4 Field Documentation and Data Management Activities

Records and data will be generated in various forms based on the nature of the technical task, as previously discussed in this section. Field data will be collected using GPS, field logs, sampling programs, as-built construction drawings, and a tracking system. In addition to becoming part of the operation documents produced during the course of excavation planning and implementation, this information will be used to prepare the deliverable documents described in Section 7.0. Appendix E provides additional information on QA protocols related to data management activities.

3.6.4.1 Tracking System for Waste Stream Categories

Field information for input to IIMS will be collected on field transfer logs (FTLs), with information subsequently entered to IIMS. Key data elements that are recorded on the field transfer logs are listed below:

- Project number and name
- Source Material Tracking Location (MTL)
- Interim or final disposition MTL
- Estimated volume of material
- Material matrix (interim movements) or profile number (final disposition movements)
- Generation date
- Signature.

Figure 3-11 shows the FTLs which will be generated between material destinations and organizational hand-off points.

MTLs are defined electronically in the IIMS using the grid system. Prior to project start-up, SED data are reviewed and contiguous areas with like data are identified as unique MTLs. Each MTL comprises

an "in situ" waste stream. MTLs are identified on project drawings and in the field. When a field tracking log is entered into the IIMS, SED data for the specified MTL are tied to excavated soil volumes that have been moved to either an interim (pre-remediation area, stockpile, or container) or final (OSDF disposal) location. IIMS maintains transaction histories to provide cumulative analytical data for soil that is moved more than one time. The main types of MTLs include WAC attainment areas (i.e., controlled areas for storing above-WAC material) and stockpiles.

The following profiles are assigned to each of the five primary waste streams designated for OSDF disposal:

| | | |
|---|---|---|
| Profile # 91,000 | OSDF Category 1 | Soil and soil-like material |
| Profile # 92,000 | OSDF Category 2 | Debris for en masse placement |
| Profile # 93,000 | OSDF Category 3 | Debris for individual placement |
| Profile # 94,000 | OSDF Category 4 | High organic content (humus and vegetation) |
| Profile # 95,000 | OSDF Category 5 | Case-by-case approval |

Numeric extensions (e.g., 91,001...95,999) are used to facilitate further delineation of waste streams on an as-needed basis. The numeric extension profiles include information in common with field tracking logs to facilitate electronic information retrieval, as well as supplementary information such as material descriptions and data group identifiers (DGI) for newly generated data.

All wastes manifested to the OSDF will be covered under a waste stream profile. OSDF manifests are prepared in IIMS by accessing information entered from the tracking logs and profiles. The manifest number facilitates retrieval of electronic characterization information from IIMS, if required, to support a determination of "meets WAC." Information recorded on the hard-copy manifest will comply with requirements of the OSDF Impacted Materials Placement Plan (DOE 1996b).

As presented in Section 3.2, based upon RI/FS and pre-excavation characterization data, an IRDP will be prepared. In addition to identifying the area-specific COCs, the IRDP will identify the excavation boundaries by soil category and the soil segregation requirements. For example, if the area to be

excavated contained some soil which exceeded the OSDF WAC for uranium and another portion of soil which exceeds the FRL for uranium, the two soil categories would be 1) above-WAC soil and 2) above-FRL soil. The IRDP would identify the excavation boundaries for each of these two soil categories and identify that the two soil categories must be segregated during excavation.

Tracking of soil from excavation to its ultimate on-site destination will be accomplished using the FEMP Integrated Information Tracking System (IIMS). In brief, unique Material Profiles will be established int he IIMS for each soil category to be excavated from an established remediation area. Also, MTLs will be established in the IIMS for each category of soil. The FTLs will be used to control and document soil transfers from one MTL to the next until the soil reaches its ultimate on-site destination.

The FTL, which will be completed at the excavation site or at the point of origin MTL (if the soil is being transferred from a temporary stockpile), will identify the material profile, the approximate soil volume, the source MTL and the destination MTL. One copy of the FTL will be maintained at the source MTL. A second copy of the FTL will accompany the soil transfer to the destination MTL. At the end of each day, FTLs from each MTL will be delivered to the Waste Acceptance Operations Project group (WAOP). The source and destination FTLs for each soil transfer will be matched and the data entered into the IIMS. In this manner, the IIMS will be used to monitor the status of soil excavation, maintain an approximate soil inventory at each MTL and track soil by Material Profile from its origin to its ultimate on-site destination.

3.6.4.2 Other Field Data

Other field data will include information on sample collection, attainment of excavation design, maps, and surveys in either electronic or hard-copy format. Field-generated analytical data will include pre-certification, certification, and WAC attainment; additional analyses may be generated in conjunction with special material activities described in Appendix F. Anticipated field instruments include, but are not limited to, the RTRAK and the HPGe. Field activity documentation requirements of the SCQ will be met. Field logs will be submitted daily to the Project Manager with approval signatures from the

Construction Manager, the Project Manager, and Subcontractor. As-built drawings will be completed in accordance with Engineering Procedure ED-12-6002, "Engineering Processing of As-Built Drawings."

3.6.4.3 Removal Action 17 Applicability

Documentation and data management methods provided for excavated materials under the Removal Action 17 Work Plan are superseded upon agency approval of this SEP. This includes, but is not limited to, soil and at-/below-grade structures. The primary remaining application of Remedial Action 17 methods is for above-grade structures, as addressed in the Operable Unit 3 Integrated Remedial Design/Remedial Action Work Plan (DOE 1996h).

TABLE 3-1

SUMMARY OF SAMPLING TASKS AND ANALYTES

| Stage | Drivers | Analytes[a] |
|---|---|---|
| Pre-Design Investigation | Extent of excavation for: technetium-99, RCRA characteristic waste, above WAC, and above FRL | Area-specific COCs, technetium-99, and TCLP |
| Excavation | Non-technetium-99 WAC attainment | Area specific gamma-emitting radionuclides and organic vapor |
| Pre-Certification | CU delineation, FRL attainment, and hot-spot screening | Area specific gamma-emitting radionuclides |
| Certification | FRL attainment, HWMU closure, and UST closure | Area specific COCs, HWMU and UST COCs |

Note: [a] See Table 2-11 for the applicable analytical methods.

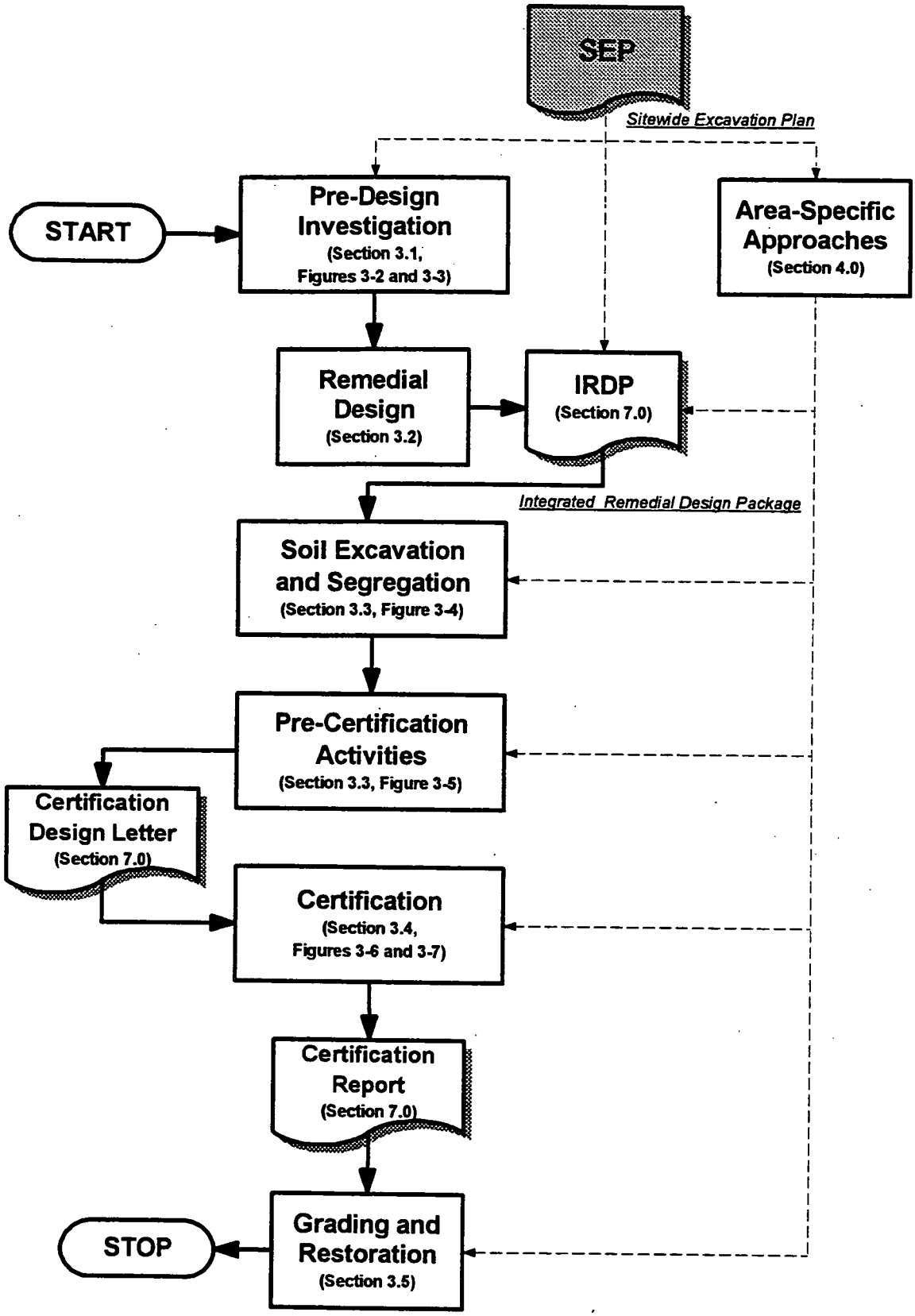



FIGURE 3-1 GENERAL SOIL REMEDIATION PROCESS

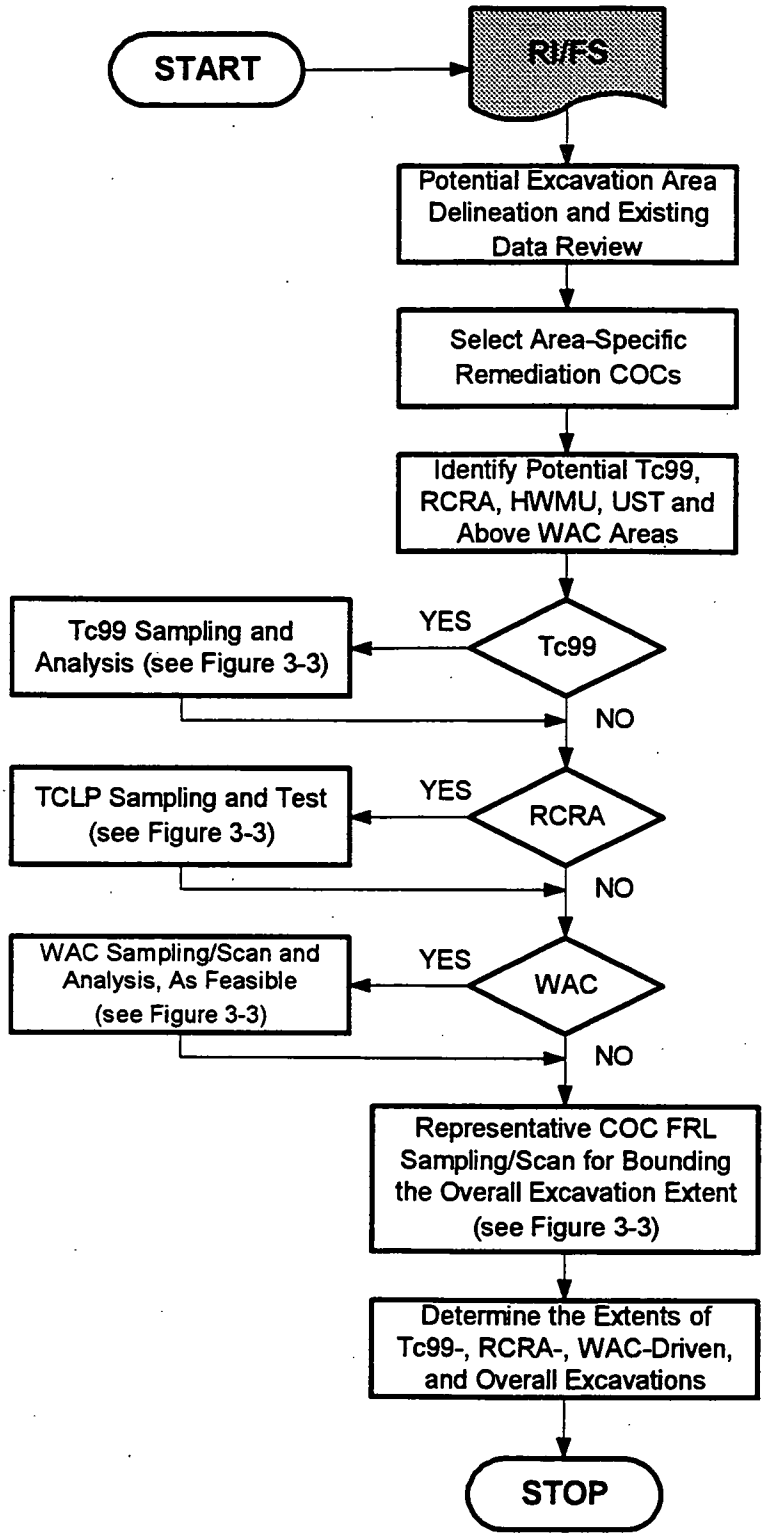



**FIGURE 3-2 GENERAL PRE-DESIGN INVESTIGATION PROCESS**

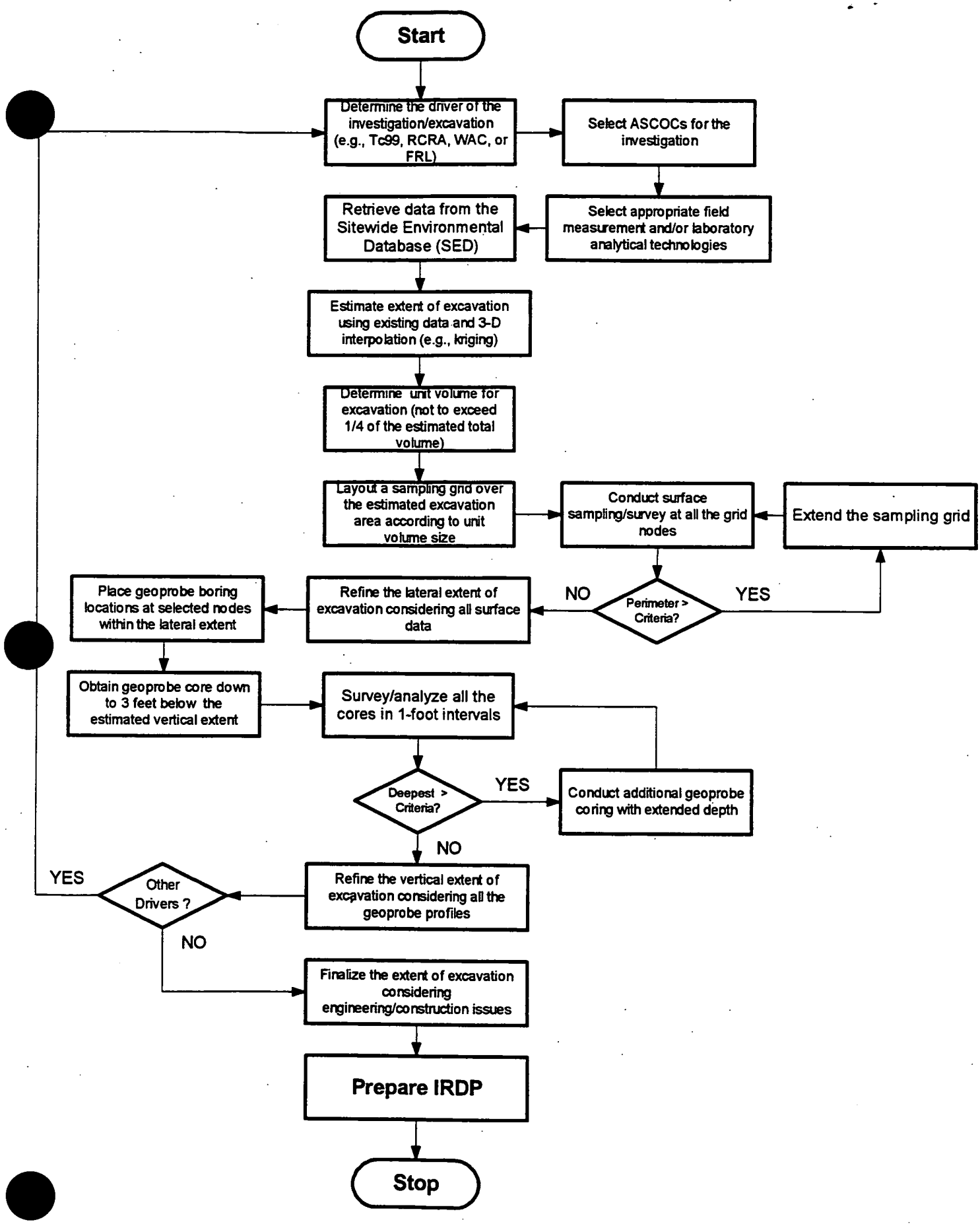



FIGURE 3-3 ESTABLISH EXTENT OF EXCAVATION

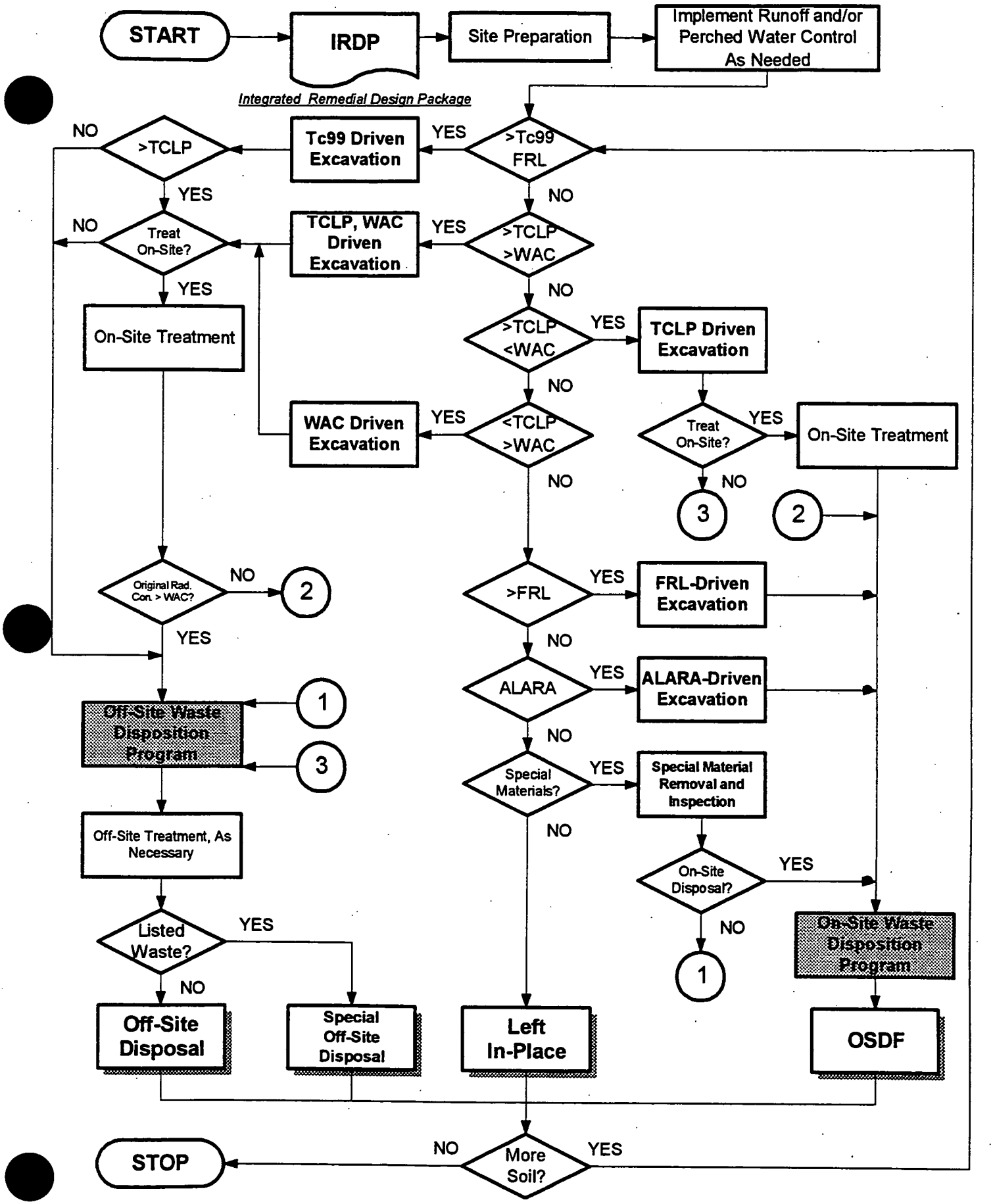



FIGURE 3-4 GENERAL SOIL SEGREGATION/DISPOSAL PROCESS

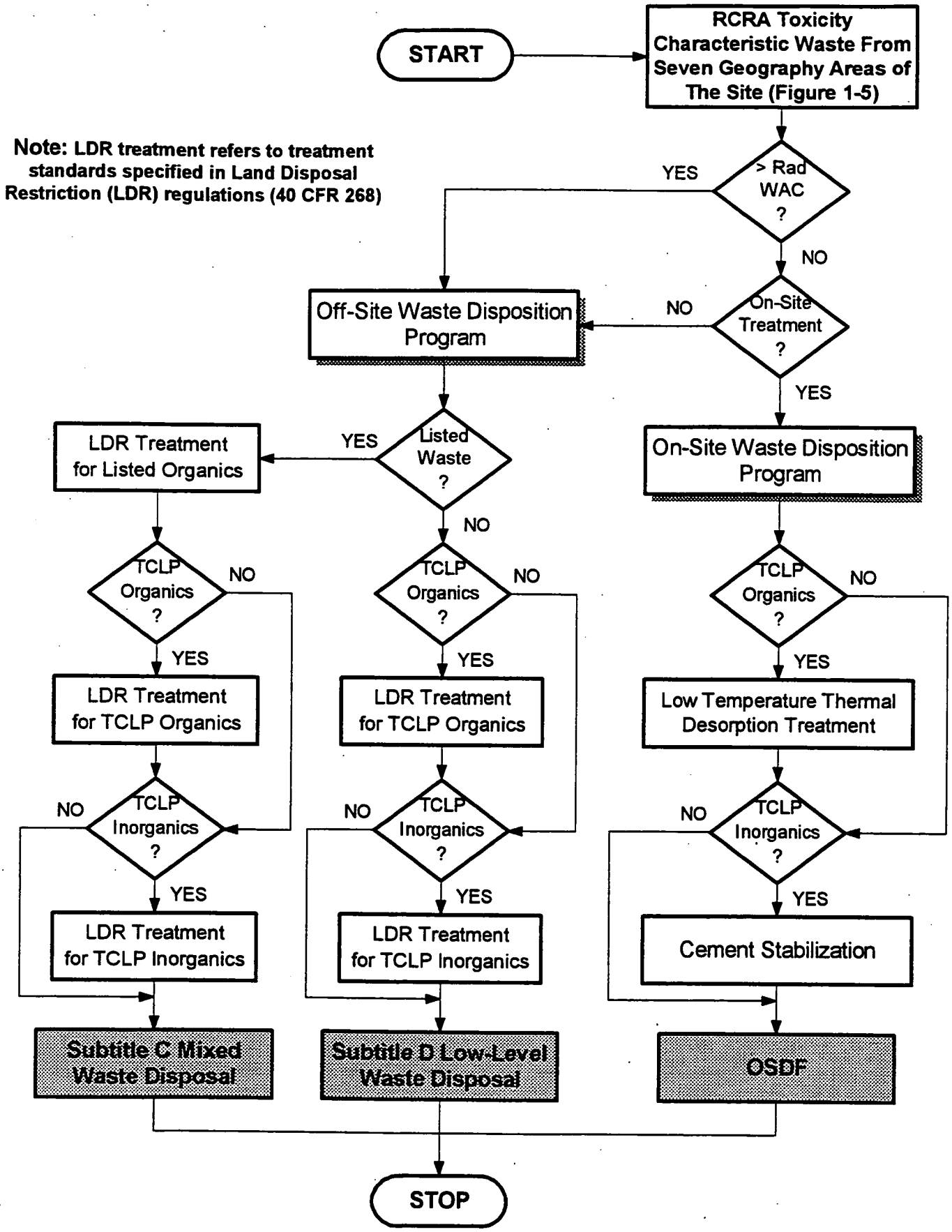



FIGURE 3-5 RCRA-REGULATED SOILS TREATMENT AND DISPOSAL REQUIREMENTS

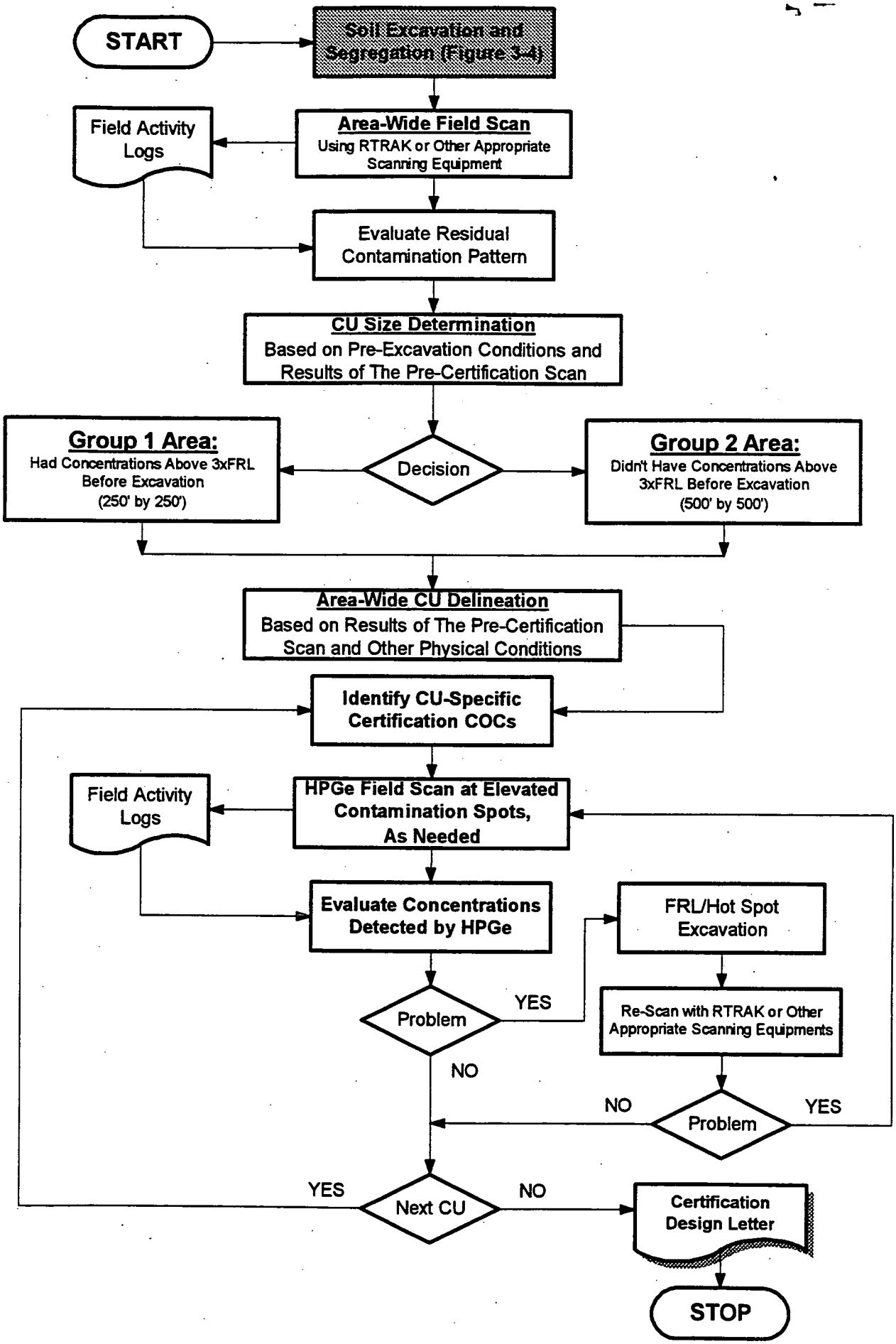



FIGURE 3-6 GENERAL PRE-CERTIFICATION ACTIVITIES

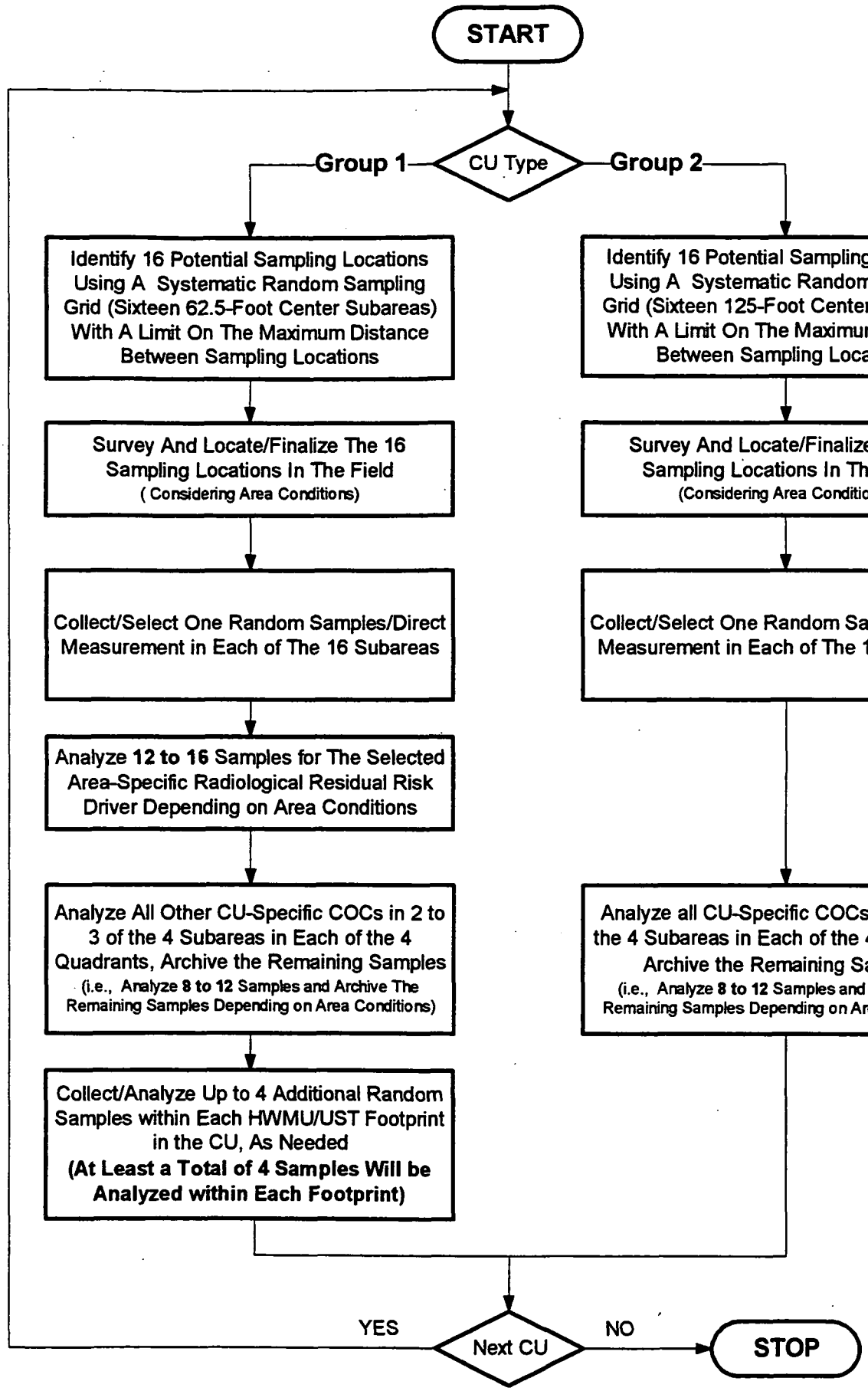



**FIGURE 3-7 GENERAL CERTIFICATION SAMPLING STRATEGY**

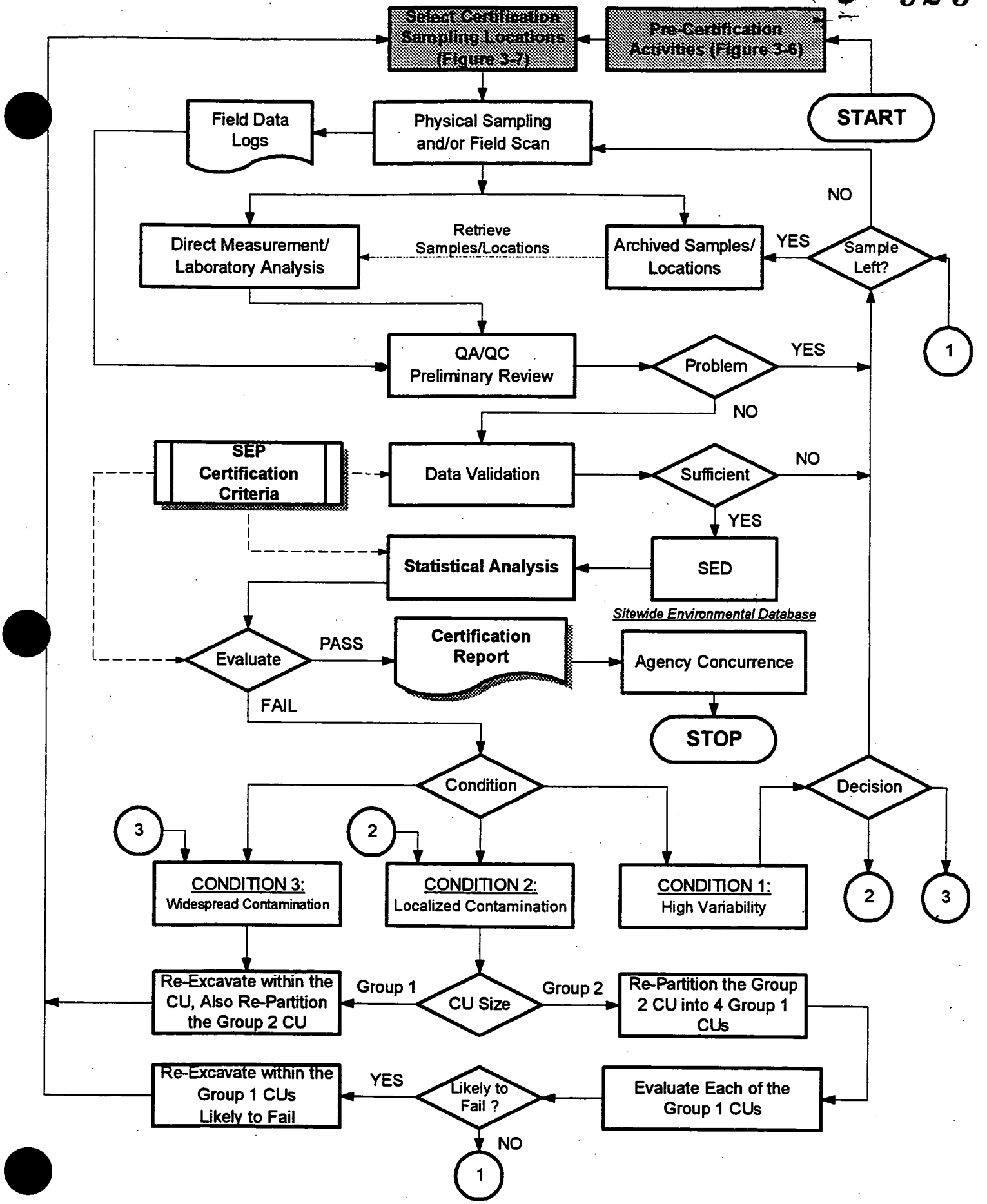
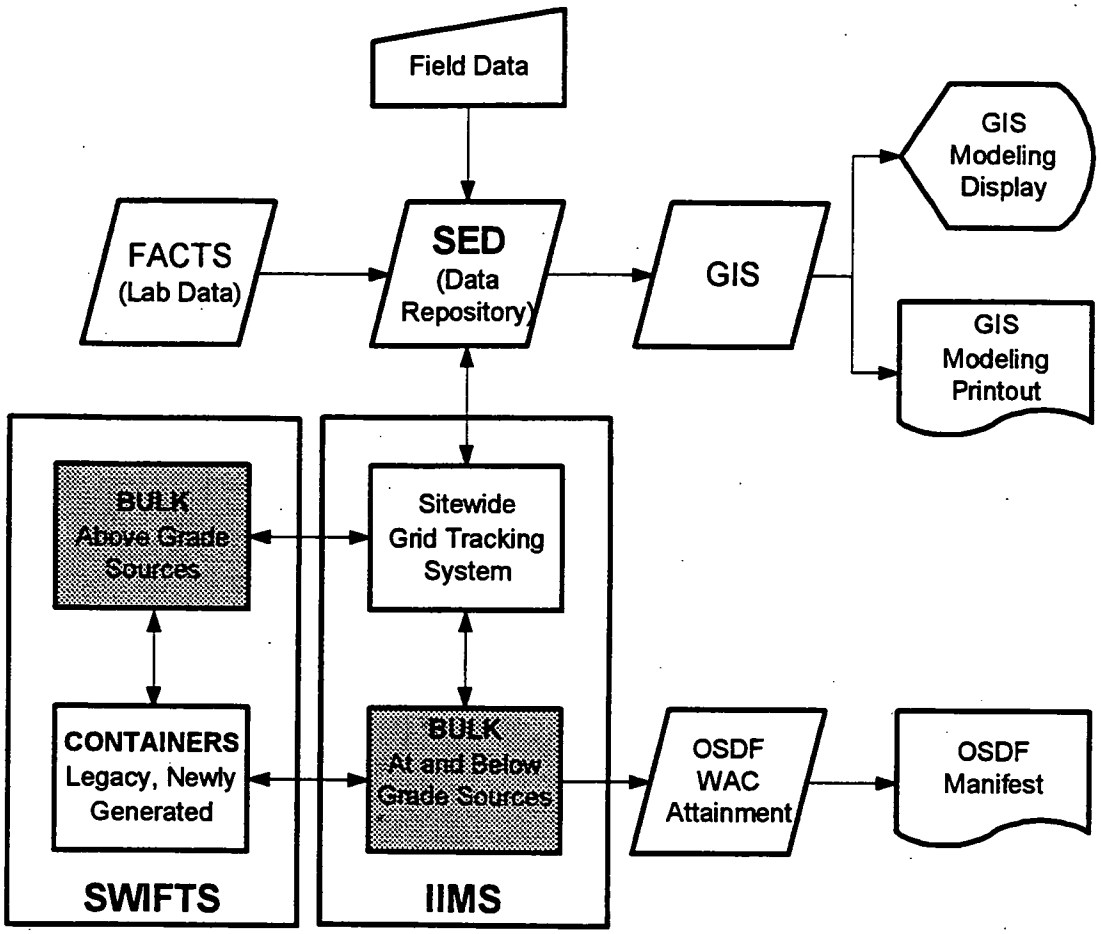



FIGURE 3-8 GENERAL CERTIFICATION PROCEDURE




FACTS: Fernald Analytical Computerized Tracking System
GIS: Geographical Information System
IIMS: Integrated Information Management System
OSDF: On-Site Disposal Facility
SED: Sitewide Environmental Database
SWIFTS: Sitewide Waste Information Forecasting and Tracking System

**FIGURE 3-9 SITE DATABASE RELATIONSHIPS**

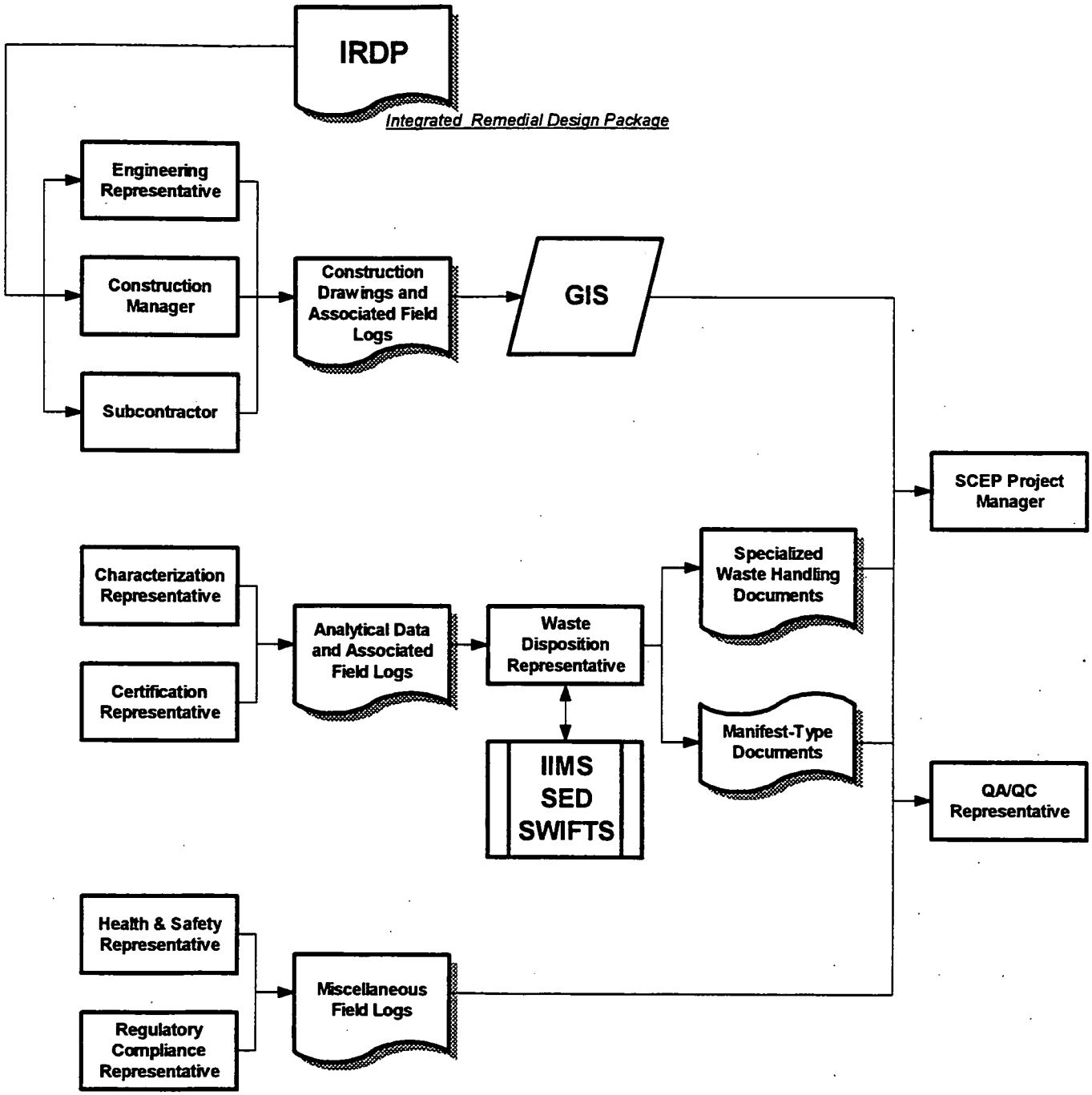
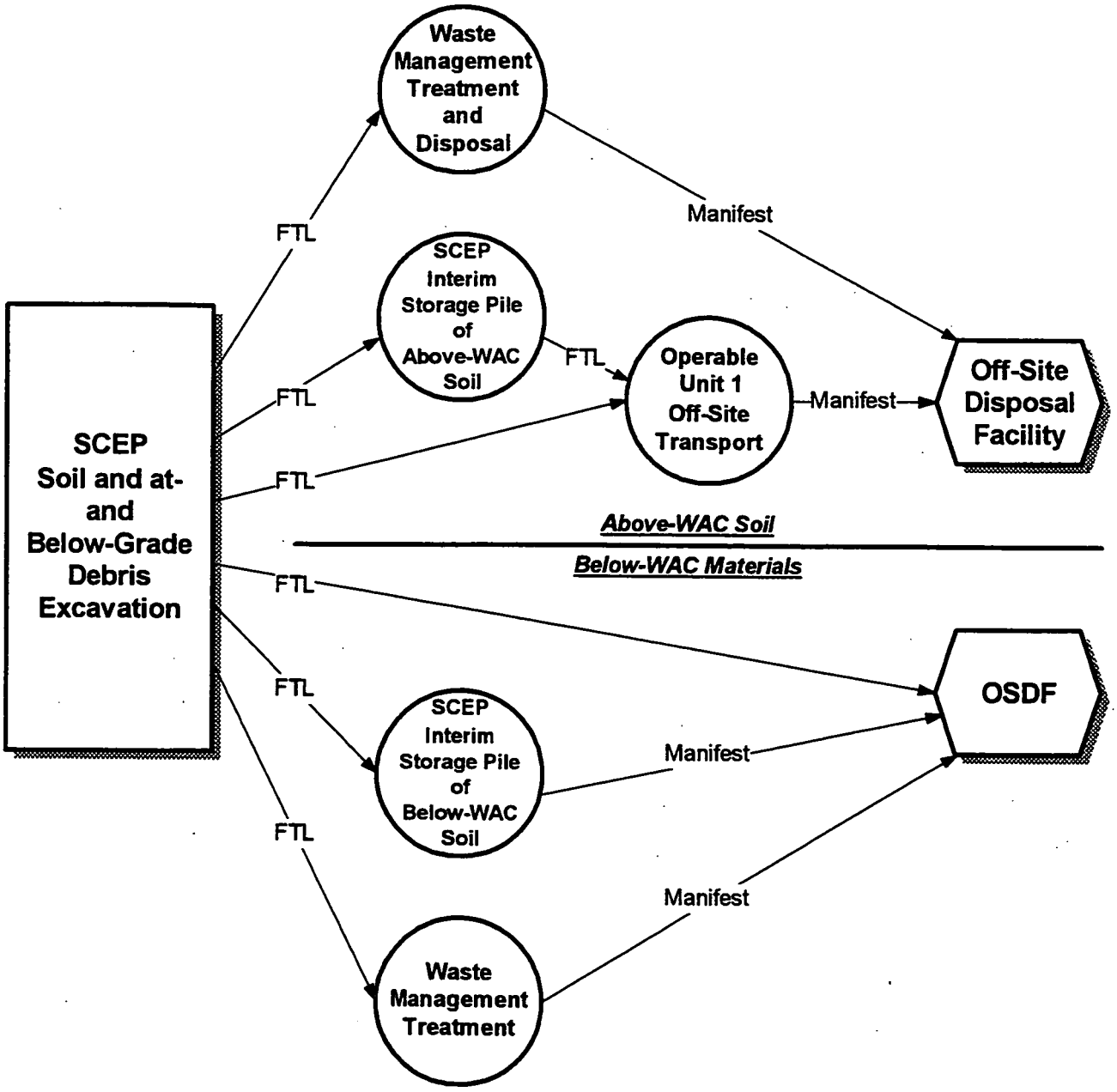



FIGURE 3-10 OPERATIONAL DOCUMENTS AND SCEP FUNCTIONAL ORGANIZATIONS




FTL: Field Transfer Logs

**FIGURE 3-11 MATERIAL DESTINATION DECISIONS AND ORGANIZATIONAL HAND-OFF**

# 4.0 LOCATION-SPECIFIC EXCAVATION APPROACHES

Because of the wide range of physical conditions at the FEMP, location-specific conceptual excavation approaches are needed to efficiently meet the various remediation challenges described in Sections 2.0 and 3.0. These conceptual area-specific approaches will incorporate the general guidelines discussed in Section 3.0 (Figure 3-1). Soil excavation conducted in impacted areas surrounding the FEMP will be relatively simple when compared to the logistics of soil excavation in the Former Production Area. Perimeter areas of the Fernald Environmental Management Project (FEMP) may have localized surface contamination that can be removed using shallow excavation procedures. However, within the Former Production Area, deep excavations of soil must be coordinated with decontamination and dismantlement (D&D) activities, removal of at- and below-grade structures, (e.g., building foundations and pipelines), and removal and closure of hazardous waste management units (HWMUs), underground storage tanks (USTs), and non-homogenous stockpiles. This section will present and discuss six location-specific soil excavation approaches to deal with the diverse nature of the soil remediation scenarios.

The six location-specific excavation approaches that will be discussed are: A) shallow excavation of impacted on-property area outside the Former Production Area and other waste storage/management areas; B) Excavation in waste storage/management areas outside the Former Production Area; C) Excavation of existing stockpiles in the Former Production Area; D) Excavation following D&D in the Former Production Area and Sewage Treatment Plant; E) Off-property and nonimpacted on-property area certification; and F) Non-high density polyethylene (HDPE) pipeline excavation outside the Former Production Area. Major differences among the six approaches include: extent of the pre-design investigation, excavation sequence, excavation control monitoring, perched groundwater controls, and WAC attainment requirements. Table 4-1 summarizes the six location-specific approaches to eight sitewide remediation areas and one off-site area.

The eight sitewide remediation areas are numbered 1 through 8, with Remediation Area 4 divided into 4A and 4B. Remediation Area 1 also contains the Sewage Treatment Plant (STP), Remediation Area 3

also includes the Fire Training Facility (FTF) and Lime Sludge Ponds (LSP), and Remediation Area 6 also contains the Solid Waste Landfill (SWL). Figure 4-1 shows the location of the eight sitewide remediation areas and their proposed division into subareas that correspond to the various excavation approaches (i.e., A, B, C, etc). Table 4-2 summarizes the proposed excavation approaches in each remediation area. For example, Remediation Area 5 is in the Former Production Area and contains an existing soil stockpile; therefore, Excavation Approaches C and D apply to Remediation Area 5. This example is important to keep in mind because remediation will be implemented within a remediation area or subarea rather than within a single excavation-approach area (i.e., remediation of all areas designated as Excavation Approach A will not take place simultaneously). The Sitewide Sequencing Plan for remediation areas is provided in Appendix B.

As shown on Figure 3-1, the general remediation process presented in Section 3.0 is followed in each of the location-specific excavation approaches, with individual variances noted in the subsections below. Principal steps in each excavation approach are 1) pre-design investigation and remedial design; 2) soil excavation and segregation; 3) pre-certification activities; 4) certification and preparation of certification report; and 5) Interim grading and restoration. Within each remediation step, distinct tasks are performed that are specific to each excavation approach. These tasks are tied to each excavation approach in Table 4-3 to provide a cross-comparison among the area-specific approaches. For example, 11 tasks comprise Remediation Step 1, 4 of which are common to all excavation approaches.

The remainder of Section 4.0 covers each of the six location-specific excavation approaches and provides a detailed discussion comparing the similarities and differences of the approaches (Table 4-3) in each remediation area. Each excavation approach is discussed with respect to the rationale for its approach, a general description of the approach, special considerations for implementing the approach, and the implementation details of the tasks. Area-specific IRDPs (Section 7.1) will reflect the conceptual approaches described in this section.

## 4.1 EXCAVATION APPROACH A - SHALLOW EXCAVATION OF IMPACTED ON-PROPERTY AREA OUTSIDE THE FORMER PRODUCTION AREA AND OTHER WASTE STORAGE/MANAGEMENT AREAS

Excavation Approach A is designed to handle shallow soil excavation that takes place in impacted areas (i.e., hot spots potentially present) which surround the Former Production Area. The nature and extent of COCs in areas proposed for Excavation Approach A is generally limited to a few COCs in localized areas of contamination restricted to the top few feet of soil. Most of the excavation area within the boundary of the FEMP is expected to follow Excavation Approach A.

Excavation Approach A will be applied to Remediation Areas 1, 2, 6, and 7 (Tables 4-1 and 4-2; Figures 4-1 and 4-3). Remediation Areas 1 and 2 encompass most of the perimeter of the FEMP, where impacted soil has been documented through the collection of RI/FS characterization data. In Remediation Areas 6 and 7, Excavation Approach A will be applied to the areas between waste storage units and the Former Production Area. The list of potential area-specific COCs for these remediation areas is provided in Table 2-9.

### 4.1.1 General Description

Excavation Approach A follows the general soil remediation process discussed in Section 3.0, as illustrated on Figures 3-1 through 3-8. The soil remediation process will begin with a pre-design investigation to estimate the extent of the excavation, identify as COCs, and perform pre-excavation surveys and sampling activities. Radiological survey results and laboratory analytical data will be forwarded to the remedial design to delineate the extent of soil excavation for technetium-99, RCRA characteristic waste (within the seven areas shown on Figure 1-5), above-WAC, and above-FRL areas. This information will be incorporated into an IRDP and submitted to the OEPA and USEPA for approval. After the IRDP has been approved, soil excavation will begin and materials delineated as technetium-99, RCRA characteristic waste, and above WAC will be segregated for treatment, if required, and disposal.

Upon completion of all excavation types, a pre-certification survey and/or sampling activities will commence, and the CU boundaries will be delineated to subdivide the remediated area for final

certification. This information will be given to the OEPA and USEPA as a Certification Design Letter to establish the boundaries of the CUs, the list of CU-specific COCs requiring certification sampling, and the certification sampling approach. Certification sampling and analysis will follow and the results will be evaluated against the certification criteria to demonstrate that the CU can be released. Sampling locations, analytical results, statistical methods, and certification criteria used to pass the CUs in the remediated area will be summarized in the Certification Report. Following approval of the Certification Report by the OEPA and USEPA, interim or final grading and restoration activities will take place.

### 4.1.2 Special Considerations

Special considerations for implementing Excavation Approach A are summarized under the following discussions of the nature and extent of contamination, radiological scanning and field measurements, and attainment of WAC.

#### Nature and Extent of Contamination

Excavation Approach A will be implemented in Remediation Area 1 (Figure 4-1) in areas that have not been remediated under the Area 1, Phase I project. Soil in Remediation Area 1 has been adversely affected, primarily by air deposition of uranium particles. This mode of deposition results in a relatively homogenous distribution of material over the land surface, and shallow excavations are expected to remove the contamination. Exceptions to this approach may be encountered in Remediation Area 1 along the north central boundary of the FEMP, where topographic data indicate a thicknesses of fill in excess of 20 feet. RI/FS data collected on surface soil samples indicate the top 6 inches of the fill are not contaminated. However, if excavation activities are conducted in this portion of Remediation Area 1, additional radiological scans will be conducted on exposed excavation surfaces to assess the presence or absence of primary radiological COCs in the fill material.

In Remediation Area 2, Phase II operations will use Excavation Approach A to remove identified surficial contamination. The Phase II operations will be implemented after Phase I work has removed the Flyash Piles and associated debris (Excavation Approach B, Section 4.2). In a similar fashion, Excavation Approach A will be applied to Remediation Areas 6 and 7 after excavation of their

respective waste storage units is complete (Section 4.2). Local excavation sequencing will be developed in the IRDP to minimize the potential of recontamination and/or cross-contamination of remediated or nonimpacted areas.

Radiological Scanning and Field Measurements

Much of the area designated for remediation under Excavation Approach A is open field terrain that is amenable to radiological scanning (100 percent coverage, if possible) using the RTRAK equipment (i.e., four large-volume NaI detectors mounted on a boom pulled by a tractor). However, the northeast corner of Remediation Area 1 contains a stand of conifers that prevents use of the RTRAK for radiological scans. Therefore, in the forested portion of Remediation Area 1 and other locations that preclude the use of the RTRAK, radiological surveys will be conducted with a single, large-volume NaI detector mounted on a tri-wheel stroller that is pushed by personnel conducting the traverses (a.k.a. the BTRAK). Additional details on these instruments are provided in Section 2.4 and Appendix H.

The time required to remediate areas designated as Excavation Approach A will be dependent on the number and types of COCs detected within the remediation areas and the type of radiological scanning equipment that can access the terrain. In Remediation Areas 2, 6, and 7, the presence of metal and organic COCs in waste storage areas dictates that volatile organic compound (VOC) monitoring and additional sampling and analysis may be required during the implementation of Excavation Approach A. These activities will be conducted independent of radiological scanning, resulting in an increase in the time required to excavate the soil. Additionally, radiological scanning of a unit soil area is likely to take longer in Remediation Areas 6 and 7 because access problems may limit the scanning to the BTRAK equipment rather than the RTRAK.

Attainment of WAC

To assure that a high level of confidence is achieved in the ability to screen and segregate above-WAC material from material that can be placed in the OSDF, several independent methods will be used to demonstrate WAC attainment. RI/FS data will be used to focus pre-excavation investigations on areas known to contain above-WAC materials. Above-WAC areas will be delineated for excavation by establishing the areal extent using real-time, large-volume NaI detectors. Radiological boundaries

established by NaI detectors will be verified for uranium, thorium, and radium by obtaining field measurements of their gamma spectra with the HPGe instrument. WAC boundaries established by the primary ASCOCs will be used as a starting point for sampling activities that will establish the extent of above-WAC secondary ASCOCs (e.g., technetium-99, metals, etc). Discrete surface and subsurface soil samples will be collected to establish the extent of secondary ASCOCs as described in Section 3.1.3. The samples will be submitted for laboratory analysis of secondary ASCOCs to determine the extent of above-WAC material. All available field and laboratory data will be used to support the demonstration of WAC attainment.

### 4.1.3 Excavation Details

Figure 4-2 presents the logic flow for conducting Excavation Approach A. Each of the 22 tasks identified for this type of excavation is discussed in detail or tied to details presented in Sections 3.0 and 7.0 and/or relevant appendices. A comparison of these tasks with other excavation approaches is provided in Table 4-3.

Task 1 - Potential Excavation Area Delineation and Data Review

This task is carried out as discussed in Section 3.1.1. The potential excavation areas have been defined using RI/FS data collected for uranium and are shown on Figure 4-3.

Task 2 - Select COCs and Identify Potential Technetium-99, RCRA, and Above-WAC Areas

The COC lists for Remediation Areas 1, 2, 6, and 7 are summarized in Table 2-9. These lists are derived from RI/FS characterization data and are divided into primary and secondary ASCOCs. (Section 2.1.3.2 defines primary and secondary COCs.)

Technetium-99 has been measured above the FRL in Remediation Area 6 near the eastern boundary with Remediation Area 3 (Figure 4-3).

There is a potential RCRA excavation unit (i.e., the potential for soil to exhibit the characteristic of toxicity) in the southern portion of Remediation Area 1 directly southeast of Remediation Area 5

(Figure 4-3). Soil removed from this potential RCRA excavation unit will be subjected to TCLP tests to determine whether treatment is required prior to disposal.

Based on the RI/FS characterization data for uranium, there are four known areas within the proposed Excavation Approach A boundaries with the potential to exceed established WAC levels for uranium (Figure 4-3). Above-WAC areas for uranium have been identified along the northern boundary of the STP (Remediation Area 1), around the northwest perimeter of the inactive flyash pile (Remediation Area 2), surrounding the south and east perimeter of the technetium-99 area in Remediation Area 6, and along the southern boundary of the FTF in Remediation Area 6.

Task 3 - Pre-Excavation Surveys and Sampling

Pre-excavation surveys and depth profile sampling (a.k.a. pre-design investigation) will be conducted using field surveys and laboratory analytical techniques as described in Section 3.1.2. In general, the concentrations of uranium, thorium, and radium (i.e., primary constituents in Table 2-9) in surface and subsurface soil will drive the excavation. Initially, radionuclide activities will be established using RI/FS data, surveys with sodium-iodide (NaI) detectors, and/or by discrete measurements with field instruments containing a high-purity germanium (HPGe) crystal. After the extent of radionuclide distribution is established with RI/FS and survey data, additional discrete soil samples will be taken for laboratory analysis, as needed. In the event metal or organic ASCOC concentrations drive the soil excavation, field x-ray fluorescence (XRF), photoionization detectors (PID), or laboratory analysis may be used to characterize the discrete soil samples.

To establish the area extent of ASCOCs, RI/FS data will be used to minimize the number of samples collected during pre-excavation survey and sampling activities. Survey and sampling activities will be carried out by placing a grid with appropriate cell dimensions over the estimated excavation area and executing a systematic surface survey and/or sampling protocol. After establishing the area extent of excavation, applicable RI/FS data will be reviewed to determine the location and number of geoprobe borings. Geoprobe borings will be placed on the established perimeter of the excavation and within the delineated excavation area to determine the depth of excavation. Section 3.1.3 and Figure 3-3 provide details on the methods and protocols proposed for establishing the extent of excavation.

Task 4 - Delineate Excavation Extent Due to Technetium-99 Contamination

The extent of soil excavation needed to remove technetium-99 will be determined using RI/FS data and by obtaining discrete samples from surface and subsurface locations, as needed. The number of additional sample locations will be determined by the adequacy of the RI/FS data, the cell dimensions of the surface grid, and the number of geoprobe borings needed to define the depth of excavation for soil containing technetium-99 above its FRL (Section 3.1.3). Samples will undergo laboratory analysis for characteristic beta radiation. Sample collection and handling procedures, laboratory protocols and methods, and instrument detection limits are presented in the QAPP (Appendix E).

Task 5 - TCLP Test and Delineate Characteristic Waste Extent

The extent of soil excavation needed to remove potential toxicity characteristic COCs in the potential RCRA excavation unit identified as the former skeet range in Remediation Area 1 (Figure 4-3) will be determined by obtaining discrete samples from surface and subsurface locations. The number of sample locations will be established by the adequacy of RI/FS data, the cell dimensions of the surface grid, and the number of geoprobe borings needed to define the depth where COCs are below their FRLs (Section 3.1.3). Samples will undergo TCLP testing to determine what portions, if any, of the potential RCRA excavation unit possess the toxicity characteristic. If soil is identified as possessing the toxicity characteristic, it will be delineated as such to indicate that treatment is required prior to disposal. For the special case where soil having the toxicity characteristic contains technetium-99 above its FRL, it will be delineated for removal with the technetium-99 and segregated from technetium-99 soil that is free of the toxicity characteristic. Additional details on the sampling and analysis approach are provided in Section 3.1.2.

Task 6 - Determine Remaining Excavation Extent

After excavation volumes for technetium-99 and identified toxicity characteristic COCs have been delineated, the excavation volumes for non-technetium-99, above-WAC soil and soil above the FRLs for primary ASCOCs will be determined. If above-WAC soil is present in the four above-WAC areas identified on Figure 4-3, the excavation extent will be determined as described in Section 3.1.3. The entire footprint for the delineated above-WAC soil area will be excavated to the depth corresponding to

WAC attainment. After the delineation of all above-WAC areas, soil remaining above the FRLs of the ASCOCs will be delineated for excavation.

Task 7 - Prepare Area-Specific IRDP

An area-specific IRDP (i.e., a remedial design) will be prepared as presented and discussed in Sections 3.2 and 7.1. The IRDP must be approved by the OEPA and USEPA prior to beginning excavation activities.

Task 8 - Prepare Excavation Site

Prior to and during excavation, a number of institutional and constructional measures will be implemented to control access to the area, prepare staging areas, prevent the spread of contaminated soil, and dispose of cleared shrubs and trees, as needed. Section 3.3.1 and Appendix F.2 further discuss site preparation activities.

Task 9 - Implement Run-off Control, As Needed

Based on the levels of contamination and the extent of excavation, an appropriate surface water management system will be implemented to ensure that water and sediment run-off/run-on is maintained and erosion is controlled to prevent cross-contamination of remediation areas during excavation. This system will conform to the FEMP NPDES Permit requirements through implementation of the FEMP SWPPP (DOE 1996f). Sections 3.3.1.1 and 5.1.3 discuss additional details of the run-off control measures.

Task 10 - Technetium-99-Driven Excavation

Soil delineated as at or above the FRL for technetium-99 in Remediation Area 6 (Figure 4-3) will be excavated and staged prior to packaging and shipment to an off-site disposal facility. This excavation may be coordinated with removal of soil having non-technetium-99 ASCOCs above the WAC if the excavation volumes overlap. That is, if ASCOCs other than technetium-99 are above the WAC and present in the soil volume designated for technetium-99 excavation, they will be removed and segregated with the technetium-99 soil rather than with the non-technetium-99, above-WAC soil. Additionally, if the technetium-99 excavation overlaps with the excavation of soil that has failed the

TCLP test, the excavated technetium-99 and toxicity characteristic soil will be treated prior to disposal. Additional information on excavation and disposal protocols is provided in Sections 3.3.1.2 and 3.3.1.3, and procedures to be followed for excavated material management are covered in Appendix F.5.

Task 11 - Characteristic Waste-Driven Excavation and Treatment

Potential RCRA excavation units containing soil that possesses the characteristic of toxicity will be excavated, staged, and passed to the Waste Disposition Program at the FEMP to establish treatment and disposal options. If the toxicity characteristic soil contains non-RCRA COCs above the WAC (e.g., uranium), the above-WAC soil will be excavated and staged for treatment prior to removing the above-FRL soil. Additional excavation and disposal information is provided in Sections 3.3.1.2 and 3.3.1.3, and procedures to be followed for excavated material management are covered in Appendix F.5.

Task 12 - Non-Technetium-99, WAC-Driven Excavation/Confirmation

There are four known soil areas at the FEMP that have the potential to exceed the established WAC levels in Remediation Areas 1, 2, and 6 (Figure 4-3). If RI/FS data and surveying and sample analysis carried out to define the excavation volumes indicates ASCOC concentrations above the WAC, the extent will be delineated with respect to non-technetium-99, above-WAC soil. The above-WAC soil will be excavated and segregated to isolate the above-WAC material prior to off-site disposal. Additional excavation and disposal information is provided in Sections 3.3.1.2 and 3.3.1.3.

Task 13 - FRL-Driven Excavation

After completing the excavations to remove soil containing technetium-99 above its FRL, soil containing the toxicity characteristic (i.e., potential RCRA excavation units), and soil exceeding or above the WAC, any remaining soil with uranium, thorium, radium, metal ASCOCs, and/or organic ASCOCs above their respective FRL will be excavated and staged (if needed) prior to placement in the OSDF. WAC attainment will be demonstrated using the field and analytical methods discussed in Sections 2.4 and 4.1.2. Additional excavation and disposal information is provided in Sections 3.3.1.2 and 3.3.1.3.

Task 14 - Pre-Certification Scan

Upon completion of excavation activities within the remediation area, the area will be prepared for a pre-certification survey. The radiation survey will be conducted with NaI detectors and/or by discrete measurements with field instruments containing an HPGe detector. Pre-certification will be based on the residual activity of primary radioactive ASCOCs in the soil, except in areas where technetium-99, metal ASCOCs, and/or organic ASCOCs drive the excavations. For these exceptions, discrete samples will be collected to supplement the pre-excavation data, as needed. Additional details on pre-certification activities are presented in Section 3.3.3.

Task 15 - CU Delineation/Classification

As part of the pre-certification survey, the excavated remediation area will be divided into certification units (CUs) and CU footprints will be defined. CUs will be approximately 500 ft by 500 ft (Group 2 CU) in Remediation Areas 1 and 2 and approximately 250 ft by 250 ft (Group 1 CU) in Remediation Areas 6 and 7. A Group 1 classification in Remediation Areas 6 and 7 has been selected to provide denser sample coverage in areas containing waste storage units. Section 3.4.1 contains additional details on the delineation and classification of CUs.

Task 16 - Evaluate Pre-Certification Scan Results

RI/FS data and results from the pre-certification scan and/or supplemental sampling and analysis will be reviewed to assess the residual pattern of primary ASCOCs across the excavated area. FRL attainment for radiological, metal, and organic ASCOCs will be evaluated with RI/FS data and samples collected during pre-excavation characterization and/or supplemental sampling and analysis, as needed. Additional assurance will be provided for the radiological ASCOCs by conducting HPGe measurements above designated certification sample locations prior to obtaining certification samples. Section 3.3.4 provides additional details on the attainment of remediation goals prior to conducting certification activities.

Task 17 - Hot-Spot/FRL Excavation/Confirmation

Hot spots (i.e., any of the three primary radiological COCs in Section 2.2.3 that is greater than three times its FRL) delineated by the pre-certification scan in Task 14 will be reexcavated, and the pre-

certification scan will be repeated on the re-excavated areas to confirm removal of radiological ASCOCs. This step will be reiterated as needed until the CU is determined to be ready for formal certification.

Task 18 - CU-Specific Certification Sampling

Based on the DQOs and CU-specific sampling needs, a sufficient number of HPGe measurements and samples (generally 12 to 16) will be collected from each CU. HPGe measurements will be used to certify the CU with respect to uranium and thorium FRLs. Section 3.4.2 provides additional details on the certification sampling design.

Task 19 - Certification/Recertification

A statistical analysis will be performed on the validated analytical results obtained from the certification samples to establish whether the CU passes the certification criteria at the specified level of uncertainty. Two criteria must be met for the CU to be certified as passing. The first criterion is that each individual sample within a CU must show each primary, CU-specific COC to be below a value of three times its FRL. When the data distribution is normal or lognormal, the second criterion compares the 95 percent UCL of the mean of each primary CU-specific COC and the 90 percent UCL of the mean of each secondary CU-specific COC to the appropriate FRL to make a pass/fail decision. In the event the data distribution is nonparametric, the pass/fail decision for the second criterion will follow the statistical protocol given in Appendix G. When the UCL of the mean (normal or lognormal distribution) of each CU-specific COC is less than its FRL or the appropriate nonparametric test is passed (Appendix G), the CU is certified as passing the second criterion. Both criteria must be met for the CU to be certified.

Task 20 - Additional Hot-Spot/FRL Excavation/Confirmation

In the event either one of the two criteria fails in Task 19, additional excavation, field screening and surveying, sampling, and analysis will be conducted until the CU passes certification. The nonattainment scenarios that pertain to additional excavation and sampling activities are discussed in Section 3.4.5.

Task 21 - Prepare Certification Report

After both criteria are shown to pass the evaluation, individual CUs will be considered certified. As each CU is demonstrated to pass certification, analytical data will be communicated to the OEPA and USEPA through the posting of data results and information via a web site. A Certification Report will be issued for each remediation area after all CUs within the remediation area have been shown to pass the certification criteria. Further discussion on the content of this report is provided in Sections 3.4.6 and 7.3.

Task 22 - Area-Wide Interim Grading and Restoration

After the Certification Report has been approved by the EPA and OEPA, interim grading and restoration will be implemented to stabilize the excavation slopes prior to final sitewide grading and restoration. Interim grading and restoration activities are described in Appendix F.7.

## 4.2 EXCAVATION APPROACH B - EXCAVATION IN WASTE STORAGE/MANAGEMENT AREAS OUTSIDE THE FORMER PRODUCTION AREA

Excavation Approach B is designed to handle moderate to deep excavation of Operable Unit 2 waste units and of soil that underlies current waste storage/management areas in Operable Units 1, 2, and 4. Soil underlying the waste storage/management areas is expected to be adversely affected by contaminants. The list of potential ASCOCs in soil areas proposed for Excavation Approach B is expected to reflect RI/FS data on the waste presently stored in the remediation areas (Table 2-9). However, the distribution of COCs in soil under the waste storage/management areas cannot be fully established until waste has been removed from the remediation areas.

Excavation Approach B will be applied to the Operable Unit 2 waste units and soil underlying waste storage areas in Remediation Areas 2, 3, 6, and 7 (Tables 4-1 and 4-2; Figures 4-1 and 4-5). Remediation Areas 2, 3, 6, and 7 encompass the waste storage areas of Operable Units 1, 2, and 4. The waste storage areas include the Southern Waste Units (SWUs; a.k.a. the Flyash Piles and South Field area) in Remediation Area 2, the LSP and SWL in Remediation Area 3, the Operable Unit 1 waste pits in Remediation Area 6, and Operable Unit 4 silos housing the K-65 and metal-oxide material (Remediation Area 7).

### 4.2.1 General Description

Excavation Approach B follows the general soil remediation process discussed in Section 3.0, as illustrated on Figures 3-1 through 3-8. The soil remediation process in Remediation Areas 2 and 3 is coupled with the removal of materials in the SWUs, LSP, and SWL because all these materials will go to the OSDF if the WAC are met. In Remediation Areas 6 and 7, the soil remediation process begins after waste materials have been removed because the Operable Units 1 and 4 waste materials will be shipped off site for disposal.

A pre-design investigation will be conducted to estimate the extent of the excavation and above WAC material using RI/FS data, pre-excavation surveys, and additional sampling activities as needed. Radiological survey results and laboratory analytical data are forwarded to the remedial design to delineate the extent of soil excavation for technetium-99, RCRA characteristic waste (within the seven areas shown on Figure 1-5), HWMUs, and above-WAC and above-FRL areas. This information will be incorporated into an IRDP and submitted to the OEPA and USEPA for approval.

After the IRDP has been approved, waste and soil excavation will begin and materials delineated as technetium-99, RCRA characteristic waste, and above WAC will be segregated for treatment, if required, and disposal. Because moderate to deep soil excavations are expected within the waste storage footprints, excavation will proceed in layers or lifts, with each layer being surveyed with a large-volume NaI detector and/or an HPGe instrument to demonstrate WAC attainment for primary radiological COCs. If special materials (Section 3.3.2.2) are encountered during the excavations, the materials will be handled, treated (as needed), and disposed of in accordance with the procedures outlined in Appendix F.5.

Upon completion of all excavation activities, the pre-certification survey, sampling activities, delineation of CU boundaries, and final certification effort follow the general approach discussed in Section 4.1.1.

### 4.2.2 Special Considerations

Special considerations for implementing Excavation Approach B are summarized under the following discussions of the nature and extent of contamination, radiological scanning and field measurements, attainment of WAC, and logistics.

#### Nature and Extent of Contamination

Contamination associated with Excavation Approach B areas is tied to waste storage/management areas in Operable Units 1, 2, and 4. The nature of contamination at the SWUs, LSP, and SWL excavation units associated with Operable Unit 2 (placed in Remediation Areas 2, 3, and 6) includes radiological, metal, and organic ASCOCs (Table 2-9), with contamination expected to extend to moderate to deep levels below the surface. RI/FS data indicate the potential for technetium-99 and uranium to be above the WAC in the SWUs. Characterization of the waste materials will be limited to delineation and removal of above WAC material for off-site disposal, with all remaining material sent to the OSDF. RI/FS data will be used to determine whether additional characterization data are needed to delineate above-WAC waste material.

Waste materials will be removed from the waste units associated with Operable Units 1 and 4 prior to completing ASCOC characterization of underlying soil. The nature of contamination is expected to follow the COCs associated with the waste materials, with the extent of soil contamination established during the pre-excavation investigation. The potential above-WAC technetium-99 zones associated with Waste Pit 5 in Remediation Area 6 and the western part of the slurry line near Silos 1 and 2 in Remediation Area 7 indicate the potential for soil underlying the waste units in these areas to be contaminated with technetium-99.

#### Radiological Scanning and Field Measurements

In Remediation Areas 2, 3, and 6, the SWUs, LSP, and SWL will be characterized, as needed, and excavated as part of Excavation Approach B. The nature of contamination in these waste units will require radiological scanning of the waste materials and field measurements of organic vapors and gamma-emitting radionuclides.

A layer-by-layer radiological scan with a large-volume NaI detector will be conducted on the waste material and if above-WAC material is identified, HPGe measurements may be taken to identify gamma-emitting radionuclides and/or a geoprobe sample may be taken for characterization of pertinent ASCOCs. In the SWL, field measurements or scanning for organic vapors will be conducted in addition to the radiological scans. However, the following special circumstances may limit the field activities.

The rheology of LSP material may not allow loading of the surface, which would eliminate walk-over radiation surveys and systematic sampling efforts. Under these conditions, materials will be screened and sampled after excavation. Similar consideration must be given to the heterogeneity of materials expected to be found in the SWL when conducting radiation surveys and sampling activities. Excavation of the SWL is not anticipated to result in the smooth surfaces expected for soil excavations. Therefore, the geometry of the surface must be considered when radiation scans and/or HPGe measurements are performed. The heterogeneity of materials expected to be found in the SWL also creates unique problems with sampling efforts designed to identify metals above the WAC, as no real-time scanning instrument similar to NaI detectors and PID meters is available for metal COCs.

Attainment of WAC

WAC attainment will be carried out using the general approach discussed in Section 4.1.2, with the following exceptions. The SWUs, LSP, and SWL will undergo a layer-by-layer NaI scan on each lift surface during excavation, if possible, to identify material containing primary ASCOCs above the WAC. If an in-situ scan is not possible, excavated material will be stockpiled and scanned to determine whether the WAC is met for primary ASCOCs. Secondary ASCOCs will be shown to comply with the WAC by sampling and analysis of in-situ or stockpiled material, with the exception of the SWL.

For the heterogeneous materials expected to be found in the SWL, radiation surveys can demonstrate WAC attainment for primary ASCOCs by scanning nearly 100 percent (if possible) of the exposed surfaces in the SWL, but it is not feasible to sample 100 percent of the waste to demonstrate WAC attainment for other ASCOCs. Therefore, biased sampling, based on radiation and organic-vapor

surveys during excavation will be coupled with random sampling during the pre-design investigation to demonstrate WAC attainment.

Logistics

Soil characterization and excavation activities conducted in waste storage footprints associated with Remediation Areas 6 and 7 will proceed after the waste materials are removed. Removal of waste material and structures associated with the Operable Unit 1 Waste Pits (Remediation Area 6) will be carried out under the Waste Pits Remedial Action Project (Section 1.2.1). Waste materials and structures associated with the Operable Unit 4 Silos (Remediation Area 7) will be removed under the Silos Project (Section 1.2.1).

The potential for deep excavations (i.e., greater than 20 ft) in the waste storage areas poses logistical problems as well as health and safety concerns. Excavation of soil, layer by layer, will be slow because of continual radiation scanning of the excavation surfaces for primary ASCOCs, the dewatering of perched water zones, and the need to construct soil ramps or retaining walls to achieve the target depth of excavation. Additionally, radiological scanning of successively deeper layers is likely to take longer than initial surface scans because access problems may limit the scanning to the BTRAK equipment or hand-held instruments rather than the RTRAK.

In addition to the challenges posed by deep excavations, the presence of metal and organic COCs in the waste storage areas dictates that VOC monitoring and additional sampling and analysis may be required during the implementation of Excavation Approach B. These activities will be conducted independently of radiological scanning, resulting in an increase in the time required to excavate the soil.

### 4.2.3 Excavation Details

Figure 4-4 presents the logic flow for conducting Excavation Approach B. Each of the 24 tasks identified for this type of excavation is discussed in detail or tied to details presented in Sections 3.0, 4.0, and 7.0 and/or relevant appendices. A comparison of these tasks with other excavation approaches is provided in Table 4-3.

Task 1 - Potential Excavation Area Delineation and Data Review

This task is carried out in the general manner outlined in Section 3.1.1. The potential excavation areas shown on Figure 4-5 have been defined where RI/FS data collected for uranium are available. However, much of the potential excavation area will not be defined rigorously until waste is removed from the waste storage units and the extent of ASCOCs in the underlying soil is determined.

Task 2 - Select COCs and Identify Potential Technetium-99, RCRA, HWMU, and Above-WAC Areas

The COC lists for Remediation Areas 2, 3, 6, and 7 are summarized in Table 2-9. These lists are derived from RI characterization data and divided into primary and secondary ASCOCs. (Section 2.1.3.2 defines primary and secondary ASCOCs.)

Technetium-99 has been measured above the FRL in three of the four remediation areas designated for Excavation Approach B: near the northwest corner of the SWUs in Remediation Area 2; in the northeast corner of Waste Pit 5 (Remediation Area 6); and surrounding the west portion of the slurry line in Remediation Area 7 (Figure 4-5). Most of the technetium-99 material in Remediation Areas 6 and 7 is likely to be removed with the waste materials prior to conducting soil excavation activities. However, the material in the SWUs and soil underlying the waste storage areas will be investigated for potential technetium-99 removal under this excavation approach.

There are two potential RCRA excavation units (i.e., potential for soil to exhibit the characteristic of toxicity) in areas covered by Excavation Approach B. In Remediation Area 7, directly west of the waste storage units that comprise Silos 1 and 2, and the South Field Firing Range in Remediation Area 2 (Figure 4-5).

Two HWMUs are located in Remediation Area 6: HWMU #27 - Waste Pit 4 and HWMU #42 - Waste Pit 5 (Table 2-1; Figure 4-5). The characterization and excavation of soil underlying waste materials in these HWMUs and the closure of the HWMUs will be covered under this excavation approach.

Based on the RI/FS characterization data for uranium, there are two known areas within the proposed Excavation Approach B boundaries with the potential to exceed established WAC levels (Figure 4-5).

Above-WAC areas for uranium have been identified along the eastern margin of the waste pit area in Remediation Area 6 and along the northwest margin of the SWUs in Remediation Area 2. It is likely that much of the above-WAC material in Remediation Area 6 will be removed when the waste materials are removed. However, underlying soil will be sampled and analyzed to determine whether above-WAC soil exists. All above-WAC material in Operable Unit 2 waste units and above-WAC soil underlying all waste units will be excavated and handled under this approach.

Task 3 - Pre-Excavation Surveys and Sampling

Pre-excavation surveys and sampling will be carried out as described under Task 3 in Section 4.1.3, with the exception of the following scenarios. The rheology of material in the LSP may not permit loading of the surface, and walk-over radiation surveys and systematic in-situ sampling may not be possible. Under these conditions, radiological scanning and sampling will take place on excavated material that has been stockpiled. A second potential scenario that varies from standard protocol is the sampling of heterogeneous material in the SWL. Although radiation surveys can demonstrate WAC attainment for primary radiological COCs by scanning nearly 100 percent (if possible) of the exposed surfaces in the SWL, it is not feasible to sample 100 percent of the waste to demonstrate WAC attainment for other COCs. Therefore, biased sampling, based on radiation and organic-vapor surveys, will be coupled with random sampling to demonstrate WAC attainment.

Task 4 - Delineate Excavation Extent Due to Technetium-99 Contamination

Delineation of the extent of technetium-99 will be carried out as described under Task 4 in Section 4.1.3, with the exception of the following scenario. Waste material in the northwest corner of the SWUs that contains technetium-99 above its FRL (i.e., the Inactive Flyash Pile) will be delineated for excavation in addition to potential technetium-99 soil areas.

Task 5 - TCLP Test and Delineate Characteristic Waste Extent

The extent of soil excavation needed to remove potential toxicity characteristic ASCOCs in the RCRA excavation unit west of Silos 1 and 2 will be determined by obtaining discrete samples from surface and subsurface locations. The sampling and analysis protocol to delineate potential characteristic waste will be carried out as described under Task 5 in Section 4.1.3.

Task 6 - Determine Remaining Excavation Extent

After excavation volumes for technetium-99 and identified toxicity characteristic COCs have been delineated, the excavation volumes for non-technetium-99, above-WAC soil and soil above the FRLs for ASCOCs will be determined. If above-WAC soil is present in the two above-WAC areas identified on Figure 4-5, the area will be delineated and excavated as described under Task 6 in Section 4.1.3. The general approach for determining the excavation extent of soil containing ASCOCs above the FRL is described in Section 3.1.3.

Task 7 - Prepare Area-Specific IRDP

The area-specific IRDP will be prepared as discussed under Task 7 in Section 4.1.3.

Task 8 - Prepare Excavation Site

The excavation site will be prepared as discussed under Task 8 in Section 4.1.3.

Task 9 - Implement Run-off Control, As Needed

Run-off control will be implemented as discussed under Task 9 in Section 4.1.3.

Task 10 - Technetium-99-Driven Excavation

Soil delineated as at or above the FRL for technetium-99 (Figure 4-5) will be excavated and staged prior to packaging and shipment to an off-site disposal facility. This excavation will be carried out as discussed under Task 10 in Section 4.1.3.

Task 11 - Characteristic Waste-Driven Excavation and Treatment

Excavation and treatment of identified RCRA characteristic waste will be carried out as discussed under Task 11 in Section 4.1.3.

Task 12 - Implement Perched Water Control, As Needed

If excavation activities encounter perched water, controls will be implemented to pump and contain the perched water prior to treatment at the AWWT facility. In the event perched water is recovered from a zone identified to contain RCRA characteristic waste, sampling and analysis will be carried out to

determine whether toxicity characteristic COCs are present in sufficient quantity to warrant pre-treatment prior to sending the water to the AWWT facility for final treatment.

Task 13 - Layer-Specific, Pre-Excavation, Non-Technetium-99 WAC Scan

During moderate to deep excavations, soil will be removed in layers. As each layer is stripped away, a WAC scan will be conducted on the exposed soil to determine whether primary ASCOCs are present above the WAC level. This survey will be conducted with the BTRAK or hand-held NaI detectors and/or by discrete measurements with a field instrument containing a HPGe crystal. When a radiological scan indicates a primary ASCOC is above the WAC, a geoprobe boring will be extended to determine the vertical extent of above-WAC material for all pertinent ASCOCs.

In the event material cannot be surveyed in-situ (e.g., LSP material), the radiological scan for WAC attainment will be conducted on excavated material staged for disposal. If ASCOCs associated with identified RCRA characteristic waste and HWMUs drive the soil excavation, field XRF, PID, or laboratory analysis may be used to delineate ASCOCs that are above the WAC levels when pre-excavation data are not sufficient to assess WAC attainment.

Task 14 - Non-Technetium-99, WAC-Driven Excavation/Confirmation

There are two known soil areas that have the potential to exceed the established uranium WAC level in Remediation Areas 2 and 6 (Figure 4-5). However, the potential also exists for soil to exceed the WAC under the waste storage units, HWMUs, and other areas within the remediation areas. If soil containing ASCOCs at or above the WAC is determined to exist through review of RI/FS data and pre-excavation characterization activities, the extent will be delineated with respect to non-technetium-99, above-WAC soil containing toxicity characteristic COCs (treatment required) and non-technetium-99, above-WAC soil. These above-WAC soil types will be excavated and segregated to isolate the above-WAC material requiring treatment. All above-WAC material will be shipped off-site for disposal. Additional excavation and disposal information is provided in Sections 3.3.1.2 and 3.3.1.3.

Task 15- FRL-Driven Excavation

The FRL-driven excavation will be carried out as described under Task 13 in Section 4.1.3. WAC attainment will be demonstrated for the excavated material placed in the OSDF using the field and laboratory analytical methods described in Sections 2.4 and 4.2.2.

Task 16 - Pre-Certification Scan

The pre-certification scan will be carried out as discussed under Task 14 in Section 4.1.3.

Task 17 - CU and HWMU Footprint Delineation/Classification

As part of the pre-certification survey, the excavated remediation areas will be divided into CUs, and CU footprints will be defined. Group 1 CUs (250 ft by 250 ft) will be established after Excavation Approach B has been executed. The footprint for HWMUs in Remediation Area 6 (i.e., Waste Pits 4 and 5) will be delineated and certified for closure independent of the CU that contains them. Section 3.4.1 contains additional details on the delineation and classification of CUs and HWMUs.

Task 18 - Evaluate Pre-Certification Scan Results

Evaluation of the pre-certification scan results will be carried out as described under Task 16 in Section 4.1.3.

Task 19 - Hot-Spot/FRL Excavation/Confirmation

Hot-spot evaluation will be carried out as discussed under Task 17 in Section 4.1.3.

Task 20 - CU-Specific Certification Sampling

Certification sampling will be conducted as presented under Task 18 in Section 4.1.3, with the exception of evaluating HWMU closure.

For HWMU closure, a minimum of four random samples will be collected from the HWMU footprint. Sample locations will be established using the GPS or appropriate survey system, and the random samples will be submitted for laboratory analysis for all HWMU COCs. Justification for a minimum of four sample locations is provided in Section 2.2.4.

Task 21 - Certification/Recertification

Certification will be evaluated as discussed under Task 19 in Section 4.1.3, with the exception of evaluating HWMU closure.

For closure of the HWMUs, analytical results will be reviewed and closure will be complete if the average concentration of each COC is below its respective FRL. Additionally, the HWMU closure will meet all substantive requirements of the RCRA and Ohio hazardous waste closure regulations.

Task 22 - Additional Hot-Spot/FRL Excavation/Confirmation

Additional hot-spot evaluation will be carried out as discussed under Task 20 in Section 4.1.3, with the exception of HWMU closures.

If the HWMU fails the closure test, the HWMU will be reexcavated to remove the anomalies, and sampling, analysis, and statistical tests will be repeated until closure meets all substantive requirements of the RCRA and Ohio hazardous waste closure regulations.

Task 23 - Prepare Certification Report

The Certification Report will be prepared after the completion of excavation in the remediation area, as presented under Task 21 in Section 4.1.3. HWMU closure will be reported as part of the Certification Report. Additionally, in accordance with the OEPA final findings and orders (OEPA 1996), HWMU closures will be documented in the Remedial Action Reports submitted for former operable units.

Task 24 - Area-Wide Interim Grading and Restoration

Interim grading and restoration activities will be carried out as described under Task 22 in Section 4.1.3.

## 4.3 EXCAVATION APPROACH C - EXCAVATION OF EXISTING SOIL STOCKPILES IN THE FORMER PRODUCTION AREA AND REMEDIATION AREA 1, PHASE I

Excavation Approach C is designed to remove existing soil stockpiles in the Former Production Area (a.k.a. Removal Action 17) and in Remediation Area 1, Phase I. For soil stockpiles in the Former

Production Area, this approach will apply only to delineation and removal of the soil stockpile, with the underlying soil evaluated for removal by Excavation Approach D (Section 4.4). The purpose for handing the underlying soil to Excavation Approach D is to allow the soil in the entire Former Production Area to be remediated at one time; following removal of all buildings, structures, and stockpiles. For the soil stockpiles in Remediation Area 1, Phase I, this approach will apply to the removal of the stockpile to the former, certified grade surface. A list of potential primary and secondary ASCOCs for Excavation Approach C areas will be based on the COC list for the remediation areas that contain the piles (i.e., Remediation Areas 1, 3, and 5; Table 2-9).

Excavation Approach C will be applied to the seven existing soil stockpiles in Remediation Areas 1, 3, and 5 (Tables 4-1 and 4-2; Figures 4-1 and 4-7). Two of the stockpiles are located northwest of the STP in the eastern corridor of Remediation Area 1, four of the soil stockpiles are located in the northwest portion of Remediation Area 3, and one pile is located at the termination of the southwest extension of Remediation Area 5. This approach will also be applied to future, temporary stockpiles that may be generated during remediation activities.

### 4.3.1 General Description

Excavation Approach C follows the first half of the general soil remediation process discussed in Section 3.0 and illustrated on Figures 3-1 through 3-5. This approach terminates when the soil stockpiles have been removed. For stockpiles in the Former Production Area, the stockpile footprint and the certification process are forwarded to Excavation Approach D (Section 4.4). The purpose for handing the underlying soil to Excavation Approach D is to allow the soil in the entire Former Production Area to be remediated at one time, after all buildings, structures, and stockpiles have been removed. After removal of the two stockpiles in Remediation Area 1, Phase I, to the former, certified grade surface, confirmation scanning with HPGe will be conducted to demonstrate attainment of the remediation goals.

Characterization of the soil stockpiles will begin by conducting a pre-design investigation to delineate the soil stockpile to be removed, identify COCs, and perform pre-excavation surveys and sampling activities. Sampling activities will be carried out to achieve a density of surface and subsurface

sampling points similar to the RI/FS sampling density in the Former Production Area or in the vicinity of the stockpile. For the western stockpile in Remediation Area 1, Phase I (Figure 4-7), sample density is approximately 60 samples (surface and subsurface) for 35,000 $yd^3$. The source of the soil in the eastern stockpile in Remediation Area 1, Phase I was characterized during Area 1, Phase I activities, and no additional characterization of this stockpile is required. Radiological survey results and laboratory analytical data will be forwarded to the remedial design to delineate the extent of excavation for technetium-99, RCRA characteristic waste, above-WAC, and above-FRL areas. This information will be incorporated into an IRDP and submitted to the OEPA and USEPA for approval.

After the IRDP has been approved, removal of the soil stockpiles will begin and soil delineated as technetium-99, RCRA characteristic waste, and above WAC will be segregated for treatment, if required, and disposal. Because of the potential for heterogeneity within the stockpiles, excavation may proceed in layers, with each layer being surveyed by a large-volume NaI detector for WAC attainment of primary ASCOCs. If special materials are encountered during the removal activities (Section 3.3.2.2), the materials will be handled, treated (as needed), and disposed of in accordance to the procedures outlined in Appendix F.5. Upon removal of the stockpiles in the Former Production Area, the soil footprint will be remediated and certified under Excavation Approach D. For the stockpiles in Remediation Area 1, removal of the stockpiles to the previously certified grade surface will be followed by HPGe measurements to demonstrate that primary ASCOCs have been returned to their certified levels.

### 4.3.2 Special Considerations

Special considerations for Excavation Approach C are summarized under the following discussions of the nature and extent of contamination, radiological scanning and field measurements, and attainment of WAC.

#### Nature and Extent of Contamination

The origin of soil and material placed in the five stockpiles located in the Former Production Area (Figure 4-7) is largely unknown. Therefore, characterization and excavation activities will proceed in a systematic and controlled manner to ensure health and safety protocol is met and all materials are

identified correctly. These activities will be coordinated with D&D operations in the Former Production Area to ensure access corridors and staging areas can be developed where they are needed. Characterization activities will be carried out to generate a sample point density that is equivalent to RI/FS sample point density in the Former Production Area. Based on the characterization data, excavation may proceed layer by layer with real-time scanning of each layer for radionuclide activity and organic vapors.

Remediation Area I, Phase 1 contains two soil stockpiles (Figure 4-7) that are distinct from a characterization perspective. The eastern stockpile is derived from soil that was characterized during Area 1, Phase I activities, and it will be excavated and transported to the OSDF without further characterization. The western stockpile is primarily comprised of soil characterized during Area 1, Phase I activities and a small amount of soil that has not been characterized. Current characterization plans specify that an additional 60 soil samples be drawn from the approximately 35,000 cubic yards of material in the western stockpile to demonstrate WAC attainment. In future remediation projects, mixing of characterized and un-characterized materials will be prevented.

Radiological Scanning and Field Measurements

Radiological scanning and field measurements will be carried out using the instruments and approach summarized in Section 4.1.2, with the following exceptions. In-situ HPGe measurements may not be possible if the pile geometry (e.g., a conical form) prevents acquisition of a representative spectra. However, excavation of the stockpiles in Remediation Area 1, Phase I, to the previously certified grade surface will be confirmed by HPGe measurements of the footprints. Although RCRA listed or characteristic waste is not expected to be present in the stockpiles, monitoring for organic vapors will be conducted during excavation activities.

Attainment of WAC

WAC attainment will be demonstrated using a combination of data obtained from NaI surveys, sampling and analysis, and HPGe measurements, if possible. Scans with NaI detectors will be used on each excavation layer within the pile, if possible, or on the unit volume removed by the excavation equipment during remediation. If radiological scans indicate primary ASCOCs exceed the WAC in

zones not characterized by pre-investigation sampling and analysis, additional sampling and analysis will be performed to determine whether secondary ASCOCs exceed the WAC. When additional assurance is needed to confirm the WAC scans, discrete samples may be collected for laboratory gamma spectroscopy analysis. Use of the HPGe instrument to establish WAC attainment may not be possible because of the geometry of the stockpiles.

### 4.3.3 Excavation Details

Figure 4-6 presents the logic flow for conducting Excavation Approach C. Each of the 15 tasks identified with this type of excavation is discussed in detail or tied to details presented in Sections 3.0, 4.0, and 7.0 and/or relevant appendices. A comparison of these tasks with other excavation approaches is provided in Table 4-3.

Task 1 - Stockpile Delineation and Data Review

The current estimated areas of the soil stockpiles are shown on Figure 4-7. Additional data will be reviewed, as necessary, to determine initial characterization aspects of the soil and final area boundaries prior to removal. If future remediation activities generate additional stockpiles that are to be remediated under Excavation Approach C, they will be delineated in a similar manner.

Task 2 - Select COCs and Identify Potential Technetium-99, RCRA, and Above-WAC Areas

The ASCOC lists for Remediation Areas 1, 3, and 5 are summarized in Table 2-9. These lists are derived from RI/FS characterization data and are divided into primary and secondary ASCOCs. (Section 2.1.3.2 defines primary and secondary ASCOCs.)

Technetium-99 has not been detected in the current soil stockpiles. If pre-excavation characterization indicates technetium-99 is present above its FRL or if future stockpiles are generated which contain technetium-99, it will be excavated and segregated under this excavation approach.

The current soil stockpiles are not known to contain characteristic waste. Therefore, RCRA excavation of toxicity-characteristic waste is not expected under this excavation approach unless organic-vapor monitoring indicates the presence of potentially toxic material.

Based on the RI characterization data for uranium, there is one known area near the northeast margin of Soil Stockpile 1 with the potential to exceed established WAC levels (Figure 4-7). If pre-excavation characterization indicates the presence of soil with ASCOCs at or above the WAC here or in other stockpiles, it will be excavated and segregated under this approach.

Task 3 - Pre-Excavation Surveys and Sampling

Pre-excavation surveys and depth profile sampling (a.k.a. pre-design investigation) will follow the general protocol discussed under Task 3 in Section 4.1.3, with the addition of the specific details noted here.

Sample point density within the stockpile will be similar to the sample point density of RI/FS data in the surrounding areas. Radiological scanning will be used to identify surface areas where primary ASCOCs are above the WAC. Any such identified areas will be investigated further using geoprobe borings. Geoprobe borings will also be placed near the established perimeter of the stockpile and within the stockpile at biased and/or random locations to determine whether technetium-99, RCRA characteristic waste, or above-WAC material is present. If available, RI/FS data will also be used to determine the extent of individual ASCOCs.

Task 4 - Delineate Excavation Extent Due to Technetium-99 Contamination

The presence or absence of technetium-99 has not been established for the soil stockpiles in the Former Production Area. Therefore, sampling and analysis will be conducted to determine whether technetium-99 is present in soil stockpiles in the Former Production Area. If present above its FRL, the extent of technetium-99 excavation will be delineated as discussed under Task 4 in Section 4.1.3. There is no planned sampling and analysis for technetium-99 in the western soil stockpile in Remediation Area 1, Phase I.

Task 5 - TCLP Test and Delineate Characteristic Waste Extent

Based on current RI/FS data, characteristic waste is not present in the soil stockpiles. Therefore, TCLP tests are not planned unless organic-vapor monitoring indicates the potential for characteristic material to be present.

Task 6 - Determine Remaining Excavation Extent

Based on the RI/FS characterization data for uranium, the northeast corner of Soil Stockpile 1 has the potential to exceed established WAC levels (Figure 4-7). Pre-excavation characterization data will determine the extent of this and other potential above-WAC areas, and all soil above the WAC will be removed prior to excavation of the remaining soil. The remaining soil will be delineated as above or below the FRLs of applicable COCs.

Task 7 - Prepare Area-Specific IRDP

The area-specific IRDP will be prepared as discussed under Task 7 in Section 4.1.3.

Task 8 - Prepare Excavation Site

The excavation site will be prepared as discussed under Task 8 in Section 4.1.3.

Task 9 - Implement Run-off Control, As Needed

Run-off control will be implemented as discussed under Task 9 in Section 4.1.3.

Task 10 - Technetium-99 Driven Excavation

If soil is delineated as being above the FRL for technetium-99, it will be excavated and staged prior to packaging and shipment to an off-site disposal facility. If needed, this excavation will be carried out as discussed under Task 10 in Section 4.1.3

Task 11 - Characteristic Waste-Driven Excavation and Treatment

Based on the RI/FS data, neither TCLP tests nor excavations are planned for RCRA characteristic waste. If organic-vapor monitoring discovers materials suspected of being characteristic waste, excavation will stop and the contingency plan will be implemented to assess and characterize the suspect materials. Based on the findings of the contingency actions, if soil should be delineated as possessing the characteristic of toxicity, it will be excavated, staged, and given to the Waste Disposition Program to establish treatment and disposal options.

Task 12- Layer-Specific, Pre-Excavation, Non-Technetium-99 WAC Scan

If the pre-design characterization data indicate above-WAC material and heterogeneity in the size and types of materials in the stockpile, excavation will take place in layers. A radiological scan will be conducted on each layer or unit volume of material removed from the pile to determine whether the activities of primary ASCOCs exceed WAC before successive layers are removed. All identified above-WAC soil will be segregated for off-site disposal. Additional excavation and disposal information is provided in Sections 3.3.1.2 and 3.3.1.3.

Task 13 - Non-Technetium-99, WAC-Driven Excavation/Confirmation

If above-WAC soil is identified and removal can proceed as a bulk excavation rather than in layers, the above-WAC material will be delineated through pre-excavation surveys and/or sampling activities. All soil with ASCOCs above the WAC will be excavated and segregated to isolate the above-WAC material prior to shipment off site. Additional excavation and disposal information is provided in Sections 3.3.1.2 and 3.3.1.3.

Task 14- FRL-Driven Excavation

After the excavations to remove any soil detected with ASCOCs above the WAC, remaining soil with uranium, thorium, radium, and other potential ASCOCs above their respective FRL will be excavated and staged prior to placement in the OSDF. WAC attainment will be demonstrated using the field and laboratory analytical methods discussed in Section 4.3.2. Additional excavation and disposal information is provided in Sections 3.3.1.2 and 3.3.1.3.

Task 15 - Remediate/Certify the Footprint as Part of the Former Production Area With Excavation Approach D

After the removal of soil stockpiles in the Former Production Area, the stockpile footprints will be established and final remediation and certification will be carried out under Excavation Approach D (Section 4.4). Soil stockpiles in Remediation Area 1, Phase I, were placed on a previously certified soil surface, and after removal actions are complete, their footprints will be subjected to HPGe measurements to confirm the removal of all primary ASCOCs. No additional excavation is planned for soil underlying stockpiles in Remediation Area 1, Phase I.

## 4.4 EXCAVATION APPROACH D - EXCAVATION FOLLOWING D&D IN THE FORMER PRODUCTION AREA, STP, AND FTF

Excavation Approach D is designed to handle shallow to deep soil excavations that take place after buildings, above-grade structures, and soil stockpiles (Excavation Approach C) have been removed from the Former Production Area , the STP, and the FTF. Soil underlying buildings, structures, and stockpiles is anticipated to be affected by contaminants. The list of potential ASCOCs for proposed Excavation Approach D areas is expected to reflect the production history of process materials and RI/FS data on soil samples collected around the perimeter of buildings and structures (Table 2-9). However, the distribution of ASCOCs under the buildings, structures, and stockpiles cannot be established completely until preliminary, above-grade D&D activities in the Former Production Area, STP, and FTF are completed.

Excavation Approach D will be applied in the following remediation areas: Remediation Area 1, Phase II - soil underlying the STP on the eastern border of the FEMP; Remediation Area 3 - soil underlying the FTF; and Remediation Areas 3, 4A, 4B, 5, and 7 - soil and at- and below-grade structures and debris associated with the Former Production Area. The preliminary extent of these excavations is shown on Figure 4-9. A comparison of Excavation Approach D with other excavation approaches is provided in Table 4-3.

### 4.4.1 General Description

Excavation Approach D follows most of the general soil remediation process discussed throughout Section 3.0 and illustrated on Figures 3-1 through 3-8. It deviates from the general approach in Section 3.0 with respect to coordinating pre-excavation characterization with above-grade D&D activities and in dealing with the disposition of at- and below-grade construction debris. The remediation process will begin by conducting a data review to estimate the potential extent of the excavation using RI/FS data and to identify ASCOCs. After initial, above-grade D&D activities have removed equipment, piping, and all other ancillary materials from the buildings and structures, pre-excavation surveys and sampling activities inside the remaining structure will commence to refine the list of ASCOCs, as needed. Upon completion of the pre-excavation surveys and sampling activities, final, above-grade D&D activities will be initiated and completed. Radiological survey results and

laboratory analytical data will be forwarded to the remedial design to delineate the extent of soil excavation for technetium-99, RCRA characteristic waste, HWMUs, USTs, above-WAC, and above-FRL areas. This information will be incorporated into an IRDP and submitted to the OEPA and USEPA for approval.

After the IRDP has been approved by the OEPA and USEPA, at- and below-grade structures will be removed and staged for disposal assessment by the Waste Disposition Program. Soil excavation will begin after the structures are removed and materials delineated as technetium-99, RCRA characteristic waste, HWMU, UST, and above WAC will be segregated for treatment, if required, and disposal. Because deep soil excavations are expected below some of the buildings, excavations in these areas will proceed in layers with each layer being surveyed for WAC attainment of primary radiological ASCOCs prior to excavating the next. Additionally, because of the expected heterogeneity of contamination within the Former Production Area, real-time monitoring of the active excavation will be conducted for WAC attainment purposes. If special materials (Section 3.3.2.2) are encountered during the excavations, the materials will be handled, treated (as needed), and disposed of in accordance with the procedures outlined in the Waste Disposition Program.

Upon completion of all excavation activities, pre-certification surveys, delineation of CU boundaries, and certification sampling activities will take place as described in Section 4.1.1. Additionally, soil samples will be collected and analyzed to obtain the necessary closure data for identified HWMUs and USTs within the CUs.

### 4.4.2 Special Considerations

Special considerations that apply to Excavation Approach D are summarized under the following discussions of the nature and extent of contamination, radiological scanning and field measurements, attainment of WAC, and logistics.

#### Nature and Extent of Contamination

The diversity and concentration of ASCOCs within the Former Production Area dictates that remediation activities will progress slowly, because of additional monitoring, sampling, and analysis

and the possibility of encountering special materials and perched water. Sampling and analysis conducted prior to above-grade demolition may not be sufficient to delineate completely the excavation zones for technetium-99, RCRA characteristic waste, above-WAC soil, and above-FRL soil or to identify all areas containing special materials. When excavation zones need to be delineated further, additional sampling and analysis will need to be coordinated with removal of at- and below-grade structures or conducted during excavation. If special materials (Section 3.3.2.2) are encountered during excavation activities, additional monitoring, sampling, and analysis may be necessary to characterize the materials.

HWMUs and USTs will be excavated and closed during remediation activities carried out in the Former Production Area. Care must be taken to ensure that sampling and analysis plans will account for the HWMUs and USTs and that the needed analyte lists are submitted with samples collected for RCRA closures as well as with certification of CUs. For example, HWMUs and USTs that lie within a CU must have a minimum of four samples collected and analyzed from within their footprint. If four of the certification sample locations for the CU fall in the HWMU or UST footprint, no further samples are required for HWMU or UST closure. If four sample locations do not fall within the HWMU and UST footprint, additional random sample locations will be selected to meet the four sample criterion. When certification sample locations are used for HWMU or UST closures, the analyte list for these samples will include the COCs associated with the HWMU or UST. This analyte list may be different from the CU-specific list of COCs.

Radiological Scanning and Field Measurements

Because of access controls and limited equipment maneuverability in the Former Production Area, real-time monitoring for WAC attainment with the large-volume NaI detector will be restricted to the BTRAK or hand-held instruments. Likewise, monitoring for organic vapors will be conducted with hand-held instruments. When conducting real-time monitoring in deep excavations with the NaI detector, the geometry of the excavation and the presence of saturated conditions from perched water zones may affect the instrument reading. The real-time monitoring will be an integral part of the excavations in the Former Production Area, and the geometry of the excavations and implementation of

perched-water controls will place additional time constraints on this monitoring, which must be considered when excavation plans and schedules are developed.

Attainment of WAC

A combination of radiological surveys and field and laboratory measurements will be used to demonstrate that soil placed in the OSDF meets the WAC. Initial radiological scans will identify above-WAC zones, and additional sampling and analysis will be conducted to delineate these zones for all ASCOCs when RI/FS data are not sufficient to make the delineation. These surveys will be concentrated in zones identified as highly contaminated by RI/FS data and in areas where historical knowledge indicates process materials were spilled. However, because of the expected heterogeneous distribution of ASCOCs in the soil, surveys with NaI detectors will also be conducted on each volume unit removed during active excavation and on the excavation layer prior to removing the next lift. Where excavation takes place in zones of perched water, scanning techniques may need to be modified to obtain a reliable reading from saturated soil and/or delayed until the soil has been dried by placement in a stockpile. Above-WAC zones identified during these scans will be investigated for all ASCOCs, as needed or demonstrated by existing RI/FS and pre-excavation characterization data.

Debris associated with the removal of at- and below-grade structures will not undergo further characterization, and treatment to remove ASCOCs above the WAC will be limited to actions specified in the Operable Unit 3 ROD (DOE 1996c).

Logistics

The coordination of D&D activities with soil characterization and remediation activities in the Former Production Area poses unique challenges in the way of logistics and health and safety requirements. Coordination of scanning, sampling, and analysis activities with D&D schedules, the removal of at- and below-grade structures in limited access areas, and the implementation of excavation activities in zones of perched water must be considered in the IRDPs prepared for remediation areas in the Former Production Area.

Initial sampling activities associated with soil underlying buildings will be scheduled after removal of production equipment and ancillary materials from the buildings, if possible. It is not desirable to conduct sampling activities coincident with the removal of equipment and ancillary materials because of the increased chance for cross-contamination of samples. When possible, the sampling will precede demolition of above-grade structures to allow proper selection and bias sampling locations and to allow sample analysis and evaluation to continue while building debris is removed.

The sequencing of building demolition will be considered from the perspective of achieving a continuous, large area where at- and below-grade remediation activities can commence without interfering with above-grade D&D activities. Access controls for personnel and vehicles will be designed to minimize traffic in areas of active excavation and demolition, where deep excavations and debris piles may pose health and safety concerns. Furthermore, access to at- and below-grade structures may be limited by debris piles produced from above-grade demolition activities. The debris piles may be present for extended periods of time as material is reduced in size and sorted and staged for disposal in the OSDF. Additional holding time for the debris piles may be incurred if the placement of the debris in the OSDF is dependent on soil to fill void space and sufficient soil is unavailable.

Perched water will be encountered during deep excavations within the Former Production Area. Access limitations constrained by rubble and soil piles from on-going D&D and remediation activities will be constrained further by the need to set up a staging area for tanks to hold the perched water prior to treatment at the AWWT facility. Alternatively, if perched water is to be pumped directly to the AWWT facility from the excavation, volumes will have to be coordinated with the treatment schedule at the AWWT facility to ensure that the system can handle the additional capacity. When perched water is encountered in areas delineated for RCRA characteristic waste removal, characterization and pre-treatment of the water may be required prior to final treatment at the AWWT facility.

### 4.4.3 Excavation Details

Figure 4-8 presents the logic flow for conducting Excavation Approach D. Each of the 25 tasks identified for this type of excavation is discussed in detail or tied to details presented in Sections 3.0,

4.0, and 7.0 and/or relevant appendices. A comparison of these tasks with other excavation approaches is provided in Table 4-3.

Task 1 - Potential Excavation Area Delineation and Data Review

This task is carried out as outlined in Section 3.1.1. The preliminary excavation areas surrounding buildings and structures have been defined using available RI data for uranium and are shown on Figure 4-9. However, the final excavation area will change after the soil underlying structures and buildings are characterized for ASCOCs.

Task 2 - Select COCs and Identify Potential Technetium-99, RCRA, HWMU, UST, and Above-WAC Areas

The COC lists for Remediation Areas 1, 3, 4a, 4b, 5, and 7 are summarized in Table 2-9. These lists are derived from RI/FS characterization data and divided into primary and secondary ASCOCs. (Section 2.1.3.2 defines primary and secondary ASCOCs.)

Technetium-99 has been measured above the FRL in soil below Tension Support Structures 4 and 5, located in the southwest corner of Remediation Area 3; in the northeast corner of the Metal Fabrication Building, located in the northeast section of Remediation Area 4a; in the southwest corner of the area associated with the STP, and along the west end of the slurry pipeline in Remediation Area 7 (Figure 4.9).

There are three potential RCRA excavation units in Remediation Area 3 and one in Remediation Area 4b (Figure 4.9). The largest potential characteristic-waste area is associated with the decontamination pad and is located in the northeast corner of the Remediation Area 3. A second potential characteristic-waste area is located along the northern boundary of Remediation Area 3 and is associated with the KC-2 warehouse (Building 63) and west pad. The third potential characteristic-waste area is associated with the lumber storage area (Building 12C) and maintenance warehouse (Building 12D) in Remediation Area 3. A fourth potential characteristic-waste area is in Remediation Area 4b and is associated with HWMU #22 - the abandoned sump west of the Pilot Plant Excavation. All of these potential characteristic-waste areas will be dealt with under Excavation Approach D.

There are 25 HWMUs in the Former Production Area (Remediation Areas 3, 4a, 4b, and 5), 1 HWMU in Remediation Area 3 outside the production area (FTF), and 1 HWMU in Remediation Area 1 (STP). A list of the HWMUs is presented in Table 2-1. All of these HWMUs will be closed under the CERCLA/RCRA process, with most of these closures anticipated to be completed during the initial D&D activities associated with preparing the buildings and structures for demolition. Footprints remaining from these closures will be evaluated for HWMU COC distribution under this excavation approach.

There are six UST sites in the Former Production Area (Table 2-2): UST-11 and UST-13, east of Plant 1 truck dock (Remediation Area 4b); UST-12, east of Building 31A (Remediation Area 5); UST-14, buried under the south end of Plant 6 (Remediation Area 4a); UST-17, north of Building 46 (Remediation Area 5); and the kerosene tank in the tank farm area of Remediation Area 3. Footprints remaining from the removal of USTs will be evaluated for UST COC distribution under this excavation approach.

Based on the RI/FS characterization data for uranium, eight known areas within the proposed Excavation Approach D boundaries have the potential to exceed established WAC levels for uranium (Figure 4-9). These areas are as follows: northeast of Soil Stockpile 1; west of Soil Stockpile 4; northeast of Quonset Hut #1; under Tension Structure #6; north of the Ore Refinery Plant; the northeast corner of the Metals Fabrication Plant; the southwest and northwest corners of the analytical laboratory; and the southwest area associated with the STP. Additional above-WAC areas may be delineated in soil underlying buildings and structures. All identified above-WAC soil in the Former Production Area will be excavated and segregated under this approach.

Task 3 - Initial D&D Activities

Initial D&D activities anticipated to be performed prior to pre-excavation surveying and sampling include removal of equipment and associated hardware, piping, and other materials from within buildings and structures. It is desirable to perform these D&D activities prior to sampling and analysis activities to eliminate cross-contamination of samples by concurrent D&D activities. Buildings and

structures will be considered ready for pre-excavation sampling activities when their shells are ready for demolition, and such activities will be carried out prior to demolition when possible.

Task 4 - Pre-Excavation Sampling and Refine COC List, As Needed

When possible, final D&D on above-grade buildings and structures will be carried out after pre-excavation sampling activities. Pre-excavation sampling will be executed to determine whether ASCOCs are present at above-WAC and above-FRL values in soil below building floors and foundations. Sampling holes will be drilled through concrete floors and foundations to access the presence of ASCOCs in underlying soils. In general, RI/FS data will be used to determine the number of additional samples to be collected near the perimeter and center of the building foundation and in areas where process knowledge and history indicate the potential for contamination to occur. When possible and as needed, geoprobe borings will be placed prior to demolition of the above-grade structures to determine the depth of ASCOCs above-WAC and above-FRL values.

In the event geoprobe borings cannot be placed prior to demolition of the above-grade structures (e.g., geoprobe equipment cannot fit into building or structure), the pre-excavation sampling event will investigate the presence of ASCOCs in the first 6 inches of soil underlying the concrete floors and foundations. A comprehensive laboratory analysis of all ASCOCs applicable to the production area will be performed to establish the nature of contamination below the building structures. The initial ASCOC list will be modified, as needed, pending the results of the laboratory analyses. If ASCOCs are determined to be present above their respective FRL, the extent of the ASCOCs will be pursued after final D&D activities are completed (Task 8).

Task 5 - Delineate Excavation Extent Due to Technetium-99 Contamination

Delineation of the extent of soil containing technetium-99 will be carried out as described under Task 4 in Section 4.1.3.

Task 6 - TCLP Test and Delineate Characteristic Waste Extent

The extent of soil excavation needed to remove potential toxicity characteristic COCs in the RCRA soil areas identified in Task 2 will be determined by obtaining discrete samples from surface and subsurface

locations. The sampling and analysis protocol to delineate potential characteristic waste will be carried out as described under Task 5 in Section 4.1.3.

Task 7 - Determine Remaining Excavation Extent

After excavation volumes for technetium-99 and identified toxicity characteristic COCs have been delineated, the excavation volumes for non-technetium-99, above-WAC soil and soil above the FRLs for ASCOCs will be determined. If above-WAC soil is present in the eight above-WAC areas identified on Figure 4-9, the excavation area will be delineated and the center of the excavation will be determined as described under Task 6 in Section 4.1.3.

Task 8 - Final, Above-Grade D&D Activities

Following the pre-excavation sampling event, demolition of the buildings and structures will take place and the above-grade debris will be removed and staged for sizing and proper disposition. Upon completion of these activities, additional surveys and sampling may be initiated, as needed, to determine the extent of soil excavation.

Task 9 - Prepare-Specific IRDP

The area-specific IRDP will be prepared as discussed under Task 7 in Section 4.1.3.

Task 10 - Implement Run-off Control, As Needed

Run-off control will be implemented as discussed under Task 9 in Section 4.1.3.

Task 11 - Technetium-99-Driven Excavation

The technetium-99 excavations will be carried out as described under Task 10 in Section 4.1.3.

Task 12 - Characteristic Waste-Driven Excavation and Treatment

Any identified RCRA characteristic waste will be excavated as described under Task 11 in Section 4.1.3.

Task 13 - UST Excavation

The six UST sites in the Former Production Area (Table 2-2) will be excavated and removed to satisfy the relevant and appropriate regulatory requirements. If fluids and/or residue material are present in the UST, they will be sampled and analyzed prior to removal of the UST to determine appropriate handling and storage procedures as well as treatment options, if applicable. Excavation will follow the protocol for UST removal identified and discussed in Appendix F.3. After UST removal, underlying soil will be surveyed and/or sampled and analyzed to determine whether COCs have been released from the UST. If surface soil samples indicate COCs are present at or above their respective FRL, the depth of excavation will be determined by obtaining soil cores with geoprobe borings and performing surveys or sampling and analysis on the core material.

The level of effort placed in the soil survey and sample effort will be determined by the production history and knowledge of the contents of the UST, analytical information on the contents of the UST (if applicable and available), and the physical condition of the removed UST. If production records and/or analytical results indicate the UST handled hazardous materials, excavation of the remaining soil may be treated as a RCRA soil area or a HWMU.

Task 14 - Implement Perched Water Control, As Needed

If excavation activities encounter perched water, controls will be implemented as discussed under Task 12 in Section 4.2.3.

Task 15 - Real-Time, Non-Technetium-99, WAC Monitoring and Excavation

Presently, there are eight known soil areas with the potential to exceed the established WAC levels in Remediation Areas 1, 3, 4a, 4b, and 5. If analytical characterization data indicate above-WAC soil is present, the delineated above-WAC areas will undergo real-time monitoring with NaI instruments during excavation to provide added assurance that above-WAC material does not enter the OSDF (Section 4.4.2). All above-WAC soil will be shipped off site for disposal. Additional details on the approach to real-time monitoring are provided in Section 3.3.3.1.

Task 16 - FRL-Driven Bulk Excavation of the Layer

Bulk excavation of soil exceeding FRLs will proceed as discussed under Task 13 in Section 4.1.3. WAC attainment will be demonstrated for all material placed in the OSDF in the manner presented in Section 4.4.2.

Task 17 - Pre-Certification Scan

The pre-certification scan will be conducted as described under Task 14 in Section 4.1.3.

Task 18 - CU, HWMU, and UST Footprint Delineation/Classification

As part of the pre-certification survey, the excavated remediation areas will be divided into CUs, and CU footprints will be defined. Group 2 CUs will be established after Excavation Approach D has been executed. The footprint for HWMUs and USTs will be delineated and certified for closure independent of the CUs which contain them. Section 3.4.1 contains additional details on the delineation and classification of CUs, HWMUs, and USTs.

Task 19 - Evaluate Pre-Certification Scan Results

Evaluation of pre-certification data will be carried out as described under Task 16 in Section 4.1.3.

Task 20 - Hot-Spot/FRL Excavation/Confirmation

Removal of hot spots will be evaluated as described under Task 17 in Section 4.1.3, with the exception of areas where the uranium FRL is 20 ppm. In these areas, hot-spot evaluation will be conducted with the HPGe instrument, as indicated under Task 17.

Task 21 - CU/HWMU/UST-Specific Certification/Closure Sampling

The CU certification and HWMU closure will be demonstrated using the approach described under Task 20 in Section 4.2.3. UST closure will follow the protocol for HWMU closure, which is a minimum of four random samples collected within the UST footprint. Sample locations will be established with the GPS or appropriate survey system, and the random samples will be submitted for laboratory analysis for all UST COCs.

Task 22 - Certification/Recertification

Certification and closure of the CUs and HWMUs will be established as outlined under Task 21 in Section 4.2.3. Closure of the UST sites will follow the HWMU closure protocol, which specifies that the average concentration of each UST COC must be below its respective FRL.

Task 23 - Additional Hot-Spot/FRL Excavation/Confirmation

Evaluation of the need to perform further excavation will be made as described under Task 22 in Section 4.2.3. UST closure will be evaluated in a manner analogous to HWMU closure.

Task 24 - Prepare Certification Report

Preparation of the Certification Report will follow the requirements summarized under Task 23 in Section 4.2.3.

Task 25 - Area-Wide Interim Grading and Restoration

Interim grading and restoration activities are described under Task 22 in Section 4.1.3.

## 4.5 EXCAVATION APPROACH E - OFF-PROPERTY AND NONIMPACTED ON-PROPERTY AREA CERTIFICATION

Excavation Approach E is designed to handle shallow soil excavations that take place in remediation areas which require a minimal amount of excavation prior to certification. In nonimpacted areas (i.e., no known hot spots), the need for excavation is unlikely, and radiological scans may be used to forward the area directly to certification. The nature and extent of COCs in areas proposed for Excavation Approach E is generally limited to a few COCs in the top 1 foot of soil. Soil excavations for technetium-99, RCRA characteristic waste, and above-WAC material are not expected. If these types of excavations are required, the area will be addressed by Excavation Approach A.

Excavation Approach E will be applied to Remediation Areas 1 (Phase III), 8, and off-property areas having the potential for excavation (Table 4-1 and Figure 4-1). Remediation Area 1, Phase III, encompasses most of the northern perimeter of the FEMP, where most areas along the perimeter have been shown by RI/FS characterization data to be nonimpacted. In Remediation Area 8, this approach

will be applied throughout the area. Off-property areas with the potential for remediation include the active outfall line and areas adjacent to the eastern fenceline.

### 4.5.1 General Description

Excavation Approach E follows a simplified version of the soil remediation process discussed throughout Section 3.0 and illustrated on Figures 3-1 through 3-8. The process will begin by screening existing data to identify whether excavation is needed. In most cases, excavation is not expected, and the area can be forwarded to the certification process. If excavation is needed, radiological survey results and laboratory analytical data may be collected and used in the remedial design to delineate the extent of soil excavation for above-FRL areas. The certification design is incorporated into a Certification Design Letter and the pre-excavation investigation information is incorporated into an IRDP, if needed. These documents are submitted to the OEPA and USEPA for review, and if an IRDP is submitted, it will be approved by the OEPA and USEPA. After the necessary reviews and/or approvals have been obtained from OEPA and USEPA, certification activities will begin along with any limited soil excavation which needs to take place. Soil delineated as above FRLs will be excavated and placed in the OSDF. Upon completion of excavation in above-FRL areas, a pre-certification survey and certification sampling activities will commence, as discussed in Section 4.1.1.

### 4.5.2 Special Considerations

Special considerations for Excavation Approach E are summarized under the following discussions of the nature and extent of contamination, radiological scanning and field measurements, and attainment of WAC.

#### Nature and Extent of Contamination

Concentrations of ASCOCs in the northern corridor associated with Remediation Area 1, Phase III, and Remediation Area 8 are expected to below established FRLs, and these areas are expected to be moved into the certification process without the need for excavation. If RI/FS data indicate the potential for contamination above established FRLs, pre-excavation surveys, HPGe measurements, and/or limited sampling and analysis will be conducted to delineate potential above-FRL zones. If the pre-excavation

survey indicates the potential for above-WAC soil, the area will be remediated under Excavation Approach A.

Radiological Scanning and Field Measurements

Radiological scanning and HPGe measurements will be performed primarily as a pre-certification activity to prepare the area for certification. Scanning with NaI detectors will be performed with the RTRAK when possible. However, trees and riparian vegetation along Paddys Run in Remediation Area 8 pose some constraints on the implementation of radiological surveys and sampling activities if minimal impact to environmental habitat is desired. Radiological scanning will be conducted with the BTRAK or hand-held instruments, and 100 percent coverage might not be attained because of physical restrictions. Certification of CUs along Paddys Run will require discrete samples, as HPGe measurements may not be reliable in these vegetated areas. Additionally, the collection of discrete samples may not be entirely random if a large tree covers a sample location.

Attainment of WAC

WAC attainment will not be relevant to most areas remediated under Excavation Approach E, as remediation will move immediately to certification without excavation. When excavation is needed to remove soil above established FRLs, WAC attainment will be demonstrated for primary ASCOCs which have WAC, using scans conducted with NaI detectors and/or HPGe measurements. RI/FS data and pre-excavation data (if collected) will be used to demonstrate that excavated soil placed in the OSDF has met the WAC for secondary ASCOCs.

### 4.5.3 Excavation Details

Figure 4-10 presents the logic flow for conducting Excavation Approach E. Each of the 16 tasks is discussed in detail or tied to details presented in Sections 3.0, 4.0, and 7.0 and/or relevant appendices. A comparison of these tasks with other excavation approaches is provided in Table 4-3.

Task 1 - Potential Excavation Area Delineation and Data Review

This task is carried out as outlined in Section 3.1.1. Based on the RI/FS data, the only potential excavation areas are within the northern corridor of Remediation Area 1, Phase III, designated as

Excavation Approach A/E on Figure 4-1. Excavation in Remediation Area 8 is not anticipated based on historic knowledge and RI/FS data. Radiological surveys and certification sampling activities will be conducted to confirm this preliminary decision.

Task 2 - Select COCs and Identify Potential Above-FRL Areas

The ASCOC lists for Remediation Areas 1 and 8 are summarized in Table 2-9. These lists are derived from RI/FS characterization data and divided into primary and secondary ASCOCs. (Section 2.1.3.2 defines primary and secondary ASCOCs.) Note that there are no secondary ASCOCs established for Remediation Area 8.

Based on the RI/FS characterization data, the only known area within the proposed Excavation Approach E boundaries with the potential to exceed established FRL levels is Remediation Area 1, Phase III. Remediation Area 1, Phase III, could potentially contain soil above WAC levels in areas along the FEMP perimeter that are designated Excavation Approach A/E (Figure 4-1). If such areas are detected, they will be remediated under Excavation Approach A.

Task 3 - Pre-Excavation Surveys and Sampling

Pre-excavation surveys and surface-soil sampling (a.k.a. pre-design investigation) will be conducted, as needed, using field and laboratory analytical techniques identified in Section 3.1.2. Activities will be carried out as indicated under Task 3 in Section 4.1.3.

Task 4 - Determine Excavation Extent

If excavation of above-FRL material is needed, excavation volumes will be defined by RI/FS data and pre-excavation survey and/or sampling results that indicate ASCOCs are present above their respective FRL. Excavation Approach E will not deal with contamination present below the depth of 12 inches or with soil having ASCOCs above established WAC values. Therefore, the presence of ASCOCs above their respective FRL at depths greater than 12 inches or above their WAC will result in the area being remediated under Excavation Approach A. Soil with ASCOCs above their respective FRL but which meets the WAC will be excavated and disposed of in the OSDF.

Task 5 - Prepare Area-Specific IRDP

If needed, an area-specific IRDP (i.e., a remedial design) will be prepared as discussed under Task 7 in Section 4.1.3.

Task 6 - CU Delineation/Classification

For most of the area designated for remediation under Excavation Approach E, the remediation areas will be divided into CUs without prior excavation. The CUs established in areas designated as Excavation Approach E will be Group 2 CUs (500 ft by 500 ft). Group 2 CUs are designated for Excavation Approach E because little to no contamination is expected in these areas. Section 3.4.1 contains additional details on the delineation and classification of CUs.

Task 7 - Implement Run-off Control, As Needed

Where excavation is required, run-off control will be implemented as discussed under Task 9 in Section 4.1.3.

Task 8- FRL-Driven Excavation

In the limited areas where it is identified, soil with ASCOCs above their respective FRL will be excavated and staged prior to placement in the OSDF. RI/FS and pre-excavation characterization data will be used to demonstrate that soil placed in the OSDF will meet the WAC. Section 3.3.4.1 provides additional details on demonstrating WAC attainment.

Task 9 - Pre-Certification Scan

Most areas will progress to a pre-certification scan without requiring excavation. Areas that have been excavated will be pre-certified as discussed under Task 14 in Section 4.1.3.

Task 10 - Evaluate Pre-Certification Scan Results

Evaluation of pre-certification results will follow the discussion under Task 16 in Section 4.1.3.

Task 11 - Hot-Spot/FRL Excavation/Confirmation

Hot-spots are not expected in areas remediated under Excavation Approach E, but a hot-spot evaluation will be carried out according to the protocol described under Task 17 in Section 4.1.3.

Task 12 - CU-Specific Certification Sampling

Certification sampling will be performed as discussed under Task 18 in Section 4.1.3.

Task 13- Certification/Recertification

Certification will be evaluated as discussed under Task 19 in Section 4.1.3.

Task 14 - Additional Hot-Spot/FRL Excavation/Confirmation

Hot spots are not expected in areas remediated under Excavation Approach E. However, additional hot-spot evaluation will be carried out as discussed under Task 20 in Section 4.1.3.

Task 15 - Prepare Certification Report

A Certification Report will be prepared for each remediation area as described under Task 21 in Section 4.1.3.

Task 16 - Area-Wide Interim Grading and Restoration

Interim grading and restoration activities will be carried out as described under Task 22 in Section 4.1.3.

## 4.6 EXCAVATION APPROACH F - NON-HDPE PIPELINE EXCAVATION OUTSIDE THE FORMER PRODUCTION AREA

Excavation Approach F is designed to handle non-HDPE pipeline excavations outside the Former Production Area. HDPE pipelines associated with the aquifer restoration activities and the AWWT will be left in place as part of the post-closure monitoring system in case that prolonged groundwater extraction is required. Excavation depths using this approach may be moderate to deep. The list of potential ASCOCs in areas proposed for Excavation Approach F is expected to reflect RI/FS data for the soils in the vicinity of the pipelines and process knowledge of materials handled by the pipelines.

However, the distribution of ASCOCs under the pipelines will not be established until the pipelines are removed.

Excavation Approach F will be applied to the pipeline associated with the STP. The STP pipeline is located in Remediation Area 1, Phase II, and off site, extending from the Former Production Area to the STP and off site to the Great Miami River. Additional non-HDPE pipelines may be delineated upon completion of Excavation Approaches A through E.

### 4.6.1 General Description

Excavation Approach F will be implemented in Remediation Area 1, Phase II, after Excavation Approach A has been completed. The approach is modified slightly from the general soil remediation process discussed throughout Section 3.0 and illustrated on Figures 3-1 through 3-8. The process will begin by conducting a pre-design investigation to delineate the extent of the STP pipeline, identify potential ASCOCs, and perform pre-excavation surveys and sampling activities as needed. Radiological survey results and laboratory analytical data will be forwarded to the remedial design to delineate the extent of soil excavation and the removal sequencing of the pipeline sections. This information will be incorporated into an IRDP and submitted to the OEPA and EPA for approval. After the IRDP has been approved, soil excavation and removal of the pipe will begin. Upon completion of excavation and pipeline removal in sections, a pre-certification survey, CU delineation (as sections of the pipe), and certification sampling activities will commence as described in Section 4.1.1.

### 4.6.2 Special Considerations

Special considerations for Excavation Approach F are summarized under the following discussions of the nature and extent of contamination, radiological scanning and field measurements, attainment of WAC, and logistics.

#### Nature and Extent of Contamination

The nature of contamination associated with soil surrounding (primarily underlying) the STP pipeline is expected to be similar to STP COCs that are established with RI/FS data. Pre-excavation and

excavation characterization data will be needed to establish the extent of contamination surrounding the STP pipeline and any other non-HDPE pipelines remediated under this approach.

Radiological Scanning and Field Measurements

Soil above the crown of the pipe to be excavated using this Approach F is not expected to be significantly contaminated. However, in certain sections of the pipe where the pipe was under pressure and/or previous leaks are suspected, radiological scanning with NaI detectors and in-situ measurements with the HPGe instrument will also be used to confirm whether soil lying above the crown of the pipe can be staged and directly used to backfill the trench. No matter what soil will be used for backfill, backfill operation can only be conducted after completion of pipe removal and certification of residual impacted soil underlying the pipe for FRL attainment.

Real-time radiological scanning is preferred to control excavation of the potentially impacted soil underlying the pipe. However, radiological scanning with NaI detectors and in-situ measurements with the HPGe instrument at the bottom of a trench may not be feasible for some conditions encountered in the field. Open trenches may prove to be unsuitable for real-time scanning and/or HPGe measurements, because of the geometry of the excavation or because of risk to personnel entering the trench. If pre-excavation surveys indicate the potential for contamination under the pipe and if in-situ HPGe measurements within the trench cannot be performed, excavated soil from under the pipe will be staged at an on-property location and the stockpile will be assigned to Excavation Approach C for later characterization and disposition decisions. Alternatively, if scanning and HPGe measurements can be performed in the trench and widespread contamination is indicated, excavation of the impacted soil under the pipe will be conducted similar to Excavation Approach D.

Attainment of WAC

WAC attainment for ASCOCs will be demonstrated using a combination of real-time scans, field measurements, and analytical data obtained on discrete samples. Real-time, gross-gamma scans and HPGe measurements will be performed on the excavation surfaces in the trench to demonstrate WAC attainment for primary ASCOCs, if possible. When the trench geometry, perched water, and/or health and safety considerations prohibit the use of real-time scans and in-situ HPGe measurements, the

potentially contaminated soil underlying the pipe will be excavated and isolated in a stockpile on FEMP property. The stockpile will be remediated under Excavation Approach C to determine characterization and disposition decisions. WAC attainment for secondary ASCOCs, if applicable, will be determined by analytical data collected on discrete samples during pre-excavation sampling activities.

Logistics

Excavation of non-HDPE pipelines outside the Former Production Area will require consideration of off-site property access, real-time monitoring limitations, perched-water controls, and handling and staging of pipeline and impacted soil. Right-of-way ownership and private property access will need to be obtained when the STP pipeline between the FEMP and Great Miami River is removed, and construction permits for off-site excavation may be required. Adequate planning must be developed in the IRDP to ensure all necessary access routes and permits are obtained prior to initiating off-site excavation activities.

Real-time monitoring may be limited by the geometry of the trench and the presence of perched water and/or by health and safety considerations. Contingency plans will be developed in the IRDP that describe the actions needed when real-time monitoring cannot be conducted. These actions may include moving the characterization and disposal decisions to a different excavation approach similar to Approach D.

The handling and staging of pipeline and soil off site may pose additional constraints on the remediation. Soil characterized as below established FRLs will be staged in proximal areas to use as backfill after the CU (i.e., a section of the trench) has been certified. However, if product material is in the pipeline or soil has been excavated without the ability to conduct an in-situ scan or HPGe measurement, different excavation and staging scenarios will apply. Contingency plans for these site-specific scenarios will be developed and addressed in the IRDP.

### 4.6.3 Excavation Details

Figure 4-12 presents the logic flow for conducting Excavation Approach F. Each of the 25 tasks is discussed in detail or tied to details presented in Sections 3.0, 4.0, and 7.0 and/or relevant appendices. A comparison of these tasks with other excavation approaches is given in Table 4-3.

Task 1 - Pipeline Section Delineation and Data Review

The potential pipeline excavation areas will be delineated using final construction plans with additional delineation provided where RI/FS data are available (Figure 4-13). However, additional pipeline excavation areas may be delineated upon completion of Excavation Approaches A through E.

Task 2 - Select COCs and Identify Potential Above-WAC Areas

The ASCOC list for Remediation Area 1, Phase II, is summarized in Table 2-9. These lists are derived from RI characterization data and divided into primary and secondary ASCOCs. (Section 2.1.3.2 defines primary and secondary ASCOCs.)

Based on the RI/FS characterization data, there are no known areas within the proposed Excavation Approach F boundaries with the potential to exceed established WAC levels. However, soil surrounding and underlying the pipelines could potentially contain ASCOCs above WAC levels. If such soil exists, it will be excavated and segregated under this approach.

Task 3 - Pre-Excavation Surveys and Sampling

The pre-excavation survey and sampling will be carried out as discussed under Task 3 in Section 4.1.3, with the following noted exceptions. Because pipeline excavation in Area 1, Phase II property will take place after Excavation Approach A has been implemented, surface soil above the pipeline will be below the FRL values established for the ASCOCs, and additional sampling of surface soil is not anticipated.

Furthermore, surface surveys and/or sampling may need to be conducted for the pipeline extending from the STP to the Great Miami River. If sampling is implemented, a nominal grid width of 50 ft will be centered along the length of the pipeline to develop an initial zone of investigation that is 25 ft on each side of the pipeline. After establishing the grid, geoprobe borings will be placed on the

established perimeter of the grid and within the estimated excavation area between the surface projection of the pipeline and grid perimeter to determine the depth of excavation. Section 3.1.3 provides additional details on establishing the excavation boundaries.

Task 4 - Determine Excavation Extent and Pipeline Section Sequence

Excavation volumes will be defined by using soil cores returned from geoprobe borings and surveying and/or sampling the cores to define the depth where ASCOCs are above their respective FRL. The presence of soil with ASCOCs at or above the WAC will result in delineation of a WAC excavation volume. Soil with ASCOCs at or above their respective FRL that meets the WAC will be delineated as a FRL excavation. Sample collection and handling procedures, laboratory protocols and methods, and instrument detection limits are presented in the QAPP (Appendix E).

In general, previous excavation completed in the Former Production Area is likely to have exposed the pipeline at the margin of the Former Production Area. Therefore, the pipeline section sequence for excavation is proposed to begin at the margin of the Former Production Area and proceed outward. The proposed excavation sequence for the pipeline associated with the STP is to initially remove the on-site pipeline followed by removal of the off-site portion of the pipeline.

Task 5 - Prepare Area-Specific IRDP

An area-specific IRDP will be prepared as described under Task 7 in Section 4.1.3.

Task 6 - Prepare Excavation Site

Prior to excavation, a number of institutional and constructional measures will be implemented to control access to the area and to prevent the spread of contaminated soil. Because pipeline excavation within the boundary of the FEMP will be conducted after all other excavation is complete, grubbing and disposal of cleared shrubs and trees will not be an issue. However, these latter preparation activities may apply to excavation of the off-site pipeline that runs from the STP to the Great Miami River. When off-site grubbing and clearing must be conducted, all needed permits and access controls must be obtained, and the action will be implemented in a manner that minimizes the impact to the environment. Section 3.3.1.1 and Appendix F.2 further discuss site preparation activities.

Task 7 - Implement Run-Off Control, As Needed

Run-off control will be implemented on the FEMP site in the manner discussed under Task 9 in Section 4.1.3. Special considerations for run-off controls in off-site areas will be evaluated on a site-specific basis in the IRDP.

Task 8 - Implement Perched Water Control, As Needed

If excavation activities encounter perched water on the FEMP property, the protocol discussed under Task 12 in Section 4.2.3 will be executed. If perched water is encountered during off-site excavation activities, the water will be pumped and stored until a disposition decision can be reached. Sampling and analysis will be necessary to determine whether the water can be discharged to the surface or whether it needs to be treated prior to discharge. Specific sampling and analysis plans will be developed on a case-by-case basis in the IRDP.

Task 9 - Excavate to Crown of Pipeline and Set Soil Aside as Clean

Because pipeline excavation within the boundary of the FEMP will take place after Excavation Approach A has been implemented, surface soil excavated to the crown of the pipeline will be below the FRL values established for the COCs. Similar conditions are expected to exist for the off-site pipeline leading from the STP to the Great Miami River. Clean soil will be excavated and segregated prior to excavation of contaminated soil. In the event surface soil above the off-site pipeline has areas where ASCOCs are above their respective FRL, the contaminated soil will be excavated and segregated from clean soil.

Task 10 - Remove Section of Pipeline and Cap Ends

Pipeline sections outside the Former Production Area but within the FEMP boundary will be removed first. If holding material is present in the pipeline, it will be drained and managed with the pipeline as summarized in Appendix F. The length of section to be removed will be tied to the nominal dimensions of the CU adjacent to the pipeline (i.e., 250 ft or 500 ft) or the length of the entire pipeline, whichever is shorter. After the pipeline is exposed by excavating the surrounding soil and staging the

soil into appropriate clean or contaminated piles, a section of the pipeline will be removed and the open end will be capped, if applicable.

If pre-excavation surveys and/or sampling indicate the potential for soil to exceed the WAC and if scanning instrumentation can enter the trench, a WAC scan of the soil under the removed section of pipeline will be conducted to delineate the excavation area (Task 11). However, if access to the trench is restricted and a WAC scan cannot be performed, bulk excavation will proceed without the WAC scan (Task 14) and the soil will be remediated under Excavation Approach C to determine the disposal option.

Task 11 - WAC Scan of Soil Below the Pipeline

When access to the trench is possible, soil below the pipeline will be surveyed to establish whether above-WAC material is present. If above-WAC soil is detected, additional WAC scans will be conducted during excavation and/or geoprobe borings will be placed to determine the depth of WAC material, as needed. In the absence of finding any above-WAC soil, bulk excavation of the remaining impacted soil will proceed (Task 13).

Task 12 - WAC-Driven Excavation/Confirmation

After the extent of above-WAC soil has been delineated, excavation will resume to remove the identified volume of above-WAC material. Soil above the WAC will be excavated, segregated, and contained to prevent contamination of below-WAC areas.

Task 13 - Bulk Excavation of Remaining Impacted Soil

Following the removal of soil above the WAC, if applicable, any remaining soil containing ASCOCs above the FRLs will be excavated and staged prior to placement in the OSDF. RI/FS data and pre-excavation scans and characterization data will be used to demonstrate WAC attainment. Section 3.3.4.1 provides additional details on demonstrating WAC attainment.

Task 14 - Bulk Excavation of Potentially Impacted Soil and Placement into a Temporary Staging Area

When access of personnel and scanning instruments to the pipeline trench is not possible, bulk excavation of impacted soil will proceed, and the soil will be remediated under Excavation Approach C prior to determining the disposal option.

Task 15 - Pre-Certification Scan to the Extent Possible

Upon completion of excavation, the site will be prepared for a pre-certification survey and/or sampling event. Based on the geometry of the excavation awaiting pre-certification, the survey and/or sampling equipment may be restricted by limited access and/or health and safety issues. The radiation survey will be conducted with NaI detectors and/or by discrete measurements with field instruments containing a HPGe, if possible. Pre-certification will be based on the residual activity of primary radioactive COCs in the soil, except in areas where primary COCs are metals or organic compounds. For these exceptions, discrete samples will be collected to supplement the pre-excavation data, as needed. Additional details on pre-certification activities are presented in Section 3.3.3.

Task 16 - CU Delineation/Classification

After the pre-certification scan, the pipeline trench will be divided into CUs. When possible, the CUs established on site will conform with surrounding CU dimensions (ideally 250 ft by 50 ft or 500 ft by 50 ft). For cases where the entire pipeline length is less than 250 ft, the CU dimensions will be adjusted accordingly. Additionally, in the event pre-excavation characterization has defined an excavation width greater than 50 ft (i.e., 25 ft on each side of the pipeline trace), the CU boundary will be extended to the designated width.

Task 17 - Evaluate Pre-Certification Scan Results

Pre-certification results will be evaluated as discussed under Task 16 in Section 4.1.3.

Task 18 - Hot-Spot/FRL Excavation/Confirmation

Evaluation of hot spots will follow the protocol described under Task 17 in Section 4.1.3.

Task 19 - CU-Specific Certification Sampling

The certification sampling will be conducted using the procedure described under Task 18 in Section 4.1.3.

Task 20 - Certification/Recertification

The criteria and statistical tests used to make the certification decision are described under Task 19 in Section 4.1.3.

Task 21 - Additional Hot-Spot/FRL Excavation/Confirmation

If certification fails and additional excavation is required, it will be carried out as indicated under Task 20 in Section 4.1.3.

Task 22 - Backfill Section with Excavated Soil Removed from Above Pipeline

After certification sample results have demonstrated that the CU is ready for certification, the trenches will be backfilled with below-FRL soil removed from above the pipeline. Interim grading and restoration will take place after the Certification Report is approved.

Task 23 - Segregate All Excavated Impacted Soil for Disposal

Soil that was staged because of the inability to conduct a WAC scan (Task 14) will be surveyed, sampled, and analyzed under Excavation Approach C prior to determining the disposal option.

Task 24 - Prepare Certification Report

The Certification Report will be prepared as described under Task 21 in Section 4.1.3.

Task 25 - Area-Wide Interim Grading and Restoration

Interim grading and restoration will be implemented as discussed under Task 22 in Section 4.1.3.

## TABLE 4-1

## EXCAVATION APPROACHES TIED TO REMEDIATION AREAS

| Excavation Approach | Remediation Areas |
|---|---|
| A: Shallow Excavation of Impacted, On-Property Area Outside the Former Production Area and Other Waste Storage/Management Areas (Figure 4-2; Section 4.1) | 1, 2, 6, and 7 (Figures 4-1 and 4-3) |
| B: Excavation in Waste Storage/Management Areas Outside the Former Production Area (Figure 4-4; Section 4.2) | 2, 3, 6, 7, LSP, and SWL (Figures 4-1 and 4-5) |
| C: Excavation of Existing Soil Stockpiles in the Former Production Area and Remediation Area 1, Phase I (Figure 4-6; Section 4.3) | 1, 3 and 5 (Figures 4-1 and 4-7) |
| D: Excavation Following D&D in the Former Production Area STP, and FTP (Figure 4-8; Section 4.4) | 3, 4a, 4b, 5, 7, FTF, and STP (Figures 4-1 and 4-9) |
| E: Off-Property and Nonimpacted, On-Property Area Certification (Figure 4-10; Section 4.5) | 1, 8, and off site areas (Figures 4-1 and 4-11) |
| F: Non-HDPE Pipeline Excavation Outside the Former Production Area (Figure 4-13; Section 4.6) | (Figures 4-1 and 4-13) |

D&D = decontamination and dismantlement
FTF = Fire Training Facility
HDPE = high-density polyethylene
LSP = Lime Sludge Ponds
STP = Sewage Treatment Plant
SWL = Solid Waste Landfill

**TABLE 4-2**

**REMEDIATION AREAS TIED TO EXCAVATION APPROACHES**

| Remediation Area | Excavation Approach |
|---|---|
| 1 (includes STP) | A, D, E, and F |
| 2 | A and B |
| 3 (includes FTF and LSP) | B, C, and D |
| 4 | D |
| 5 | C and D |
| 6 (includes SWL) | A and B |
| 7 | A, B, and D |
| 8 | E |
| 9 (off-site) | TBD |

FTF = Fire Training Facility
LSP = Lime Sludge Ponds
STP = Sewage Treatment Plant
TBD = to be determined
SWL = Solid Waste Landfill

## TABLE 4-3

## CROSS-COMPARISON OF TASKS WITHIN THE EXCAVATION APPROACHES

| Step | TASK | Excavation Approach | | | | | |
|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F |
| | Potential Excavation Area Delineation and Data Review | x | x | x | x | x | x |
| | Select COCs, Identify Potential Technetium-99, RCRA, HWMU, and Above-WAC areas | x | x | x | x | x | x |
| | Coordination with D&D Activities | | | | x | | |
| | Pre-Excavation Surveys and Sampling | x | x | x | x | x | x |
| | Delineate Excavation Extent Due to Technetium-99 Contamination | x | x | x | x | | |
| | TCLP Test and Delineate Characteristic Waste Extent | x | x | x | x | | |
| | Delineate Remaining Excavation Types | x | | | | x | |
| | Determine Excavation Extent and Vertical Intervals or Unit Volume | | x | x | x | | |
| | Determine Excavation Extent and Pipeline Section Sequence | | | | | | x |
| | Prepare Area-Specific IRDP | x | x | x | x | x | x |
| 1 | Pre-Excavation CU Delineation/Classification | | | | | x | |
| | Prepare Excavation Site | x | x | x | | | x |
| | Implement Run-off Control, as Needed | x | x | x | x | x | x |
| | Technetium-99 Driven Excavation, as Necessary | x | x | x | x | | |
| | Characteristic Waste Excavation, as Necessary | x | x | x | x | | |
| | Implement Perched Water Control, as Needed | | x | | x | | x |
| | Layer/Volume-Specific, Non-Technetium-99, WAC Scan | | x | x | | | x |
| | Non-Technetium-99, WAC-Driven, Excavation/Confirmation (Search and Remove) | x | x | x | | | x |
| | Real-Time, Non-Technetium-99, WAC Monitoring/Excavation | | | | x | | |
| | FRL-Driven Excavation (after above-WAC material is removed) | x | | | | x | |
| | Bulk Excavation to OSDF | | x | x | x | | |
| 2 | Bulk Excavation to Temporary Staging Area for Segregation | | | | | | x |
| | Pre-Certification Scan | x | x | | x | x | x |
| | Post-Excavation CU Delineation/Classification | x | x | | x | | x |
| 3 | Pre-Certification Hot-Spot/FRL Excavation/Confirmation | x | x | | x | x | x |
| | CU-Specific Certification Sampling and Scan | x | x | | x | x | x |
| | FRL/HWMU/UST Certification/Recertification | x | x | | x | x | x |
| | Additional FRL/Hot-Spot Excavation/Confirmation, As Necessary | x | x | | x | x | x |
| 4 | Prepare Area-Wide-Certification Report | x | x | | x | x | x |
| 5 | Area-Wide Interim Grading and Restoration | x | x | | x | x | x |

CU = Certification Unit
FRL = Final Remediation Level
HWMU = Hazardous Waste Management Unit
OSDF = On=Site Disposal Facility
UST = Underground Storage Tank
WAC = Waste Acceptance Criteria

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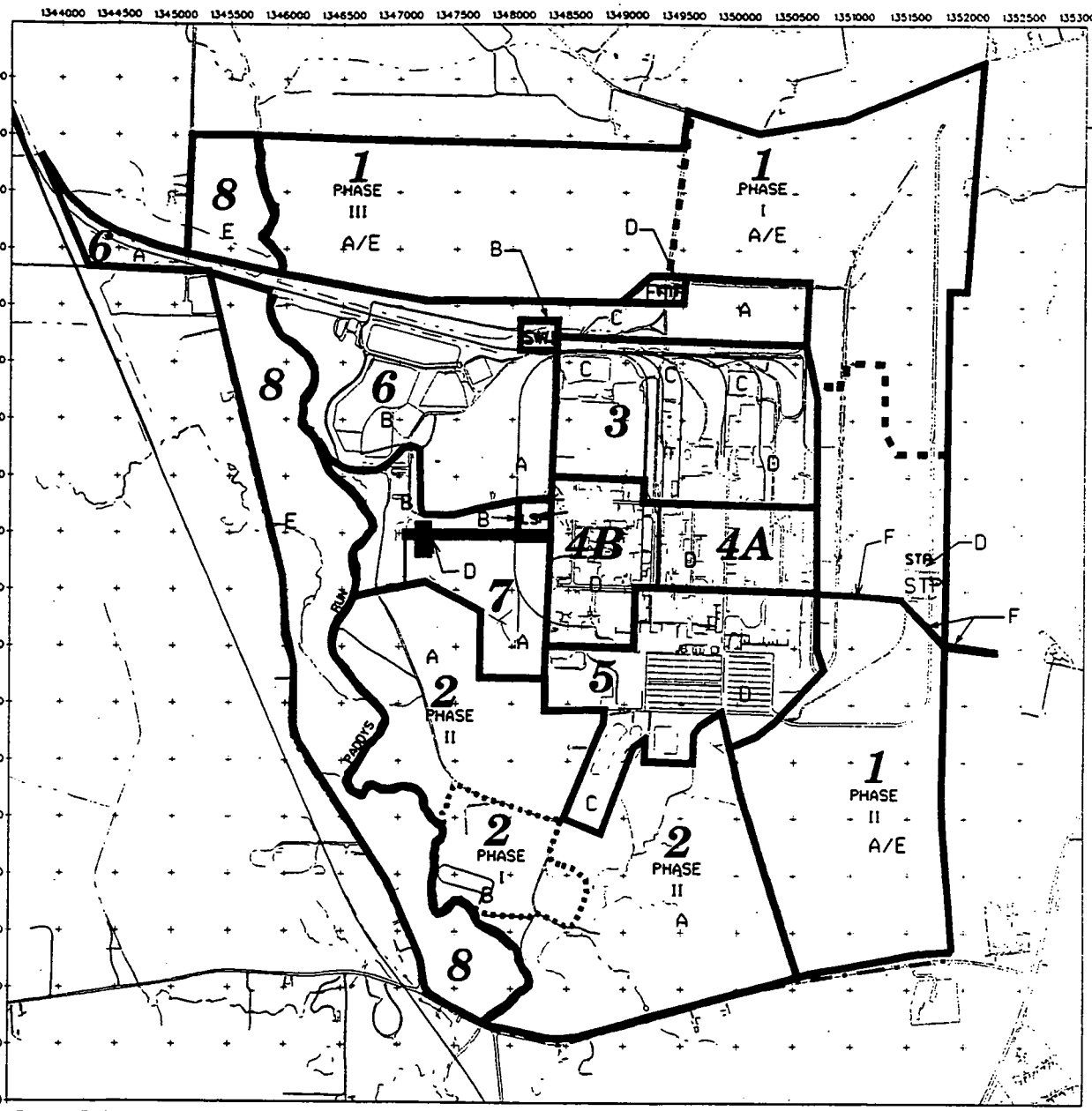


EXCAVATION APPROACH DEFINITION:

A: SHALLOW EXCAVATION OF IMPACTED ON-PROPERTY AREA OUTSIDE OF THE FORMER PRODUCTON AREA AND OTHER WASTE STORAGE/MANAGEMENT AREAS.

B: EXCAVATION IN WASTE STORAGE/MANAGEMENT AREAS OUTSIDE THE FORMER PRODUCTION AREA.

C: EXCAVATION OF EXISTING STOCKPILES IN THE FORMER PRODUCTION AREA.

D: EXCAVATION FOLLOWING D & D IN THE FORMER PRODUCTION AREA. SEWAGE TREATMENT PLANT AND THE FIRE TRAINING FACILITY.

E: OFF-PROPERTY AND NON-IMPACTED ON-PROPERTY AREA CERTIFICATION.

F: NON-HDPE PIPELINE EXCAVATION OUTSIDE THE FORMER PRODUCTION AREA.

LEGEND:

- - - - - - PHASE BOUNDARY

— · — · — FEMP BOUNDARY

——— EXCAVATION APPROACH BOUNDARY

*4b* REMEDIATION AREA

B EXCAVATION APPROACH

STATE PLANAR COORDINATE SYSTEM 1983

10-JUL-1997

000256

SCALE

1500 750 0 1500 FEET

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FIGURE 4-1.
PROPOSED EXCAVATION APPROACHES WITHIN SITEWIDE REMEDIATION AREAS

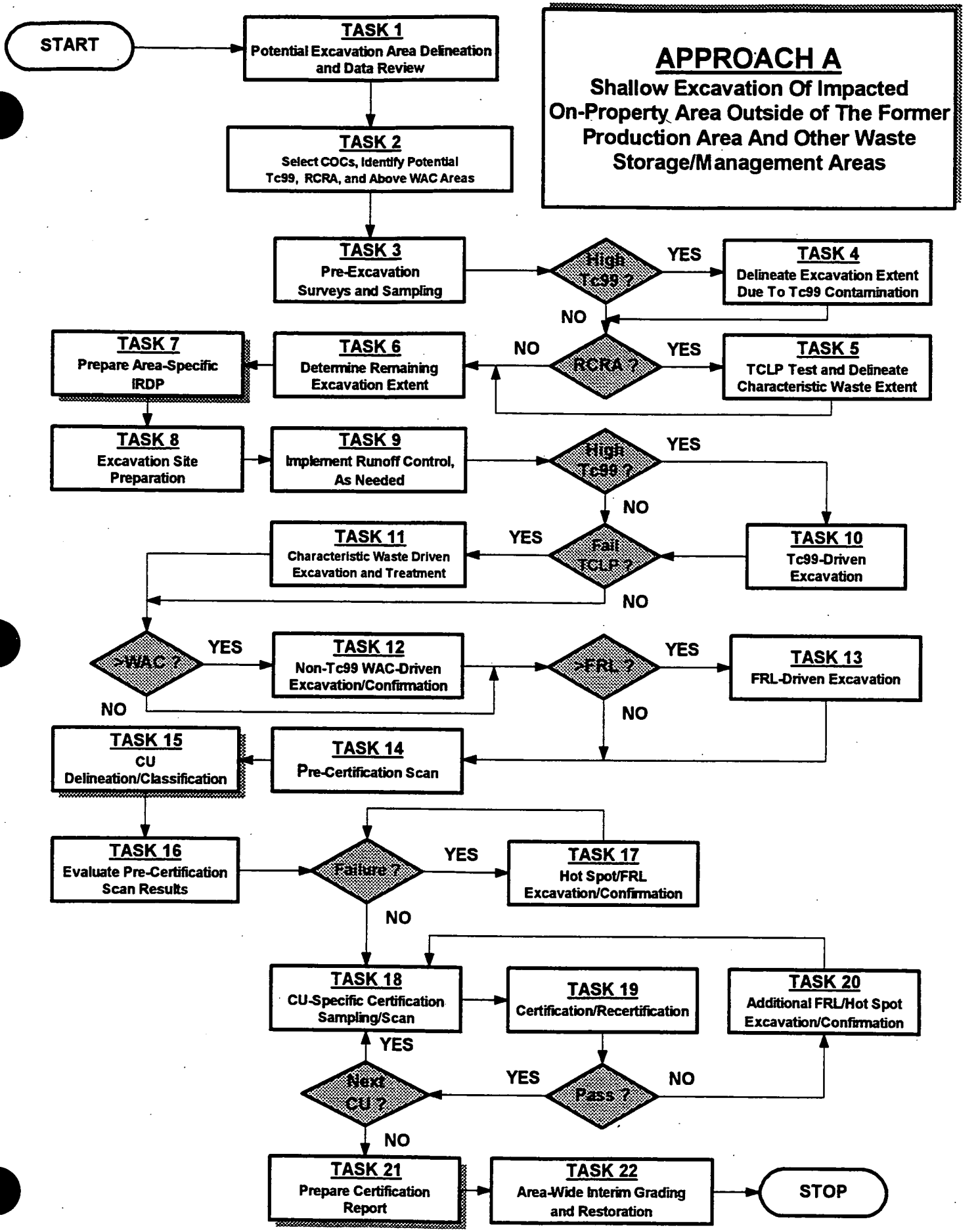
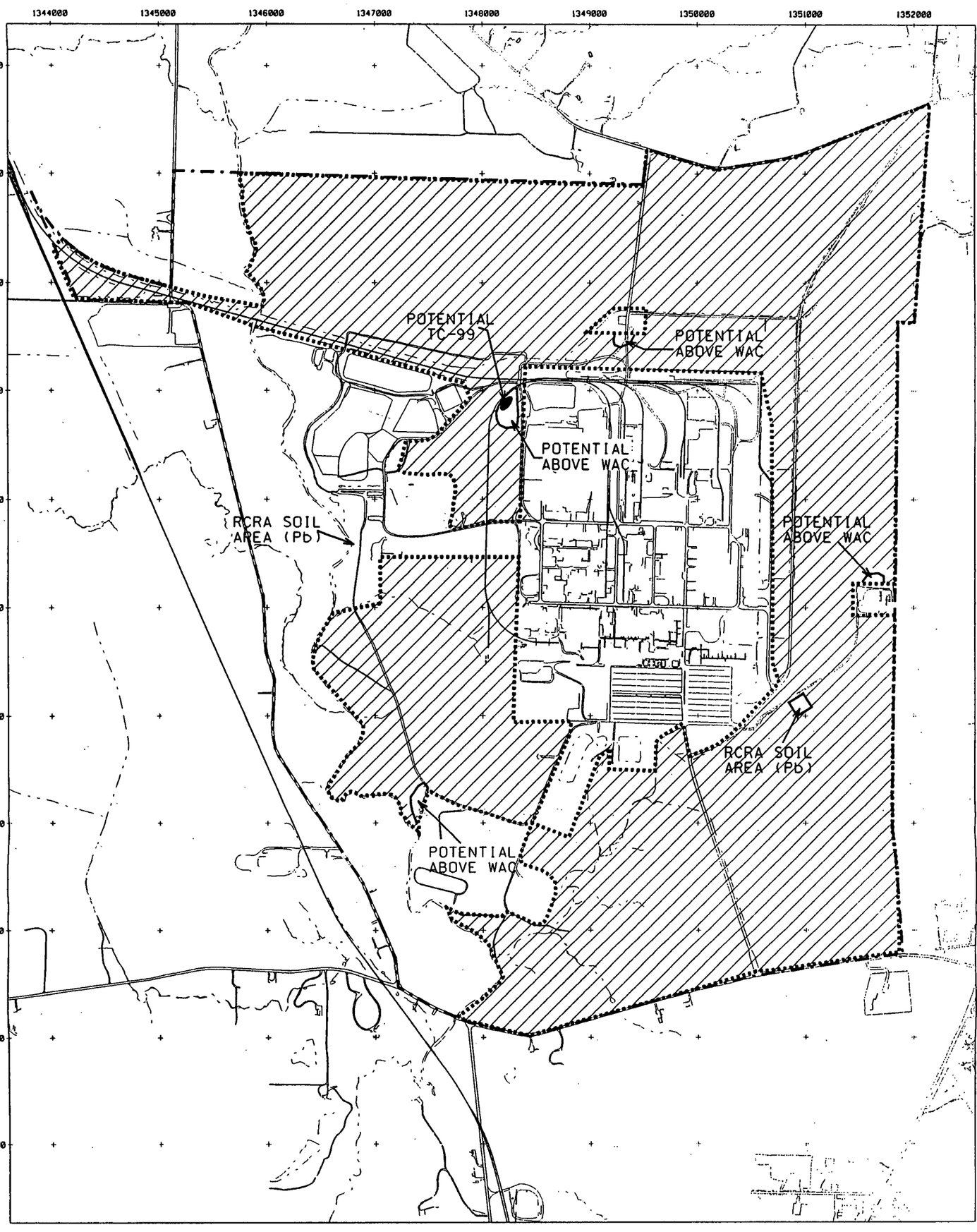



FIGURE 4-2 LOGICAL FLOW FOR EXCAVATION APPROACH A




LEGEND:

FEMP BOUNDARY

EXCAVATION APPROACH A BOUNDARY

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SCALE

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FIGURE 4-3.
ESTIMATED EXCAVATION AREAS FOR EXCAVATION APPROACH A

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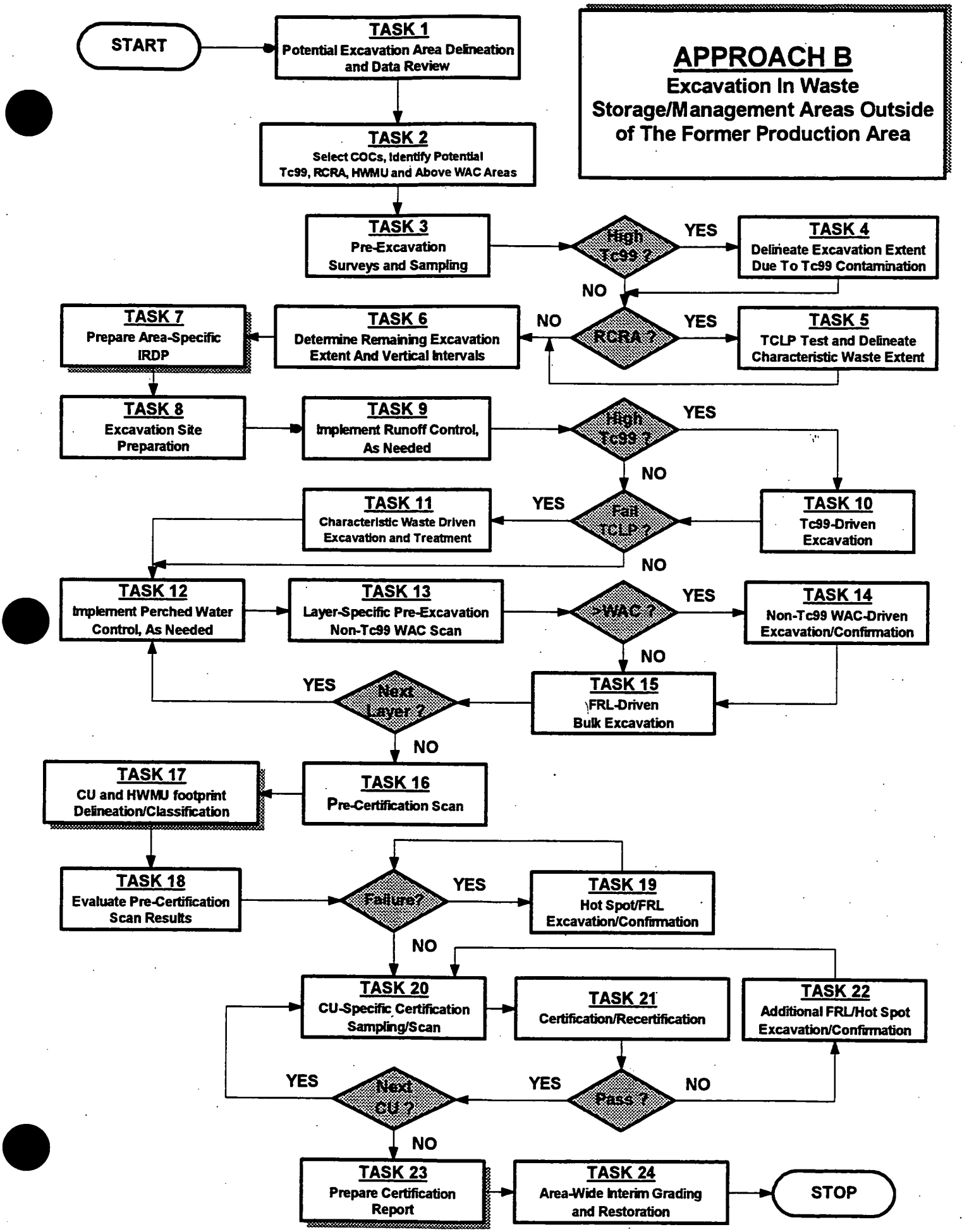
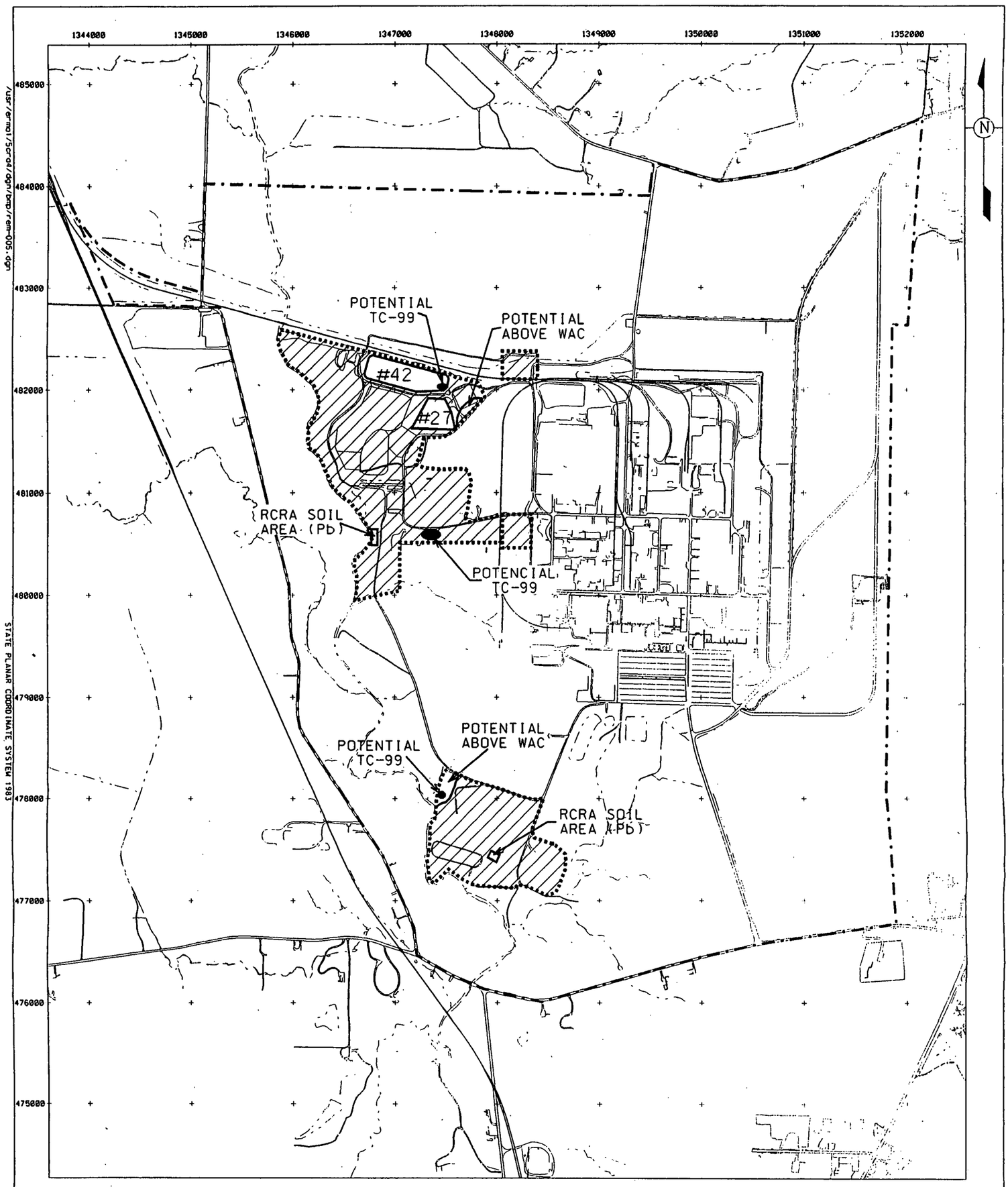



FIGURE 4-4 LOGICAL FLOW FOR EXCAVATION APPROACH B




LEGEND:

FEMP BOUNDARY

EXCAVATION APPROACH B BOUNDARY

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SCALE

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FIGURE 4-5.
ESTIMATED EXCAVATION AREAS FOR EXCAVATION APPROACH B

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925

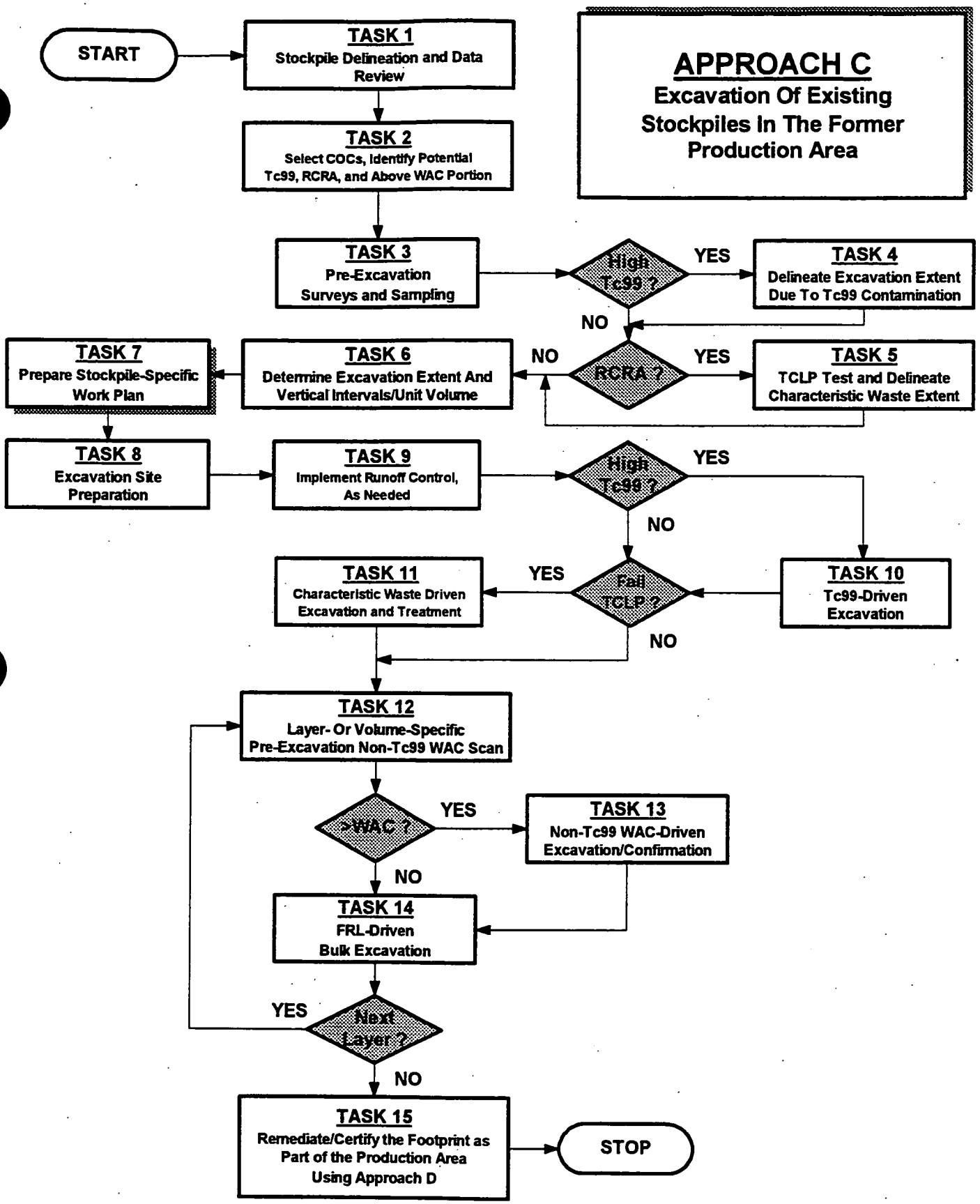
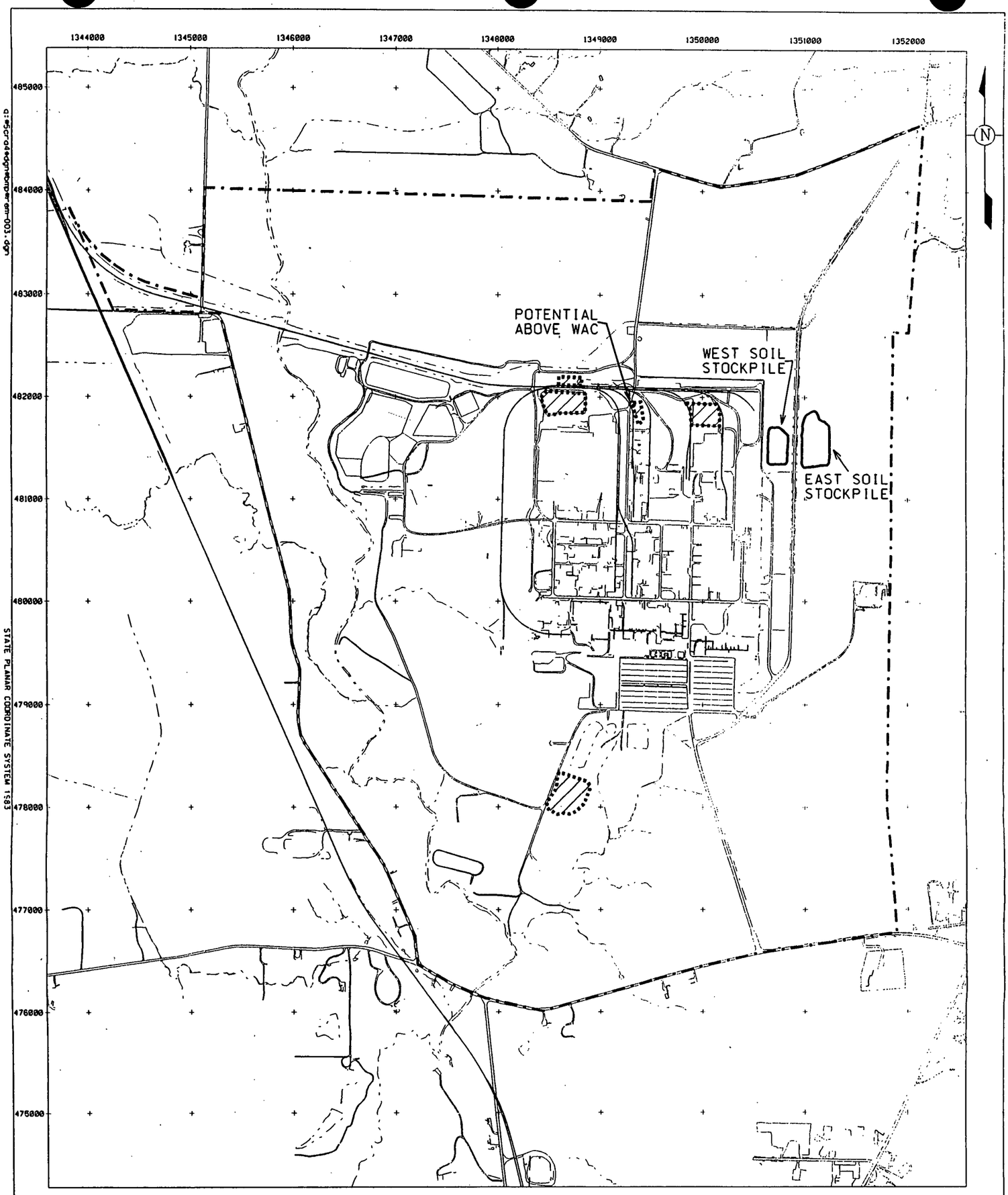



FIGURE 4-6 LOGICAL FLOW FOR EXCAVATION APPROACH C




LEGEND:

FEMP BOUNDARY

EXCAVATION APPROACH C BOUNDARY

SCALE

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STATE PLANAR COORDINATE SYSTEM 1983

10-JUL-1997

FIGURE 4-7.
ESTIMATED EXCAVATION AREAS FOR EXCAVATION APPROACH C

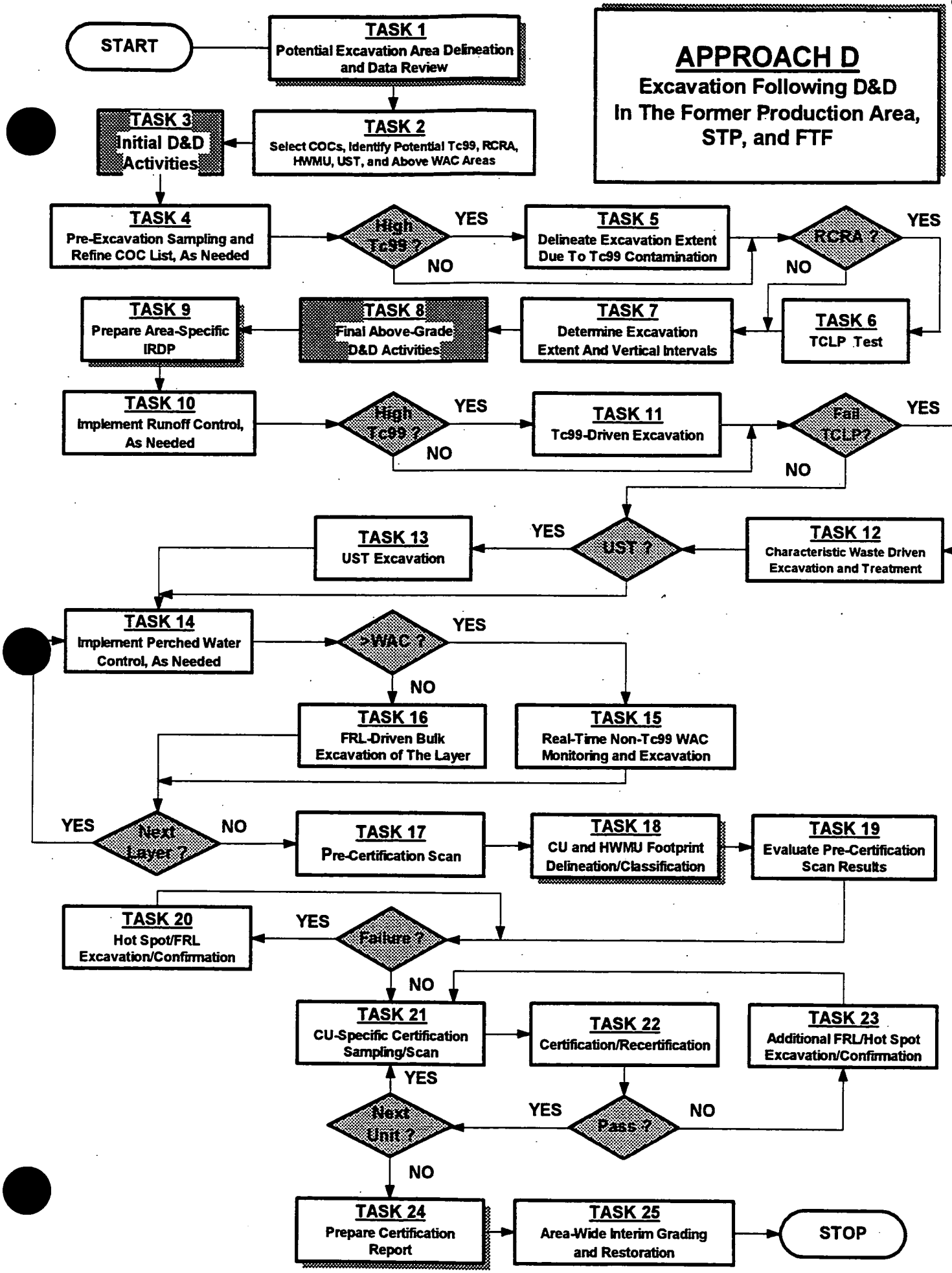
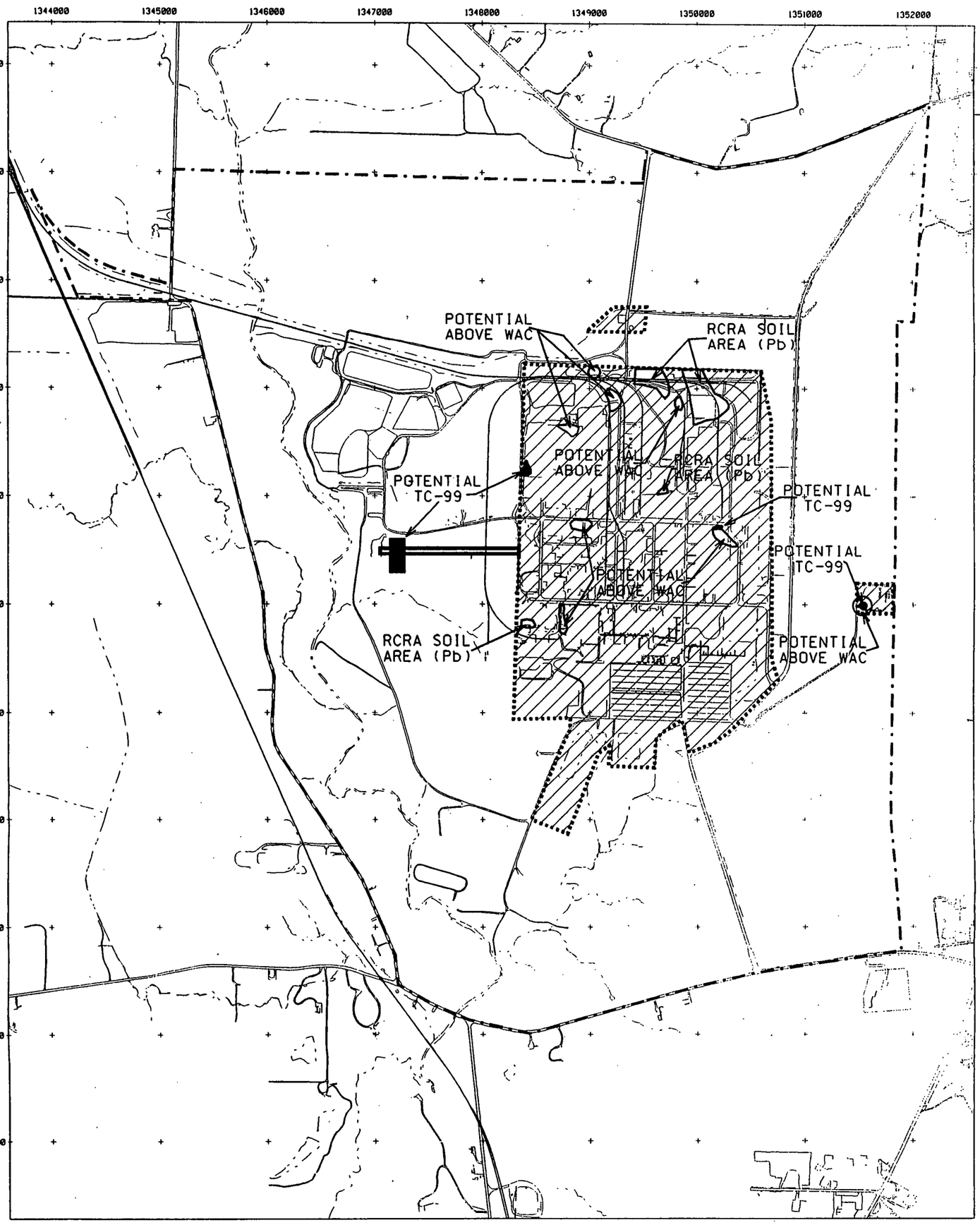



FIGURE 4-8 LOGICAL FLOW FOR EXCAVATION APPROACH D




LEGEND:

FEMP BOUNDARY

EXCAVATION APPROACH D BOUNDARY

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SCALE

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09-JUL-1997

FIGURE 4-9.
ESTIMATED EXCAVATION AREAS FOR EXCAVATION APPROACH D

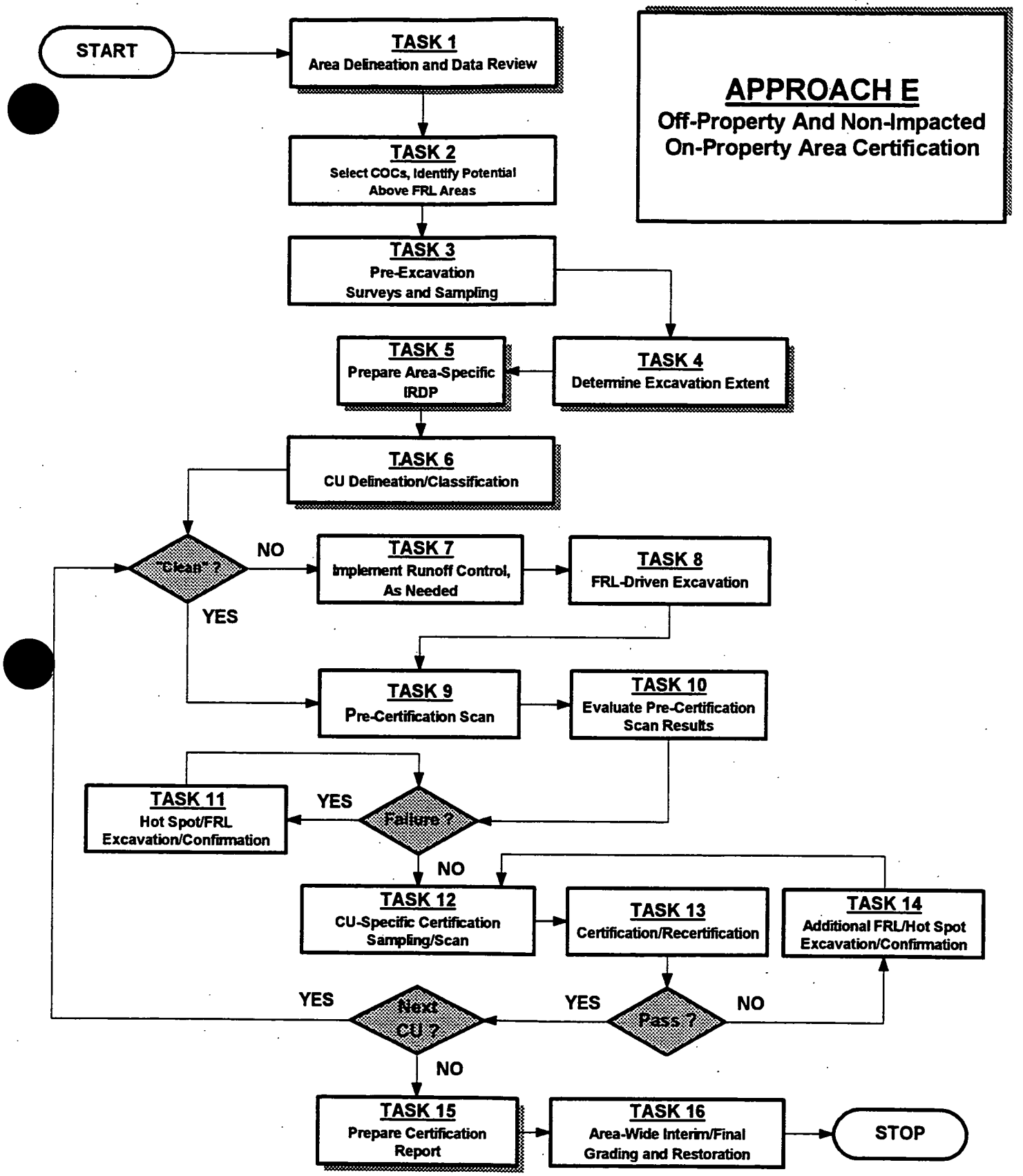
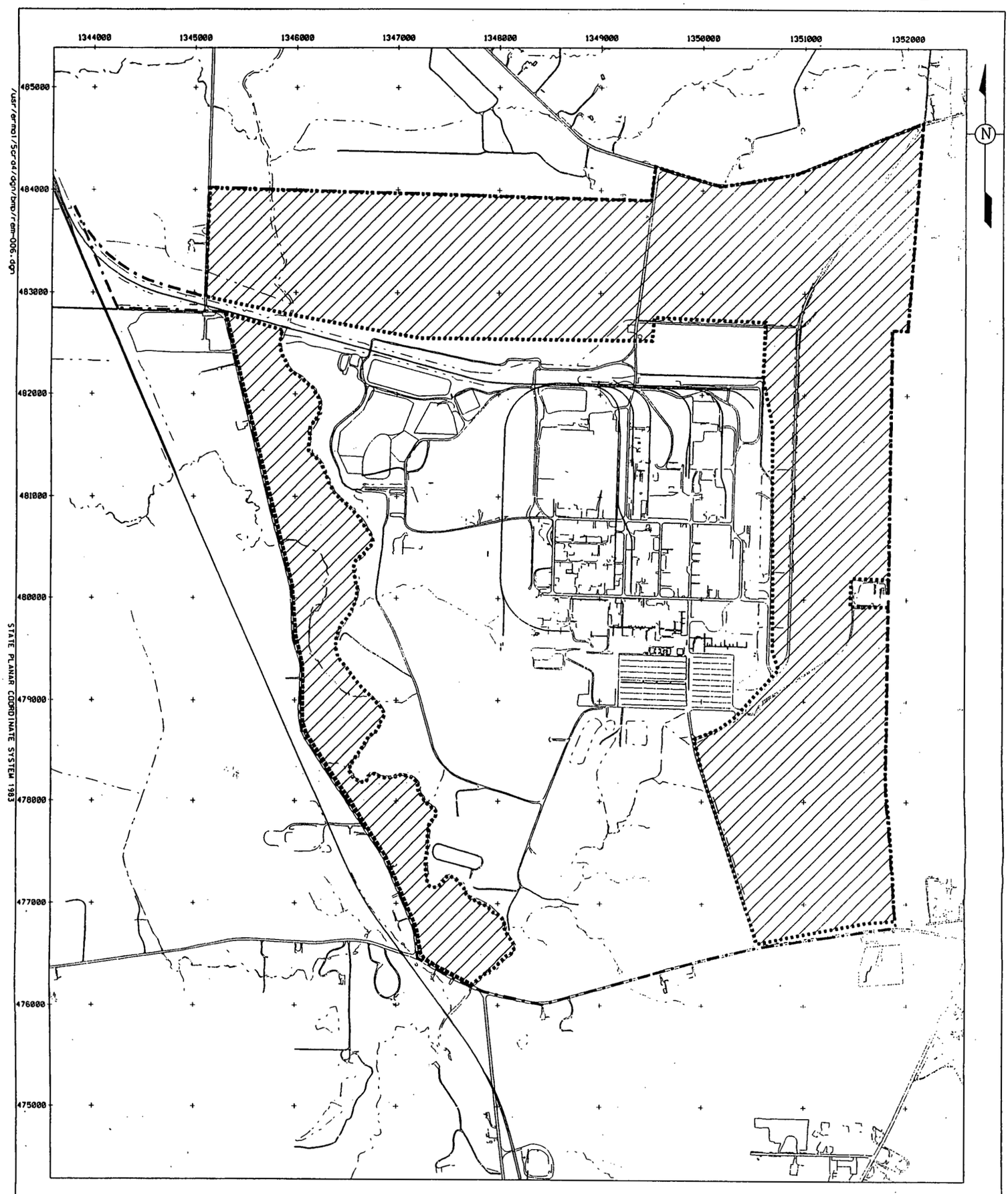



FIGURE 4-10 LOGICAL FLOW FOR EXCAVATION APPROACH E




LEGEND:

FEMP BOUNDARY

EXCAVATION APPROACH E BOUNDARY

DRAFT

SCALE

1000 500 0 1000 FEET

FIGURE 4-11.
ESTIMATED EXCAVATION AREAS FOR EXCAVATION APPROACH E



000266

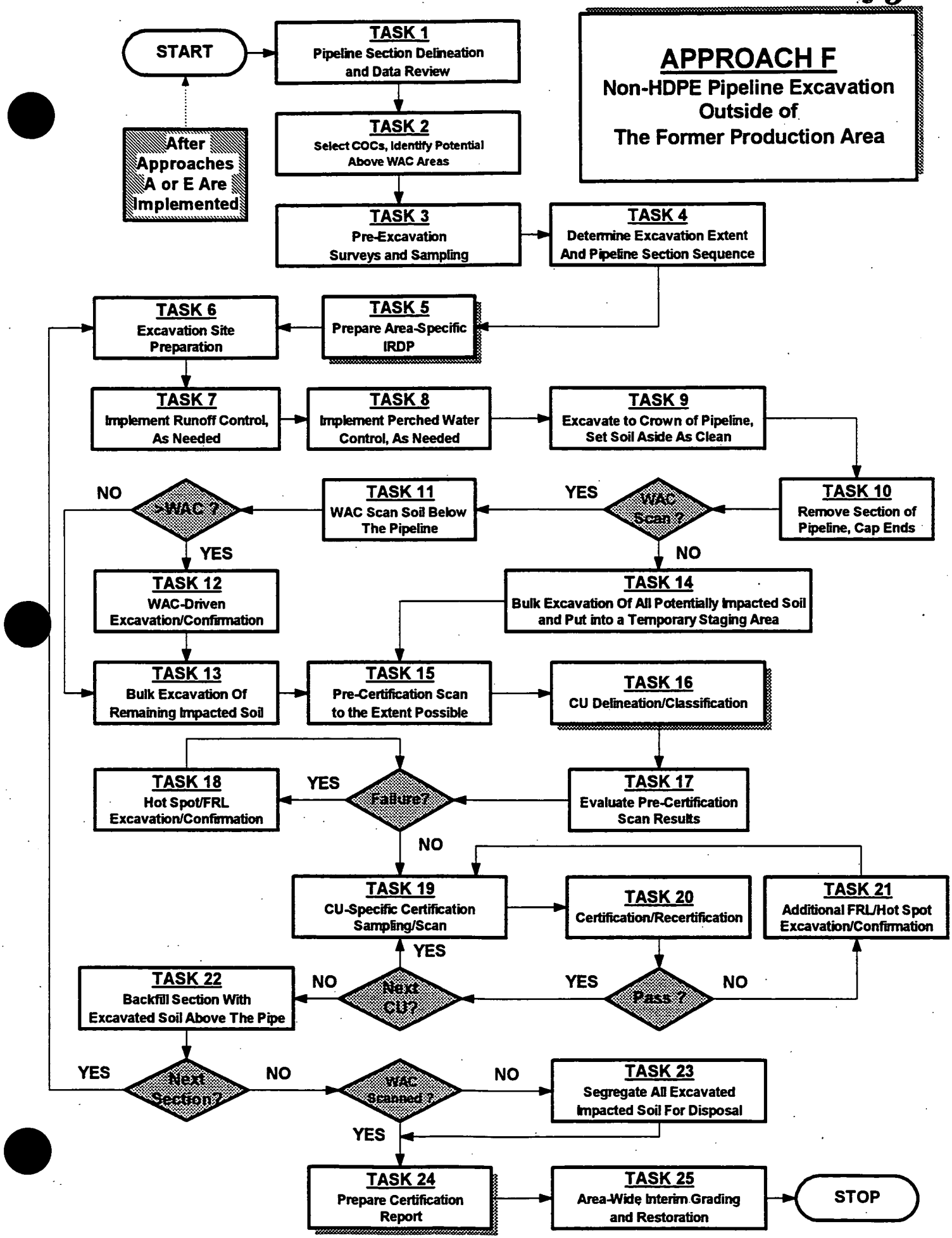
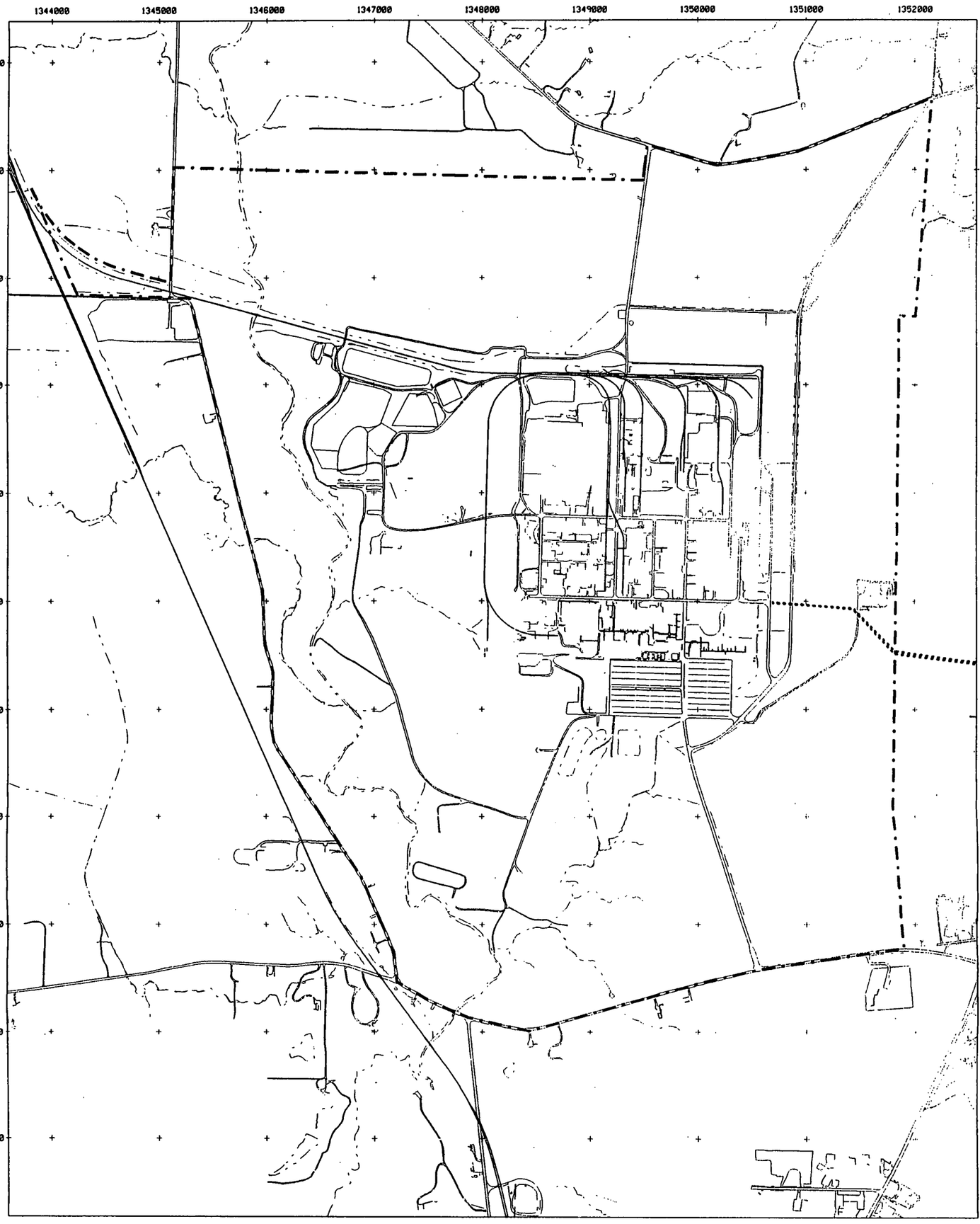



FIGURE 4-12 LOGICAL FLOW FOR EXCAVATION APPROACH F




LEGEND:

FEMP BOUNDARY

EXCAVATION APPROACH F BOUNDARY

STATE PLANAR COORDINATE SYSTEM 1983

09-JUL-1997

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SCALE

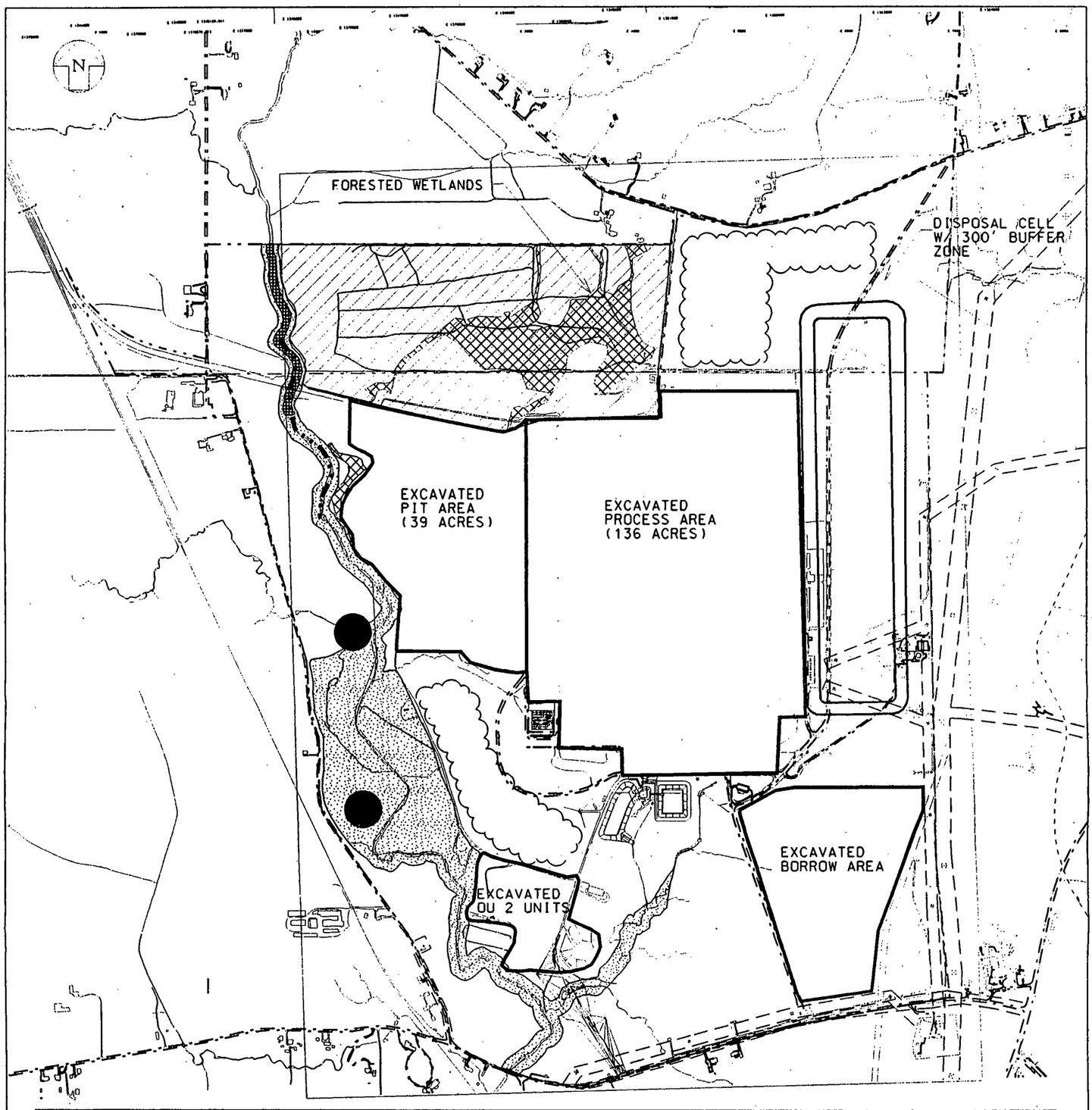
1000 500 0 1000 FEET

FIGURE 4-13.
ESTIMATED EXCAVATION AREAS FOR EXCAVATION APPROACH F



000268

FIGURE 5-2. PRIORITY NATURAL RESOURCE AREAS




| LEGEND: | ACREAGE: |
|---|---|
| RIPARIAN CORRIDOR | 78 |
| SLOAN'S CRAYFISH AREA | 2 |
| INDIANA BROWN BAT HABITAT | 3 |
| WETLANDS | 36 |
| NORTHERN WOODLOT AREA | 100 |
| PINES | 125 |

SUSPECT RUNNING BUFFALO CLOVER AREAS

PRELIMINARY INFORMATION ONLY CADD SERVICES

| NO. | REVISIONS | DATE | DWN. BY | APPD. | REF. DWG. NO. |
|---|---|---|---|---|---|

FORMAT REVISED 8/7/95

NOTE: FERMCO C.A.D. DRAWING NOT TO BE REVISED MANUALLY

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BY: DATE:

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FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION
FERMCO
Fernald Environmental Management Project
U.S. DEPARTMENT OF ENERGY

REG. 2785
DATE 11-8-95
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## 5.0 ENVIRONMENTAL CONTROLS AND MONITORING

In accordance with the Integrated Environmental Monitoring (IEMP) (DOE 1997a), each remediation project is responsible for the design and execution of its own monitoring activities (outside the Integrated Environmental Monitoring Plan [IEMP]) to demonstrate compliance with its respective project-specific environmental-emission-control applicable or relevant and appropriate requirements (ARARs) (Appendix A) and to obtain the timely feedback required to track the effectiveness of those controls and make necessary, routine "process adjustments." This section includes the management strategy for implementing project-specific environmental control mechanisms and for conducting project-specific environmental monitoring, during remediation of impacted soils at the Fernald site. Environmental control mechanisms, and monitoring and reporting requirements, are provided by pathway for natural resource impacts, air, surface water, and groundwater. This sequence follows that of Appendix A, where the pertinent environmental requirements are presented.

This section of the sitewide excavation plan (SEP) will be used as the basis for defining the specific environmental control, monitoring, and data evaluation requirements in each project-specific integrated remedial design package (IRDP). The information provided in this section addresses the approach for project-specific environmental control and monitoring, how the resulting information will be used by the project organization for "process-adjustment" decisions, and how it will be integrated with sitewide monitoring and reporting requirements, based on the regulatory-driven (Appendix A) and IEMP-related monitoring and reporting programs at the site. To the extent practical (dependent on sampling frequency, analysis turnaround times, etc.), data collected under both the project-specific and sitewide monitoring programs will be reported in accordance with their associated regulatory drivers and the framework of the IEMP reporting schedule. The IEMP will provide a summary reporting link (to assist with sitewide interpretations) and a cumulative feedback function for the project-specific monitoring conducted by the individual remediation projects. It should be noted, however, that routine "process-adjustment" decisions, which will be made by the Soil Characterization and Excavation Project (SCEP) (as the Fernald Environmental Management Project's [FEMP's] lead project organization) to react and respond to project-specific operating conditions and process-control objectives, will not be reported as part of the IEMP quarterly or annual reporting cycles. Rather, these

types of routine decisions will be maintained as part of the project organization's daily operations logs and are considered to be a normal course of day-to-day practice to achieve project-specific operating objectives (Section 3.6). Figure 5-1 summarizes the FEMP sitewide and project-specific environmental monitoring and control mechanisms.

The potential need to relocate some of the then-existent sitewide environmental monitoring program's monitoring locations or stations will be evaluated during the development of project-specific IRDPs. Such anticipated relocations will be coordinated with IEMP personnel to ensure that the integrity of the sitewide environmental monitoring program is maintained. To the extent practical, those relocations will be identified in the IEMP during its annual review or biennial revision cycles. Needed relocations not known in time for these cycles will be identified in the respective IRDP and reflected in the subsequent IEMP cycle.

## 5.1 PROJECT-SPECIFIC CONTROL MECHANISMS AND MONITORING

Project-specific control mechanisms, associated monitoring, and the use of the resulting information by the project organization for "process-adjustment" decisions are presented in the following subsections. Each project-specific IRDP will utilize the control mechanisms, monitoring programs, and data evaluation programs described in this section for development of their project-specific programs, but may revise and improve the programs described herein using the "keep, stop, start" concept to take advantage of "lessons learned" during the previous phases of the soil remediation process.

### 5.1.1 Natural Resource Impacts

#### 5.1.1.1 Control Mechanisms

For soil remediation projects to be initiated under the SEP, the strategic control mechanism for natural resource impacts is fourfold:

1. Identify the unavoidable impacts to natural resources anticipated to result from remediation activities.

2. Plan and design the remediation activities to limit the anticipated natural resource impacts to those which practically cannot be avoided.

3. Monitor to document the actual extent of impacts.

4. Conduct natural resource restoration.

The first component, unavoidable impacts to natural resources, has been addressed by the Records of Decision (RODs) for Operable Units 2 and 5 (DOE 1995d, 1996d). These RODs identified the unavoidable potential natural resource impacts anticipated to occur as a result of remediation activities to be initiated under the SEP. The second component, design, is discussed briefly in the following paragraph.

Avoidance of impacts to FEMP natural resources will be controlled through design as follows. Sensitive natural resource areas have been delineated at the FEMP through a variety of field activities and through regulator and stakeholder input. These areas, termed "Priority Natural Resource Areas," encompass the Paddys Run riparian corridor; the 36-acre forested wetlands; the northern woodlots of the site; and threatened and endangered species habitat on the FEMP. These areas are illustrated in the Natural Resource Impact Monitoring Plan (briefly discussed below) and Figure 5-2. All remedial activities will be designed to avoid impacts to Priority Natural Resource Areas to the extent practicable. Each IRDP will specify access points, laydown areas, etc., outside Priority Natural Resource Areas. Potential impacts to other FEMP natural resources will be minimized through the incorporation of appropriate environmental control mechanisms as well. These are addressed in the subsequent, media-specific discussions.

The third component, monitoring, and the fourth component, restoration, are addressed briefly in the discussion in the following subsection.

5.1.1.2 Monitoring

Project-specific monitoring of natural resources under each IRDP will be conducted in accordance with the provisions of the Natural Resources Impact Monitoring Plan (a part of the IEMP). Objectives of that plan include field verification and documentation of the extent of natural resource impacts identified under the various operable unit RODs and identification of any unanticipated natural resource

impacts that may occur during remediation. As presented in Section 5.2.1 herein, natural resource monitoring data collected under the Natural Resources Impact Monitoring Plan (a part of the IEMP) will be reported within the framework of the IEMP reporting schedule. The natural resource monitoring data collected from the FEMP will be updated in the Natural Resources Restoration Plan (NRRP) as it is relevant to restoration.

### 5.1.2 Air Pathway

The strategy for assessing impacts on the air pathway from remedial activities includes monitoring activities that will satisfy requirements for noise, fugitive emissions (visible dust), airborne radiological particulate, and radon and direct radiation monitoring during excavation of impacted soils. Air pathway monitoring activities initiated under the SEP to the maximum extent possible will make use of both the existing FEMP occupational air monitoring program and the sitewide environmental monitoring program (described in Section 6.0 of the IEMP). Using existing monitoring programs will help ensure that project-specific data are of comparable quality and are beneficial in evaluating and reporting project-specific air pathway releases under the various regulatory drivers (Appendix A) associated with these monitoring programs. Administrative and engineering control techniques, in accordance with the FEMP fugitive dust control "best available technology" (BAT) determination, will be implemented during excavation activities to mitigate potential emissions of fugitive dust and airborne radiological particulate emissions.

Project-specific monitoring requirements related to noise and fugitive emissions (visible dust) are presented in the following pages. Plans for integrating project-specific air pathway monitoring data into the IEMP reporting process are described in Section 5.2.2 herein.

#### 5.1.2.1 Noise

Federal law mandates that all federal agencies, including DOE, comply with federal, state, interstate, and local laws and regulations governing the control and abatement of environmental noise. As identified in the Operable Unit 5 ROD (DOE 1996d), the Noise Control Act (42 U.S.C. 4901 et seq.) and the Noise Pollution and Abatement Act (42 U.S.C. 7641 et seq.) are the two primary federal statutes regulating noise pollution and abatement. Executive Order 12088, entitled "Federal

Compliance With Pollution Control Standards," also requires federal agencies to comply with the Noise Control Act. The implementing regulations associated with these statutes that are ARARs under the SEP (Appendix A) include the construction equipment noise standards promulgated in 40 CFR §204.1 and the transportation equipment noise standards promulgated in 40 CFR §205.1.

Control Mechanisms

Noise control and abatement will include noise control devices (mufflers) on vehicles and machinery, proper maintenance of vehicles and machinery, and also may include rescheduling time periods in which heavy equipment is used in the field. Currently, only minimal remediation activities are anticipated to be performed after sunset.

To ensure that Occupational Safety and Health Administration (OSHA) and American Conference of Governmental and Industrial Hygienists (ACGIH) noise limits are met, an administrative action level below these limits will be specified in the project-specific health and safety plans. This administrative action level will be used to assess the need for hearing protection for field personnel in the vicinity, the need for maintenance of vehicles and machinery, and the need for additional noise control and abatement.

Monitoring

Noise monitoring will be conducted to implement IRDP project-specific health and safety plans. Noise measurements will be made in the field by health and safety personnel, using health and safety protocols for noise monitoring, to assess whether administrative action levels are exceeded; the need for hearing protection; the need for maintenance of vehicles and machinery; the need for additional noise control or abatement; and compliance with Occupational Safety and Health Administration (OSHA) and American Conference of Governmental Industrial Hygienists (ACGIH) occupational noise limits.

Components of noise monitoring will include establishing remediation area-specific background levels prior to the start of excavation activities, and occasional monitoring during implementation of remedial activities. If background noise levels are within 10 dBA (decibels on the A-weighted scale) of a

pre-contemplated administrative action level (e.g., from a preceding project), then a new administrative action level may be established for a given area before remediation of that area is initiated. If the environmental noise level falls within 5 dBA of the administrative action level, health and safety personnel will contact the project field manager to begin appropriate corrective actions.

Field managers will be responsible for documenting noise monitoring in the field in accordance with the recordkeeping guidelines presented in Section 3.6 and Appendix F of the SEP and for initiating noise abatement measures.

5.1.2.2 Fugitive Emissions

Control Mechanisms

Project-specific IRDPs will be developed in accordance with the following, which has itself been developed from the "Fugitive Dust Control Sitewide Guidelines," developed in turn from the FEMP-specific determination of BAT for dust control.

Water, commercially available dust suppression agents, or other appropriate methods and work practices, will be used proactively to reasonably minimize dust generation from remediation activities. Only the amount or method necessary for dust control will be applied; excessive amounts or methods will not be applied. The application rate of water or other dust suppression agents, and frequency of application, are anticipated to vary depending on existing moisture, surface type, and other environmental conditions. Water or other dust suppression agents will be applied in sufficient quantity to prevent dust generation but limited so that they do not result in migration of the agent beyond work area boundaries, ponding, or disruption of other portions of work.

For soil hauling activities, dust control shall be by progressive increments focused on making the material to be transported unlikely to become airborne. The base mechanism is anticipated to be reliance on inherent moisture in the soil or soil-like materials, coupled with a 15-mile-per-hour (mph) speed limit during hauling. If visible dust emissions from the hauled materials occur during hauling, one or a combination of the following dust control methods are anticipated to be used:

- Change configuration of material (e.g., place less in the trucks)
- Apply water mist
- Add surfactants or other agents to the water mist
- Apply resins, crusting agents, or foams in lieu of water mist (atypical truck load bed covers)
- Reduce hauling speed
- Cover truck load bed.

Wheel-washing stations will be used at the point of origin from the soil remediation project prior to entering any defined paved or unpaved roadways. Clods, clumps, or visible deposits of soil or other materials that could readily become visible fugitive emissions from paved or treated unpaved roadways/parking areas will be promptly removed. Appropriate dust control mechanisms will be applied to reasonably minimize the generation of visible dust that may result from the removal process.

Applicable definitions, and the criteria for determining visible dust or excessive visible dust, will be as follows:

1. Definitions

   *Dust alert:* Whenever FDF gives notification to the Subcontractor that visible particulate emissions exceed six (6) minutes during any 60-minute observation period during non-work periods.

   *Paved roadway or paved parking area*: A predetermined and delineated area designed and improved specifically for vehicle traffic. Improvements to the predetermined area include the application of materials such as asphalt or cement that forms a level surface for travel.

   *Unpaved roadway or unpaved parking area*: A predetermined and delineated area designed and improved specifically for vehicle traffic. Improvements to the predetermined delineated area include the application of gravel, shredded shingles, cinders, compaction, etc.

   *Visible particulate emissions (visible dust):* Visible particulate that are generated during material handling, construction, or remediation activities, from equipment wheels or tracks, or from any tools or other equipment used. Visible particulate emissions are also those generated by wind.

   *Wind erosion*: Fugitive emissions strictly created by the wind and not by material handling, equipment, or vehicle traffic.

2. For dust control purposes, the relationship between categories, remediation activities, associated areas, dust control/work practices, and site-specific limits or Ohio standards are summarized in Table 5-1.

Remediation activities will be monitored for visible dust. Project personnel will tour the areas of remediation activities at the start of the day and periodically during the day. The number or type of dust suppression equipment in operation will not preclude stopping work if there is visible dust or excessive visible dust. Visible dust indicates the need to increase the level of dust control effort. Increasing levels of visible dust indicate a need to increase the dust control level of effort up to and including alteration of, possible slowdown of, or even temporary suspension of corresponding work activity(ies) observed to be generating the visible dust. Work activity(ies) observed to be generating the visible dust will be temporarily suspended if visible dust exceeds the corresponding site-specific limit or Ohio standard; an increase of dust controls and/or modification to work practices will be implemented to bring the fugitive emissions to, at a minimum, below the limit/standard during dust-generating activities.

Personnel will be on-call during non-work periods seven (7) days per week (including holidays) to respond to an off-hours dust alert. A "dust alert" is defined above. Pre-designated site personnel will notify pre-designated Subcontractor personnel of a dust alert; dust suppression will begin no more than three (3) hours after dust-alert notification given by the pre-designated site personnel.

As part of the Subcontractor's "Safe Work Plan," the Subcontractor will develop a "Dust Suppression Plan" to specify:

- A narrative description of how the Subcontractor field personnel will implement the "Dust Suppression Plan," how they will monitor for visible dust, how they will progressively implement increased dust control or alter work activities when required, and how they will maintain appropriate records of dust control activities.
- A listing of methods to be used to suppress dust, and the associated frequency that routine dust suppression is to take place.
- By method, the materials to be used to suppress dust — e.g., water, dust suppression agents, etc.
- By method, the specific types and quantities of equipment to be used to suppress dust.

- A description of the notification process, including designation of personnel, that the Subcontractor intends for site personnel to utilize during non-work periods to notify the Subcontractor of a "dust alert."

Monitoring

Real-time visual observation of visible dust, in accordance with the criteria described in the preceding control mechanisms discussion, will be used to assess in real time the presence of visible fugitive dust emissions and progressively implement corrective changes.

Additionally, visual monitoring in accordance with 40 CFR Part 60, Appendix A, Method 22, Visual Determination of Fugitive Emissions from Material Sources and Smoke Emission from Flares, will be conducted.

Furthermore, in accordance with the OEPA's fugitive dust control BAT determination for the FEMP, visual determination of opacity will be conducted on activities identified in the above table as project field activities and material handling/vehicle traffic on storage piles. That determination will be in accordance with 40 CFR Part 60, Appendix A, Method 9, Visual Determination of Opacity of Emissions from Stationary Sources (or an approved alternative method).

Field managers will be responsible for documenting visible emission monitoring records in the field in accordance with the recordkeeping guidelines defined in Section 3.8 and Appendix F.12 of the SEP and initiating fugitive dust abatement measures. Records of the following information for each work day (including off-hours dust-alert response, except as noted below) will be maintained for each soil remediation project:

- The date, weather conditions, and scheduled work activities (e.g., excavation, trenching, hauling, placement, compaction, loading, etc.)

- Records of opacity readings (if any) conducted that day in accordance with 40 CFR Part 60, Appendix A, Method 9, Visual Determination of Opacity of Emissions from Stationary Sources (or an approved alternative method) [NOTE: not required for off-hours dust alert responses]

- Time of dust-alert notification given to the Subcontractor, names of the individuals (FDF notified, Subcontractor employee notified, and Subcontractor dust-alert responders), and time of initiation of dust suppression activity [NOTE: required only for days when such notification occurs]

- Identification of areas (or segments) where dust control was performed

- The manner or type of dust control activity(ies) applied by area (or segment) to which applied

- Application rate of water or other dust suppression agents — at a minimum, tank truck load capacity and number of tankloads applied per area (or segment) to which applied

- Identification of the party(ies) responsible for the dust control activity by area (or segment) — at a minimum, name of the Subcontractor firm.

5.1.2.3 Airborne Radiological Particulates

Control Mechanisms

Airborne radiological particulate emissions associated with on-site excavation activities to be initiated under the SEP are anticipated to all be from fugitive emissions. Control mechanisms for fugitive emissions are presented in the preceding subsection. No additional airborne radiological particulate control mechanisms for environmental or public safety concerns are anticipated to be required as a result of remedial activities to be initiated under the SEP.

Monitoring

Airborne radiological particulate emissions associated with on-site excavation activities to be initiated under the SEP will be monitored via the sitewide airborne radiological particulate monitoring program presented in Section 6.0 of the IEMP. That program is designed to collect data representative of ambient air quality at select locations at or near potential receptors and remote background locations outside the FEMP's potential zone of impact. The monitoring network encompasses all the current and expected diffuse and point sources at the Fernald site. The data collected under the IEMP airborne radiological particulate monitoring program will be used to assess the collective effect of concurrent remediation activities at the site, including those to be initiated under the SEP, under various regulatory drivers described in Section 6.0 of the IEMP.

No supplement or modification to the sitewide airborne radiological particulate monitoring program (as briefly described above) is anticipated to be required as a result of remedial activities to be initiated under the SEP until SEP work begins in the former waste pits area. The need for supplement or modification to the then-existent IEMP airborne radiological particulate monitoring program will be evaluated during the development of the project-specific IRDP for that area. Supplement to or modification of the then existent program might be required if monitoring stations do not already exist downwind (under the prevailing wind) of the SEP remediation activities, or if the monitoring frequency and/or analyses addressed by the program do not adequately address the COCs in that particular remediation area. However, since these same issues will arise as part of the Waste Pits remedial action project that will precede the soil remediation project under this SEP, the potential need for supplement or modification triggered by SEP-initiated soil remediation activities is anticipated as very minor. If needed, such a supplement or modification would be coordinated with IEMP personnel to ensure that the integrity of the sitewide airborne radiological particulate monitoring program was maintained. To the extent practical, such a supplement or modification would be identified in the IEMP during its annual review or biennial revision cycles; if it could not be accommodated within these cycles, it would be identified in the respective IRDP and reflected in the subsequent IEMP cycle.

Furthermore, some of the airborne radiological particulate monitoring stations might need relocation to facilitate excavation activities to be initiated under the SEP. The need to relocate any of the then-existent airborne radiological particulate monitoring stations will be evaluated during the development of project-specific IRDPs; if relocation is required, it will be coordinated with IEMP personnel to ensure that the integrity of the sitewide monitoring network is maintained.

5.1.2.4 Radon

Control Mechanisms

Emission of radon from soils being remediated under the SEP is not anticipated to be an environmental or public safety concern. Hence, no control mechanisms are anticipated to be required as a result of remedial activities to be initiated under the SEP.

Monitoring

Radon emissions associated with on-site excavation activities to be initiated under the SEP will be monitored via the sitewide radon monitoring program presented in Section 6.0 of the IEMP. That program is designed to monitor environmental radon concentrations resulting from radon generating sources at the site, in addition to fulfilling the monitoring requirements imposed by the Federal Facility Agreement for Control and Abatement of Radon-222 Emissions. As remedial activities are undertaken at the Fernald site, the sitewide radon monitoring program may change to ensure proper monitoring as a result of changing work activities. No supplement to that sitewide radon monitoring program is anticipated to be required as a result of remedial activities to be initiated under the SEP.

However, some of the radon monitoring stations might need relocation to facilitate excavation activities to be initiated under the SEP. The need to relocate any of the then-existent radon monitoring stations will be evaluated during the development of project-specific IRDPs; if relocation is required, it will be coordinated with IEMP, Radiological Environmental Monitoring (REM), and Radiation Control personnel to ensure that the integrity of the sitewide monitoring network is maintained.

5.1.2.5 Direct Radiation

Control Mechanisms

No additional control mechanisms for environmental or public safety concerns are anticipated to be required as a result of remedial activities to be initiated under the SEP.

Monitoring

Environmental radiation levels associated with on-site excavation activities to be initiated under the SEP will be monitored via the sitewide environmental direct radiation monitoring program presented in Section 6.0 of the IEMP. That program is designed to collect measurements of environmental radiation levels resulting from radioactive materials stored on site. As remedial activities are undertaken at the Fernald site, the sitewide environmental direct radiation monitoring program may change to ensure proper monitoring as a result of changing work activities. No supplement to that sitewide environmental direct radiation monitoring program is anticipated to be required as a result of remedial activities to be initiated under the SEP.

However, some of the environmental direct radiation monitoring stations might need relocation to facilitate excavation activities to be initiated under the SEP. The need to relocate any of the then existent environmental direct radiation monitoring stations will be evaluated during the development of project-specific IRDPs; if relocation is required, it will be coordinated with IEMP, REM, and Radiation Control personnel to ensure that the integrity of the sitewide monitoring network is maintained.

### 5.1.3 Surface Water Pathway

Control Mechanisms

As a condition of its NPDES Permit (Ohio EPA Permit No. 1IO00004*ED), the FEMP was required to develop and implement a Storm Water Pollution Prevention Plan (SWPPP) by May 1, 1996 (DOE 1996f). The SWPPP identifies potential sources of pollution associated with industrial and construction activities that may affect storm water quality at the facility and describes the practices that will be employed to reduce pollutants within these types of discharges. The SWPPP also contains provisions on the inspection programs which are being implemented to ensure that discharges of storm water associated with industrial and construction activities comply with the requirements of the FEMP NPDES Permit and of the SWPPP.

Effective implementation of erosion control and storm water management strategies depends on addressing these issues during the design, early in the planning phase of a remediation project. The erosion control measures and storm water management strategies must be appropriate for the area of remediation activity, and must be clearly transferred from the conceptual basis to the detailed design while maintaining the constructability of the remediation activity. Inside the former production area and waste pit area drainage basin (hereinafter referred to as the "former production area drainage basin" as that term is used in the SWPPP), erosion and sediment control measures will be implemented, as appropriate, to mitigate sediment loading to the existing controlled storm sewer system. Outside the former production area drainage basin, erosion and sediment control measures will be implemented to protect downgradient areas.

Inside the former production area drainage basin (i.e., inside the former production area and waste pit area drainage basin), storm water run-off will continue to be controlled by the existing controlled storm sewer system, gravity drained to the Storm Water Retention Basin (SWRB), and under normal conditions, treated through the Advanced Wastewater Treatment (AWWT) facility. Additional erosion and sedimentation controls may be specified under project-specific IRDPs, as appropriate, to ensure that sediment loading to the existing controlled storm sewer system is minimized to the greatest extent practicable during excavation activities. It is anticipated that surface water control and treatment devices currently in place within the former production area drainage basin of the site will remain largely in place until remediation of the area has been completed; however, they will be dismantled in phases (area-by-area) during implementation of the SEP. To the extent practical, surface water discharges from the area being worked will be conveyed via pumping or other appropriate mechanism to the adjacent area where the conveyance system is still intact. Because of the finite treatment capacity available at the site, it is the intent of the FEMP to minimize storm water treatment requirements through prioritization, pollutant source isolation and excavation sequencing, and limiting duration of open excavations. Thus, in accordance with the SWPPP (DOE 1996f), once an area is certified clean, surface water run-off/storm water from that area will be diverted so that it is not routed to the SWRB or to the AWWT.

Outside the "storm water run-off controlled" former production area drainage basin, storm water from construction activity is regulated as an industrial activity (if a certain magnitude of earth-moving activities is involved). Soil remediation activities to be initiated under the SEP are a subset of construction activities. In accordance with the SWPPP under the FEMP's NPDES permit, erosion and sediment controls will be installed where appropriate to protect downgradient areas. These controls will be designed and installed as specified in individual, project-specific IRDPs to manage surface water run-off and run-on, minimize erosion, and control sedimentation in on-site surface waters such as wetlands and Paddys Run.

The grubbing and grading of various areas of the site, particularly those associated with construction of the OSDF and excavation of the Southern Waste Units (SWUs), will result in the generation of substantial quantities of downed trees and brush. Current management options include the following:

- Chip (or shred) and manage in on-site stockpiles for potential use as compost during future site restoration activities.
- Shred and land apply these materials concurrently with their generation.
- Grind stumps and roots in place, mix with soil, and dispose of in the OSDF.

In the middle case, chipped/shredded tree and brush material can be land applied in areas identified for future remediation, or in areas identified where soil excavation will not be required to achieve soil final remediation levels (FRLs), or in excavated areas which have already undergone FRLs attainment certification.

The specific strategy(ies) used to manage chipped/shredded tree and brush material from each remediation area will be identified in its corresponding IRDP; however, management of chipped/shredded material under either of the first two options (other than disposal in the OSDF) is supported by the following analysis:

- Soil FRLs. Sampling of on-site tree tissues supports the premise that land application of these materials will not adversely affect the site's ability to attain soil FRLs. Analytical data have demonstrated that the concentrations of constituents exhibited in on-site tree tissues are substantially lower than their respective soil FRLs (see Appendix D). Therefore, the biodegradation and subsequent release of constituents contained in woody tree and brush tissues during land application will not lead to an exceedance of soil FRLs in any areas of the site. Grubbed stumps will be managed as debris for disposal into the OSDF to ensure the potentially contaminated soils clinging to their roots are not introduced into the chipped/shredded tree and brush material stream.

- Storm water Quality. Because of the bio-degradation process, slight increases in loadings and observed values for conventional pollutants, such as biological oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS), pH, color, and turbidity, are likely to be associated with storm water discharges from both woodchip stockpile areas and areas in which chipped/shredded tree and brush material has been land applied. In either case, discharges from these areas are not anticipated to contribute to the eutrophication of Paddys Run, since their small volume and intermittent nature will render them innocuous when mixed with the larger volume of run-off available within Paddys Run during a typical storm event.

  Storm water discharges from woodchip stockpile and land application areas are considered industrial in nature and therefore can be managed under the terms and conditions of the existing FEMP NPDES permit, provided they occur at one of four permitted industrial storm water outfalls along Paddys Run. The current permit specifies biannual monitoring for

conventional pollutants at each outfall and, therefore, additional monitoring of run-off from woodchip stockpile and land application areas is deemed unnecessary at this time.

Also in accordance with the SWPPP under the FEMP's NPDES permit, during development of project-specific IRDPs, the need to provide treatment for storm water generated during remediation will be evaluated based upon two categories of activities:

- Shallow soil excavation or other earth-moving activities
- Deeper excavation.

The need to provide treatment is best determined through a comparison to existing conditions and whether storm water degradation is expected to occur during the period of excavation. For instance, areas with only surficial or shallow subsurface contamination may be removed in a manner such that storm water degradation would not be expected. For areas where there is considerable subsurface contamination (e.g., Operable Unit 2 Southern Waste Units), the removal of the surface soils would expose the subsurface contamination, such that storm water degradation could be expected. Thus, consistent with the SWPPP (DOE 1996f), project-specific IRDPs will designate whether treatment of storm water run-off will be provided.

During the development of each project-specific IRDP, the FEMP Drainage Area Map (Figure 2-1 of the SWPPP) will be revised to show changes in the drainage areas flowing to NPDES-permitted storm water outfalls #4003 through #4006 that result from SEP-initiated remedial activities in these areas. A revised copy of the FEMP Drainage Area Map will be submitted with each project-specific IRDP and with the annual update of the SWPPP. Revisions to the descriptions of the watershed basins currently provided in Section 4.0 of the SWPPP will be provided with the annual SWPPP update.

Monitoring

Under the SWPPP (DOE 1996f) in accordance with the FEMP's NPDES permit, an industrial activity inspection program exists for the FEMP site. It covers both the former production area drainage basin and areas outside that drainage basin. Under the FEMP's industrial activity inspection program, quarterly inspections are and will be conducted in areas draining to the site's controlled storm sewer system (former production area drainage basin) and the uncontrolled watershed basins draining through

NPDES permitted storm water outfalls *4003 through *4006 (see Figure 5-3). These industrial activity inspections include evaluation of housekeeping issues, engineering controls and practices, and material handling and management activities associated with any industrial processes located within each of these watershed basins. Industrial activity inspections are not conducted within areas that are actively being inspected under the construction activity inspection program described below. Industrial activity inspections are documented and maintained as part of the NPDES and SWPPP files at the facility. See the SWPPP for further details.

Similarly, under the SWPPP (DOE 1996f) in accordance with the FEMP's NPDES permit, a construction activity inspection program exists for the FEMP site. Under the FEMP's construction activity inspection program, weekly inspections are and will be conducted within all construction areas at the site and after any rain events totaling 0.5 inch or more of precipitation within a 24-hour period. Construction activity inspections mandated by the SWPPP are and will be conducted in all remediation areas disturbed under the IRDPs. Inspections conducted in these areas will ensure that:

- Erosion and sedimentation controls required under the approved IRDPs are in place and are well maintained.
- Work practices and housekeeping activities are conducted in a manner that reduces the potential discharge of pollutants in association with storm water discharges from disturbed areas.
- Corrective actions related to the establishment and/or maintenance of erosion and sedimentation control structures are documented and tracked to resolution.
- Excessive erosion and/or siltation to Paddys Run or other off-property waterways is not occurring as result of construction activities initiated under the IRDPs.

Construction activity inspections are documented and maintained as part of the NPDES and SWPPP files at the facility. See the SWPPP for further details.

Outside the former production area drainage basin, a project-specific Storm Water Monitoring Program will be implemented under the SEP. It is designed primarily to monitor performance of erosion and sedimentation control structures (e.g., sediment traps and basins) against their anticipated design

efficiencies; and secondarily to determine whether the run-off, or potential overflow, presents an unacceptable impact to surface water quality or presents an unacceptable cross-media impact to Great Miami Aquifer groundwater.

Sampling, analyses, and evaluation will be conducted as follows:

- Specifically designated, installed control structures will be sampled once a month, *provided* that the qualifying storm event (next bullet) occurs and that sufficient discharge occurs to collect a sample.
- Influent and effluent grab samples will be collected during storm events of a magnitude of 0.5 inch of rainfall or greater within a 24-hour period.
- At a minimum, the influent and effluent samples will be analyzed for TSS at ASL B; for the effluent, an additional volume will be collected and analyzed for dissolved-fraction total (not isotopic) uranium at ASL B.
- A trap efficiency will then be calculated from this TSS data, which will be compared to the anticipated trap efficiencies for the particular type of control structure to determine its effectiveness.
- Trap efficiency and effluent TSS will be trended to evaluate changes over time and the need for potential corrective actions.
- Effluent dissolved-fraction total uranium data will be trended to evaluate changes over time and the potential need for additional monitoring.

Project-specific IRDPs will designate:

- The control structure(s), if any, that will be sampled for this type of evaluation.
- The anticipated trap efficiency(ies) for the particular type(s) of control structures designated. (Anticipated trap efficiencies generally range from 50 to 80 percent for sediment traps, and 60 to 80 percent for sediment basins.)
- Any modifications to the evaluation frequency, rainfall event magnitude, or duration of such evaluation efforts.
- Any other modifications or qualifications, as appropriate.

If the trap efficiency of a particular control structure is less than anticipated for that type of structure, existing administrative and engineering controls specified in an IRDP will be evaluated for the watershed basin in which the control structure is located. Attempts to rectify the problem through improvements in administrative and engineering controls will be documented and tracked through the construction inspection process currently in place under the SWPPP. Improvements to administrative and engineering controls may include revisions to project-specific work and housekeeping procedures, repair or maintenance of existing control structures, minor retrofits to control structures, or the installation of additional control structures such as silt fences and checkdams.

Because uranium is the principal site contaminant and the predominant constituent of concern in the soils being remediated, it will be used as an indicator parameter. The particle-bound fraction settles either in the sediment trap or basin or settles as sediment in the surface water course. Both of these on-site surfaces will be addressed by follow-on soil remediation projects. IEMP monitoring in the surface water courses at the basin-specific NPDES permitted outfalls address site discharge concerns. Thus, the dissolved fraction is the focus of interest for this project-specific monitoring. Therefore, dissolved-fraction total uranium data will be compared to the surface water human-health-protective FRL of 530 micrograms per liter ($\mu$g/L) (Table 9-5, Operable Unit 5 ROD, DOE 1996d). If the trended measured values indicate exceedance of the FRL value, effluent monitoring for additional remediation-area-specific parameters will be initiated in the dissolved fraction at the control structure. The frequency of monitoring and the selection of specific parameters to be monitored would be determined for each remediation area on an as-needed basis and would be described and documented in a project-specific post-IRDP document. Frequency and parameter designation would be coordinated with IEMP personnel so that the same monitoring occurred downgradient at the basin-specific NPDES permitted outfall and at other points downgradient of the control structure as appropriate, under the IEMP program. Measured values for the parameters would then be evaluated against the following criteria:

Potential surface water impact:

- Do surface-water COC concentrations at the control structure exceed the surface-water FRL or BTV?

- Only if the answer to the preceding criterion is yes: Do surface water COC concentrations at the corresponding downgradient, basin-specific, NPDES-permitted storm water outfall exceed the surface-water FRL or BTV?

Potential groundwater impact:

- Do surface-water COC concentrations at the control structure exceed the concentration in the Great Miami Aquifer (GMA) in that area?

- Only if the answer to the preceding criterion is no: Do surface-water COC concentrations at the corresponding IEMP surface water course sampling point (near the point where the protective glacial overburden has been breached by unlined site drainage courses) downgradient of the control structure exceed its GMA groundwater FRL (Table 9-4, Operable Unit 5 ROD, DOE 1996d)?

These criteria, situation-dependent details, and other situation-dependent criteria, as appropriate, would be the basis for determining a future course of action. Potential project actions include the following:

- Scale up the expanded monitoring, continue the expanded monitoring as is, scale down the expanded monitoring, cease the expanded monitoring.

- Improve administrative and engineering controls, such as revisions to project-specific work and housekeeping procedures, repair or maintenance of existing control structures, minor retrofits to control structures, or the installation of additional control structures such as silt fences and checkdams.

- Modify the approach to be implemented in subsequent soil remediation projects to further minimize potential adverse impacts to the surface water pathway from soil remediation activities.

As discussed in Section 5.2.3 herein, storm water run-off from the former production area drainage basin will continue to be monitored under the IEMP to continue to fulfill the site's current NPDES and Federal Facilities Compliance Agreement (FFCA) monitoring and reporting obligations. To the extent practical (dependent on sampling frequency, analysis turnaround times, etc.), surface water monitoring data collected under the sitewide IEMP monitoring program or under project-specific IRDPs will be reported within the framework of the IEMP reporting schedule.

### 5.1.4 Groundwater Pathway

Control Mechanisms

Impacts to the Great Miami Aquifer (GMA) might occur during the excavation of soil under the SCEP. The potential for impacts to the GMA is expected to be highest when the overlying glacial till is breached or is excavated to significantly reduce the effective till thickness. Therefore, for soil remediation projects to be initiated under the SEP, the strategic control mechanism to mitigate against potential adverse impacts to the GMA is as follows:

1. Identify known or reasonably expected impacted perched water zones using existing site characterization (geotechnical, hydrogeologic, groundwater monitoring, etc.) information.

    a. For deep excavations in projects in those areas identified under 1 above, as appropriate and practicable, implement dewatering of in-situ perched water during deep excavation to control seepage into the open excavation; other project-specific controls may be implemented.

2. Pump out the water (perched water or storm water) that accumulates in the open deep excavation to limit the volume of potential infiltration through this pathway.

3. Identify known or reasonably expected areas where the overlying glacial overburden is already or will be breached, or where it will be excavated to significantly reduce the effective till thickness.

    a. Where excavation to construct sedimentation basins or run-off collection channels extends into the sands and gravels of the GMA, create an infiltration barrier (typically by placing compacted clay) in the bottom of the feature to minimize the potential for adverse impact through this pathway.

    b. For projects in those areas identified under 3 above, monitor select Type 2 GMA wells in the proximity of such projects to evaluate whether adverse impacts to the GMA occur during the soil remediation activity.

4. Identify deep excavations in projects that are to remain as a pond or lake where insufficient effective thickness of undisturbed glacial overburden will likely remain after excavation is complete.

    a. After the terminal extent of excavation has been reached (cleanup certified), create an infiltration barrier (e.g., compact existing clay or place compacted clay) in the bottom of the open excavation identified under 4 above to minimize future potential adverse impact through this pathway.

The actual mechanism(s) to be implemented will be determined by the project-specific IRDP. During the development of a project-specific IRDP, early efforts will focus on the identifications under mechanisms 1, 3, and 4 above; Aquifer Restoration Project (ARP) personnel will be informed of these projects. For projects specifically designated under mechanisms 1, 3, and 4 above, ARP personnel will provide input to SCEP project personnel during the development of project-specific IRDPs (e.g., what effective thickness of undisturbed glacial overburden is sufficiently protective of the GMA) so that the individual project will be protective of the GMA to the extent practicable. For projects specifically designated under mechanism 3 above, each project-specific IRDP will identify pre-existing (if any) Type 2 groundwater monitoring wells in proximity to and downgradient of the area to be excavated that will remain after well abandonment efforts which will be used for project-specific groundwater monitoring; where the number or placement is insufficient, additional wells will be installed for this purpose.

Project-specific IRDPs will designate:

- Whether impacted perched water zones are known or reasonably expected to exist in the project area.
- Whether dewatering (or other appropriate project controls) will be implemented during deep excavation to control seepage of perched water into the open excavation; if dewatering is to be used, then the IRDP also will estimate the pumping rate required and designate how the water will be managed (e.g., conveyed to AWWT for final treatment, or discharged to surface water courses without treatment).
- Whether water (perched water or storm water) that accumulates in the open deep excavation will be pumped out; if so, then the IRDP also will designate how the water will be managed (e.g., pretreatment, conveyed to AWWT for final treatment, or discharged to surface water courses without treatment; see discussion in preceding surface water pathway subsection).
- Whether the overlying glacial overburden in the project area is already or will be breached, or whether it will be excavated to significantly reduce the effective till thickness.

- Whether an infiltration barrier will be created in the bottom of sedimentation basins or run-off collection channels.

- Whether any Type 2 groundwater monitoring wells in the proximity of the project will be monitored; if so, then the IRDP also will identify those wells, the sampling and analysis requirements (frequency, indicator parameters, etc.), and the duration of that monitoring effort. Unless specified otherwise in an IRDP, such project-specific groundwater monitoring will cease when soil cleanup is certified for that area (those certification units).

- Whether a deep excavation is anticipated to remain open as a lake or pond; what effective thickness of undisturbed glacial overburden is sufficiently protective of the GMA; and whether an infiltration barrier will be created in the bottom of the open deep excavation after the terminal extent of excavation has been reached (cleanup certified).

Monitoring

ARP personnel will use groundwater monitoring data collected under the IEMP monitoring program to assess the potential impact of remedial activities on groundwater quality within the GMA and will assist SCEP personnel in assessing the need to conduct project-specific groundwater monitoring to supplement the IEMP groundwater monitoring.

Project-specific groundwater monitoring is briefly described above. During implementation of soil excavation, data collected from any such effort and the IEMP groundwater monitoring will be carefully scrutinized in an effort to determine whether the soil remediation activities are adversely affecting the GMA groundwater (e.g., vertical migration through the glacial overburden or as a result of surface water infiltration), or whether other conditions (migration of existing plume, groundwater remediation activities) are the likely impacting factors. The data from any such project-specific groundwater monitoring will be evaluated to spot a trend or change in trend that could indicate potential adverse impact to the GMA. Aquifer Restoration Project (ARP) personnel also will use groundwater monitoring data collected under the IEMP monitoring program to assess the potential impact of remedial activities on groundwater quality within the GMA. In the event that data from project-specific groundwater monitoring indicate a potential adverse impact, an appropriate future course of action will be evaluated and implemented considering the following:

- Is this area of the GMA already planned for groundwater remediation? If not, should it be remediated (in accordance with the criteria in the OU5 ROD, DOE 1996d)?

- If the answer to either of the above is yes: Is GMA groundwater remediation of this area already ongoing? If not, should GMA groundwater remediation for the area be re-prioritized?

- After project-specific groundwater monitoring ceases as previously determined, should monitoring of those wells be continued under the IEMP?

- What modifications, if any, can be retrofitted to that soil remediation project to mitigate the situation?

- What modifications to approach can be implemented in subsequent soil remediation projects to further minimize potential adverse impacts to the GMA from soil remediation activities?

The sitewide management strategy for monitoring groundwater during remedial activities is described in detail in Section 3.0 of the IEMP (DOE 1997a). To the extent practical (dependent on sampling frequency, analysis turnaround times, etc.), groundwater monitoring data collected under the sitewide IEMP monitoring program or under project-specific IRDPs will be reported in accordance with the framework of the IEMP reporting schedule.

## 5.2 COORDINATION WITH SITEWIDE MONITORING

The IEMP has been prepared in a manner that focuses on air, surface water, and groundwater monitoring, data evaluation, and reporting necessary to ensure protection of human health and the environment during sitewide remediation activities. The IEMP provides the central reporting mechanism to the regulators and the stakeholders for the ongoing environmental/emission control and monitoring activities at the FEMP.

The following subsections describe how the reporting of project-specific monitoring data collected under the SEP will be integrated into existing reporting programs established under the IEMP and its associated regulatory drivers. The integration of project-specific and sitewide monitoring, data evaluation, and reporting responsibilities is summarized in the following subsections.

### 5.2.1 Natural Resource Impacts

Sitewide monitoring of natural resource impacts associated with remedial activities will be conducted under the Natural Resources Impact Monitoring Plan (part of the IEMP). Descriptions of the objectives, regulatory drivers, monitoring, data evaluation, and reporting requirements for the program are provided therein. Sitewide monitoring of natural resource impacts will continue under the IEMP during remedial activities to be initiated under the SEP. Monitoring under that program will verify and document the actual extent of natural resource impacts anticipated by and identified in the record of decision for each of the various operable units and will identify any unanticipated impacts to wetlands and floodplains associated with Paddys Run and its tributaries and threatened and endangered species habitat.

To the extent practical (dependent on sampling frequency, analysis turnaround times, etc.), natural resource impact monitoring data will be reported in accordance with its associated regulatory drivers and within the framework of the IEMP reporting schedule.

### 5.2.2 Air Pathway

The sitewide air monitoring program is described in Section 6.0 of the IEMP. Descriptions of the objectives, regulatory drivers, monitoring, data evaluation, and reporting requirements for the program are provided therein. Sitewide air monitoring will continue under the IEMP during remedial activities to be initiated under the SEP. Data from this program will be used to assess the impact of air emissions from remedial activities.

To the extent practical (dependent on sampling frequency, analysis turnaround times, etc.), data collected under the sitewide air monitoring program will be reported in accordance with their associated regulatory drivers and within the framework of the IEMP reporting schedule.

### 5.2.3 Surface Water Pathway

The sitewide surface water environmental monitoring program is described in Section 4.0 of the IEMP (DOE 1997a). Descriptions of the objectives, regulatory drivers, monitoring, data evaluation, and reporting requirements for the program are provided therein. Monitoring of

surface water discharges from the former production area drainage basin in accordance with NPDES and FFCA requirements will continue under the IEMP during remedial activities to be initiated under the SEP. Data from this program, in conjunction with information from project-specific surface water monitoring discussed in Section 5.1.3 herein, will be used to assess the impact of remedial activities on Paddys Run and the Great Miami River.

To the extent practical (dependent on sampling frequency, analysis turnaround times, etc.), data collected under both the sitewide and project-specific monitoring programs will be reported in accordance with their associated regulatory drivers and within the framework of the IEMP reporting schedule.

### 5.2.4 Groundwater Pathway

The site's groundwater monitoring program is described in Section 3.0 of the IEMP. Descriptions of the objectives, regulatory drivers, monitoring, data evaluation, and reporting requirements for the program are provided therein. Sitewide monitoring of groundwater will continue under the IEMP during remedial activities to be initiated under the SEP. Data from this program, in conjunction with information from any project-specific groundwater monitoring discussed in Section 5.1.3 herein, will be used to assess the impact of remedial activities on the Great Miami Aquifer.

To the extent practical (dependent on sampling frequency, analysis turnaround times, etc.), groundwater monitoring data will be reported in accordance with its associated regulatory drivers and within the framework of the IEMP reporting schedule.

## TABLE 5-1

## DUST CONTROL REQUIREMENTS

| Category | Remediation Activities/Areas Included | Dust Controls/Work Practices (to be applied progressively as environmental conditions dictate) | Site-Specific Limit or Ohio Standard |
|---|---|---|---|
| Paved roadways and paved parking areas | Activities:<br>• Hauling nonimpacted materials<br>• Hauling impacted materials<br>• Vehicle and equipment traffic<br>Areas:<br>All predetermined areas designed and improved specifically for vehicle traffic. Improvements include the application of materials such as asphalt or concrete that form a firm level surface for travel. | • Apply dust suppression agents.<br>• Minimize the amount of unnecessary traffic on unpaved roadways or unpaved parking areas.<br>• Limit speed to 15 mph during operation of equipment or vehicles.<br>• Apply dust suppression agents such as surfactants or crusting agents to inactive storage piles, or cover with tarpaulin, plastic, etc., if practical; for extended periods of planned inactivity, vegetate as a last resort if periodic application of crusting agent or protective cover proves ineffective.<br>• Apply appropriate dust suppression agents such as water or surfactants to material being transported by truck load beds to ensure the material will not become airborne; cover truck load bed when transported material is still likely to become airborne.<br>• Wheel wash prior to entering unpaved roadways.<br>• Remove, as practical, any clods, clumps, tracks, or visible deposits of soil or mud from unpaved roadways.<br>• Repair or resurface roadways/parking areas as needed, or use an alternative road surface as a last resort. | Limit:<br>Visible particulate emissions shall not exceed one (1) minute during any sixty (60)-minute observation period. |



002296

**TABLE 5-1**

(Continued)

| Category | Remediation Activities/Areas Included | Dust Controls/Work Practices (to be applied progressively as environmental conditions dictate) | Site-Specific Limit or Ohio Standard |
|---|---|---|---|
| Unpaved roadways, unpaved parking areas, and wind erosion from storage piles | Activities:<br>• Hauling nonimpacted materials<br>• Hauling impacted materials<br>• Vehicle and equipment traffic<br>Areas:<br>All predetermined areas designed and improved specifically for vehicle traffic. Improvements include the application of gravel, shredded shingles, cinders, compaction, etc., to the delineated areas. | • Apply dust suppression agents.<br>• Minimize the amount of unnecessary traffic on unpaved roadways or unpaved parking areas.<br>• Limit speed to 15 mph during operation of equipment or vehicles.<br>• Apply dust suppression agents such as surfactants or crusting agents to inactive storage piles, or cover with tarpaulin, plastic, etc. if practical; for extended periods of planned inactivity, vegetate as a last resort if periodic application of crusting agent or protective cover proves ineffective.<br>• Apply appropriate dust suppression agents such as water or surfactants to material being transported by truck load beds to ensure the material will not become airborne; cover truck load bed when transported material is still likely to become airborne.<br>• Wheel wash prior to entering unpaved roadways.<br>• Remove, as practical, any clods, clumps, tracks, or visible deposits of soil or mud from unpaved roadways.<br>• Repair or resurface roadways/parking areas as needed, or use an alternative road surface as a last resort. | Limit:<br>Visible particulate emissions shall not exceed three (3) minutes during any sixty (60)-minute observation period. |

000297

**TABLE 5-1**

(Continued)

| Category | Remediation Activities/Areas Included | Dust Controls/Work Practices (to be applied progressively as environmental conditions dictate) | Site-Specific Limit or Ohio Standard |
|---|---|---|---|
| Project feild activities and material handling/vehicle traffic on storage piles | Activities:<br>• Excavation<br>• Trenching<br>• Loading/Unloading<br>• Transportation to defined roadway (paved or unpaved)<br>• Load-in/load-out of storage piles<br>• Material placement into On-Site Disposal Facility<br>• Vehicle traffic on storage piles<br>Areas:<br>• Working faces<br>• Transition areas between working faces and defined (paved or unpaved) roadways<br>• Storage piles | • Apply dust suppression agents<br>• Minimize the amount of unnecessary traffic in and around field activities<br>• Limit speed to 15 mph during operation of equipment or vehicles<br>• Reduce rate of excavation<br>• Minimize height of drop during loading and unloading<br>• Change method of excavation & transport (e.g., from front-end loader dumping into a truck to a self-propelled pan)<br>• Apply dust suppression agents such as surfactants or crusting agents to storage piles<br>• Apply appropriate dust suppression agents such as water or surfactants to material being transported by truck load beds to ensure the material will not become airborne; cover truck load bed when transported material is still likely to become airborne | Limit:<br>Visible particulate emissions shall not exceed twenty percent (20%) opacity as a three (3)-minute average<br>[OAC 3745-17-07(B)(1)] |

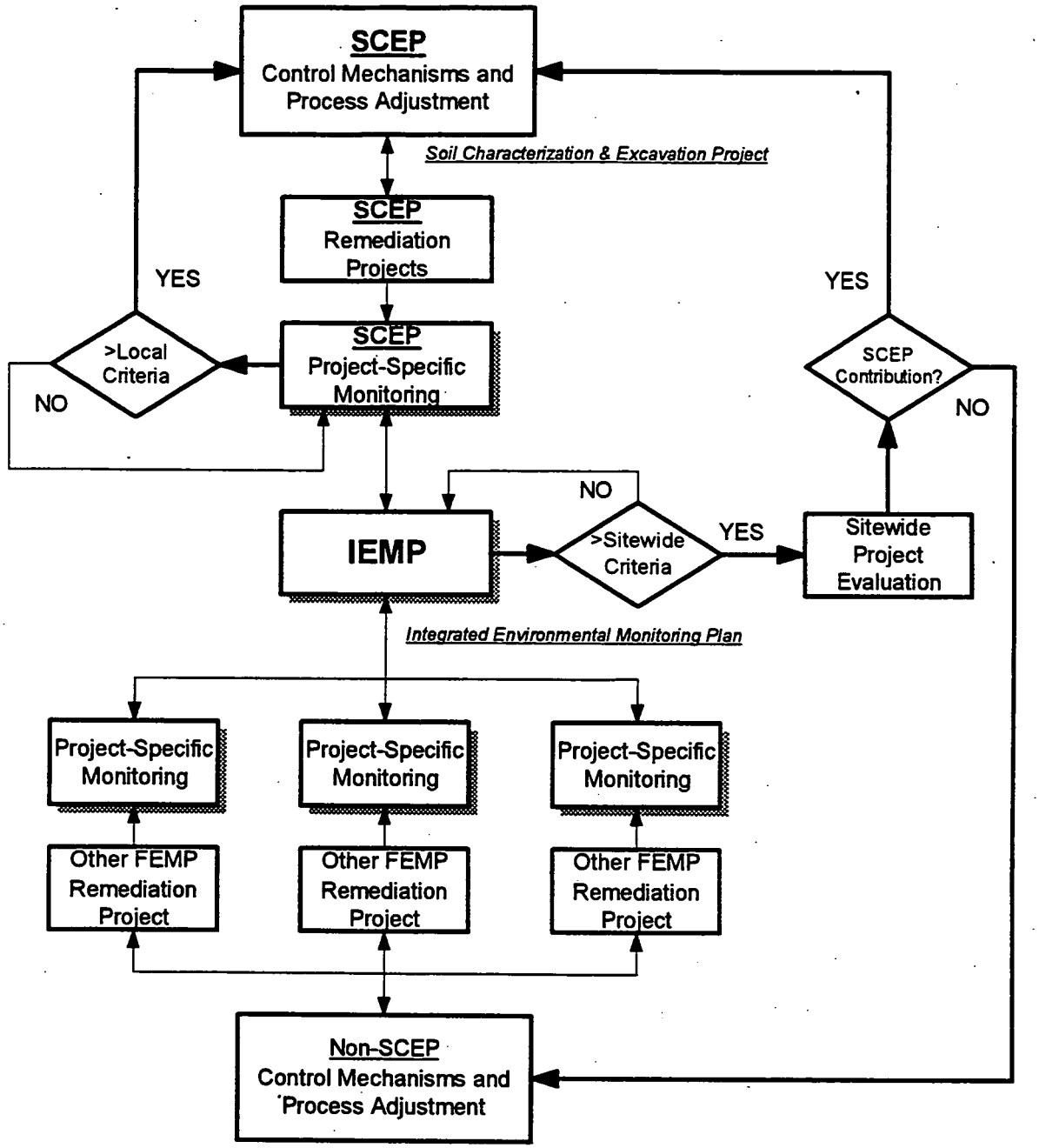
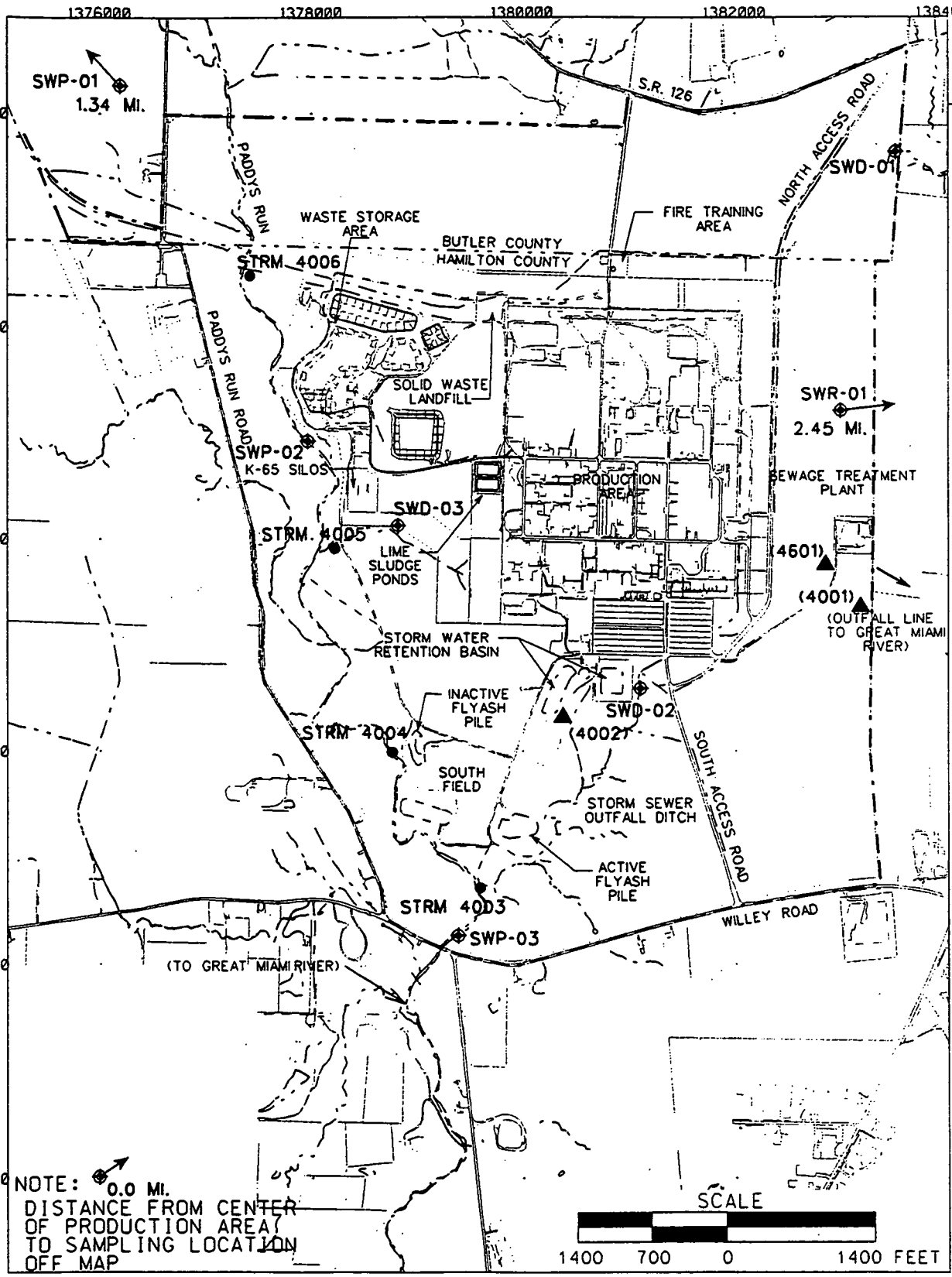



FIGURE 5-1 SITEWIDE AND PROJECT-SPECIFIC ENVIRONMENTAL MONITORING AND CONTROLS

/USR/ERMA1/CRUS/DGN/MAP/HOR/DPTH/SEP001.DGN.DGN FER OU5 7/2/97 STATE PLANAR COORDINATE SYSTEM 1927




LEGEND:

- FEMP BOUNDARY
- SWD-02 SURFACE WATER SAMPLING LOCATION
- STRM 4003 NPDES MONITORING POINT
- ▲ PERMITTED NPDES OUTFALLS
- (4001) PARSHALL FLUME
- (4002) EMERGENCY SPILLWAY
- (4601) SEWAGE TREATMENT PLANT EFFLUENT

DRAFT

FIGURE 5-3. IEMP SURFACE WATER SAMPLE LOCATIONS

# 6.0 PROJECT HEALTH AND SAFETY

Fluor Daniel Fernald (FDF) is required to comply with various health and safety standards during implementation of the Sitewide Excavation Plan (SEP) at the FEMP. These standards include U.S. Department of Energy (DOE) Order 5480.4, "Environmental, Protection, Safety and Health Protection Standards"; DOE Order 440.1, "Worker Protection Management for DOE federal and Contractor Employees"; FDF RM-0021, "Safety Performance Requirements Manual"; 10 CFR Part 835; and FDF RM-0020, "Radiological Controls Manual." The specific portions of these documents applicable to each remediation project will be delineated in Part 8 of the remediation subcontract. This section summarizes the general requirements for project-specific health and safety practices to be implemented during remediation under this SEP.

All DOE and FDF employees, visitors, vendors, contractors, and subcontractors are required to abide by the provisions of applicable Project-Specific Health and Safety Requirements Matrix (PSHSRMs) and Project-Specific Health and Safety Plans (PSHASPs) prepared by FDF (DOE 1995b); as well as the FDF-approved Safe Work Plan prepared by the Subcontractor. Managers and supervisors are responsible for ensuring that the requirements of the applicable HASPs and PSHSRMs are met. All personnel have stop-work authority for imminent safety hazards resulting from noncompliance with the applicable health and safety practices.

All subcontractor activities conducted in support of this project are governed by the safety requirements specified within the remediation contract, which addresses environmental, occupational, industrial, and construction health and safety. In addition to the contract requirements, PSHASPs, and the requirements of this document, the Subcontractor will comply with all federal, state, and local requirements (e.g., OSHA, Subpart P - Excavations, 1926.650, .651, .652, and Appendix A through F).

## 6.1 PROJECT-SPECIFIC HEALTH AND SAFETY PLANS

The purpose of the PSHASP is to provide health and safety guidance for protecting workers during all phases of work associated with the project. Specific health and safety guidance and requirements for

each major phase of excavation will be identified in a PSHASP and a PSHSRM. The PSHSRM will be included in each integrated remedial design package (IRDP) to provide health and safety requirements for each discrete phase or activity in the project.

The PSHSRM is developed to aid the Subcontractor in identifying the hazards associated with the project. The matrix is prepared to address minimum requirements for foreseen and known hazards existing at the time of contract. Actual conditions are subject to change. Additional mitigators may be required based on actual radiological, industrial hygiene, and safety conditions existing during work activities.

The Subcontractor shall utilize the PSHSRM to determine the general and task-specific health and safety requirements. The PSHSRM includes a hazard analysis for each task and required mitigators, including personal protective equipment, engineering and administrative controls, pre-job planning and permits, personal training personnel and air monitoring, medical monitoring and medical surveillance, and decontamination and disposal procedures.

The PSHSRM may be revised after reviewing the subcontractor's proposed Safety Work Plans as tasks and/or associated hazards are identified, added, or deleted. The PSHSRMs and the detailed HASPs will be maintained at the project site; controlled copies will be kept in the project document control files. The project-specific HASP and PSHSRM will identify the following components:

- Project organization and responsibilities
- Hazards associated with the project tasks
- Worker training requirements
- Personal protective equipment (PPE) for each project task
- Medical surveillance requirements
- Frequency and types of air and personnel monitoring
- Site control measures

- Decontamination procedures
- Emergency response and contingency plans
- Additional permits required (e.g., confined-space evaluation)
- Substance abuse program
- Other work practice requirements

A PSHASP will be provided at mobilization. The plan shall be read, understood, and signed by the Subcontractor and lower-tier Subcontractors. The Subcontractor and lower-tier Subcontractors shall orientate their employees on the plan, and the employees will sign the acknowledgment sheet signifying that they understand the requirements.

The PSHSRM will include health and safety requirements (handling guidance, permits etc.) for materials that require special handling procedures as defined in Section 4.4.1 of this document. Based on this initial health and safety assessment, the contractor will develop procedures/plans to handle these materials that will include PPE required, exposure monitoring, contamination control, and all other aspects of worker protection. This procedures/plans will complement the Environmental Contingency Plans in Appendix F.4 of this document.

## 6.2 SUBCONTRACTOR SAFE WORK PLANS

Subcontractors will be required to prepare, and submit to FDF for approval, a Safe Work Plan. The Subcontractor shall utilize the PSHSRM and applicable contract documents to prepare the safe work plans.

The subcontractor Safe Work Plan will describe the work in sufficient detail to:

- Provide assurance to FDF that:
  - The Subcontractor has assessed the risks associated with the work, and addressed preventive measures for safety and health hazards.

- The work in progress complies accurately with the health and safety, and performance requirements specified in the subcontract documents.
- The Subcontractor has safely planned the work in sufficient detail to meet schedule requirements.

- Provide a basis for FDF's internal planning activities.

The Safe Work Plan will be developed in such a way that it provides a document that is usable to brief the work force prior to the commencement of each new activity. The following items will be addressed in the subcontractor Safe Work Plan:

- A narrative description of the work to include the Subcontractor's methods of performing the work.
- Crew size and craft.
- Sub-tier subcontractors with a description of their work (as applicable).
- Number and type of equipment to be used and the Subcontractor's plan for repair and maintenance.
- Identification of training requirements and levels required to operate each piece of equipment to be used.
- Identification of critical sequence of work along with the reason it is critical.
- Methods of waste minimization, disposal and cleanup.
- A narrative description of an analysis of hazards such that the work force can clearly understand the hazards involved in the task. The mitigators and controls are to be well defined, practicable, and clearly written for workers in the field. Specialized equipment or training shall be specifically addressed.
- Identification of when a competent person is required by OSHA and those activities to be completed prior to start of work.

- Occupational exposure monitoring in compliance with OSHA and applicable contract documents.
- Radiological controls Standards/Requirements Identification Documents (S/RIDS).

## 6.3 EMERGENCY PREPAREDNESS

Health and safety emergencies during remedial activities are covered by the existing FEMP Emergency Preparedness Program. This program complements the engineered safety features of the FEMP facility and details the procedures to be followed at the FEMP in the event of an accident (spill) or emergency. The program provides a strategy for managing communications, site assessment, fire control, medical assistance, and monitoring equipment. Emergency phone numbers are also provided in the program, which is distributed to participating mutual aid organizations and other local organizations, such as local fire departments, hospitals, etc., in the general vicinity of the FEMP.

The FEMP emergency organization is available 24 hours a day to respond to all emergencies and abnormal events. The emergency organization includes FEMP personnel and resources as well as those of the local community. This group of trained personnel can be quickly expanded and reinforced, as necessary, through existing mutual-aid agreements with local fire, ambulance, law enforcement, and medical services. Members of this extended emergency organization undergo a formal training program, including participation in drills and exercises conducted under the Emergency Preparedness Program. These drills and exercises present simulated emergency conditions, which allow the extended emergency organization to practice, maintain, test, and refine the emergency plans, procedures, training, and response capabilities.

The Emergency Preparedness and Public Affairs groups at the FEMP maintain several ways to inform state and local groups about emergency preparedness and response. Meetings between the state, county, and local government agencies, emergency response personnel, and FEMP personnel are held on a regular basis at Cooperative Planning and Training Committee meetings hosted by the FEMP Emergency Preparedness organization. The meetings provide a forum for these agencies to discuss issues related to response, communications, information sharing, available training, drills, and

exercises. An emergency planning brochure is distributed annually to the Emergency Planning Zone population on what to expect and what to do in the event of an emergency at the site.

## 6.4 OCCUPATIONAL AIR MONITORING (EMPLOYEE EXPOSURE)

This section is only to be used as a guide for occupation exposure monitoring; it contains basic requirements and strategy for occupational air monitoring associated with excavation projects. Project-specific monitoring strategies must be developed by FDF when determined necessary by the cognizant FDF Health & Safety Officer. The Subcontractor will incorporate its occupation exposure monitoring requirements into their FDF-approved Safe Work Plan. These strategies will address the contaminants of concern for the specific project area.

### 6.4.1 Sampling Strategy

#### 6.4.1.1 Activities to be Sampled

It is anticipated that good work practices and engineering controls, including dust control measures, will maintain worker exposure levels of nonradioactive contaminants below OSHA/ACGIH limits and exposures to airborne radioactive contaminants below 10 CFR 835 occupational exposure limits. Air monitoring will be performed to verify that worker exposures to contaminants are below these limits.

Monitoring will be conducted on those workers performing activities with the highest potential for exposure to the contaminants identified for the project.

Those activities anticipated to have the highest exposure potential are:

- Workers on foot (e.g., spotters) in the active excavation area
- Equipment operators performing dumping, spreading and/or excavating
- Workers and equipment operators performing work within a Contamination Area.

In addition to personal sampling, radiological monitoring will be conducted at the perimeter of the active excavation area work area during remedial activities/construction to ensure that workers outside the project work area are not affected.

Monitoring requirements for all excavation work will be addressed in a project-specific air monitoring plan or the PSHSRM for that phase of the work as determined by FDF Health & Safety Officer. All radiological monitoring activities will be conducted by FDF Health & Safety personnel. The subcontractor shall conduct Industrial Hygiene monitoring (as required) and submit data to the FDF Health & Safety Officer (HSO). The FDF Industrial Hygienist will conduct side-by-side occupational exposure monitoring periodically to verify subcontractor data.

The occupational air monitoring plan or PSHSRM will be reviewed on a 6-month frequency (or more often as needed) after the start of construction and will be modified as necessary by the HSO.

6.4.1.2 Contaminants of Concern

Air monitoring will be conducted for the contaminants identified or suspected within the project area. The following are examples of contaminants likely to be encountered during excavation projects:

- Presumed asbestos-containing materials
- Dust, nuisance
- Metals
- Organic vapors
- Uranium (thorium if indicated as the isotope of concern)
- Radon isotopes.

Because of its relatively low concentrations, technetium-99 is not considered a contaminant of concern from a remedial worker health and safety standpoint.

6.4.1.3 Available Historical Data

In the preparation of project-specific monitoring requirements, FDF Health & Safety personnel will use all available historical sample data (e.g., previous occupational and radiological monitoring/sampling, RI/FS data, etc.). This information will be considered when establishing initial PPE levels and sampling strategies. If occupational air monitoring data for an activity are not available, FDF will implement a conservative approach in the specification of PPE until initial sample data become available.

6.4.1.4 Monitoring for Unidentified Contaminants

Air monitoring needs will be reviewed as work proceeds. Work activities will be reviewed, and available information on specific contaminants will be reviewed. The FDF Health & Safety Officer will determine the need for worker exposure assessment/re-assessment based on the available information. Information to be reviewed, as available is, to include:

- Actual air monitoring data associated with the project (e.g., air monitoring results collected during excavation)
- Any chemicals/products used during the course of the project (e.g., glues, disinfectants, etc.)
- Reports of dusty conditions or the presence of unusual odors.

Material Safety Data Sheets (MSDSs) will be reviewed and evaluated by project construction management for any new products that will be used during project work. If information on the MSDS indicates that a material to be used contains a hazardous component, a determination will be made as to the need for air monitoring based on the following factors: the potential for exposure considering the applicable occupational limits, the amount of the product to be used, the duration of the activity, and work practices and controls to minimize exposure.

### 6.4.2 Monitoring Methods and Frequency

#### 6.4.2.1 Personal Air Sampling Planned During Project Work

Asbestos

| | |
|---|---|
| Activity: | Handling/placement/covering of presumed asbestos-containing material |
| Frequency: | Subcontractor to collect samples daily, FDF to collect samples weekly (when such activities are performed) |
| Number: | 25 percent of workers involved in each different activity within the regulated asbestos area |
| Location: | Worker breathing zone |
| Method: | NIOSH 7400 or nationally recognized equivalent method (Note: NIOSH stands for the National Institute for Occupational Safety and Health.) |

Dust, Nuisance

| | |
|---|---|
| Activity: | General excavation activities |
| Frequency: | Monthly and as determined necessary by the FDF Health & Safety representative. |
| Number: | 25 percent of work force |
| Location: | Worker breathing zone |
| Method: | NIOSH 0600 or a nationally recognized equivalent method (Note: Direct reading instruments may be used at the direction of the FDF Health & Safety Representative rather than using sample collection with subsequent analysis.) |

Metals

| | |
|---|---|
| Activity: | General excavation activities where metals have been determined to be a potential exposure concern. |

| | |
|---|---|
| Frequency: | Monthly and as determined necessary by the Health & Safety Representative. |
| Number: | 25 percent of work force |
| Location: | Worker breathing zone |
| Method: | NIOSH 7300 or a nationally recognized equivalent method (Note: Direct reading instruments may be used at the direction of the FDF Health & Safety Representative rather than using sample collection with subsequent analysis.) |

Organic Vapors

| | |
|---|---|
| Activity: | General excavation activities where organic vapors have been determined to be a potential exposure concern. |
| Frequency: | As determined necessary by the Health & Safety Representative when materials with potential to produce organic vapors are discovered. |
| Location: | Worker breathing zone |
| Method: | Direct reading photoionization instrument (PID); (sample collection with subsequent analysis by NIOSH/OSHA may be used upon review of particular impacted materials). |

Airborne Radiological Contamination

| | |
|---|---|
| Activity: | Handling/placement/covering of radiologically contaminated material |
| Frequency: | Daily (when such activities are performed) |
| Number: | 25 percent of personnel in each work group (may vary based on work being performed and group being represented by sample) |
| Location: | Worker breathing zone |
| Method: | Lapel air samplers with in-line filters; samplers are collected after use and filters removed/replaced for counting on a low background counting instrument (after 7-day decay period); use "real time" dust monitoring data as an indicator of airborne radiological hazards in the field. |

6.4.2.2 General Area Air Sampling Planned During Project Work

Asbestos

| | |
|---|---|
| Activity: | Handling/placement/covering of presumed asbestos-containing material |
| Frequency: | Subcontractor to collect samples daily, FDF to collect samples weekly (when such activities are performed) |
| Location: | At the perimeter of the work area to include upwind and downwind locations |
| Method: | NIOSH 7400 or a nationally recognized equivalent method |

Dust, Nuisance

| | |
|---|---|
| Activity: | General excavation activities |
| Frequency: | Monthly and as determined necessary by the FDF Health & Safety representative. |
| Location: | At the perimeter of the work area upwind and downwind |
| Method: | NIOSH 0600 or a nationally recognized equivalent method (Note: Direct reading instruments may be used at the direction of the FDF Health & Safety Representative rather than using sample collection with subsequent analysis.) |

Metals

| | |
|---|---|
| Activity: | General excavation activities where metals have been determined to be a potential exposure concern. |
| Frequency: | Monthly and as determined necessary by the FDF Health & Safety representative. |
| Location: | At the perimeter of the work area upwind and downwind |
| Method: | NIOSH 7300 or a nationally recognized equivalent method (Note: Direct reading instruments may be used at the direction of the FDF Health & Safety Representative rather than using sample collection with subsequent analysis.) |

Organic Vapors

| | |
|---|---|
| Activity: | General excavation activities where organic vapors have been determined to be a potential exposure concern |
| Frequency: | As determined necessary by the FDF Health & Safety Representative |
| Location: | At the perimeter of the work area upwind and downwind |
| Method: | Direct reading PID; (sample collection with subsequent analysis by NIOSH/OSHA recognized method may be used upon review of particular impacted materials). |

Airborne Radiological Contamination

| | |
|---|---|
| Activity: | Handling/decontamination of radiologically contaminated material within a significantly contaminated area (e.g., from Production Area and waste storage/management units) |
| Frequency: | Daily (when such activities are performed) |
| Location: | At the perimeter of the work area to include upwind and downwind locations |
| Method: | Low-volume air samplers with in-line filters; filters are removed/replaced each day and counted on a low-background counting instrument (after 7-day decay period) |
| Note: | Generally, project-specific air monitoring is not required during remediation for soil contamination areas outside of the Former Production Area and waste storage/management units. |

### 6.4.3 Results and Action Levels

See Table 6-1 for monitoring levels and action levels.

### 6.4.4 Data Reporting and Documentation

Results of air monitoring will be documented and will be summarized/provided to project management for use, and will be supplied to the appropriate FDF Health & Safety Officer. The HSO will ensure that all needed documentation is provided in a timely manner to the project personnel. Involved

workers will be informed of the results of personal air sampling as required by OSHA and/or 10 CFR 835.

6.4.5 Quality Assurance

6.4.5.1 Calibration/Analysis Requirements

All monitoring/sampling will be performed by qualified and trained personnel using appropriate methods, and following manufacturer's instructions for equipment operation and maintenance.

Personal air sampling pumps will be calibrated before and after use each day. Nonradiological samples will be analyzed by appropriate OSHA or NIOSH methods, and radiological samples will be analyzed by FDF-approved Radiological Control methods (to meet the limits specified in 10 CFR 835 and DOE/EH-0256T, DOE Radiological Controls Manual). Real-time air monitoring instruments will be calibrated according to manufacturer's recommendations before being used in the field.

6.4.5.2 Sample Chain of Custody

Collected samples will remain in the custody of the sampling personnel, transportation personnel, or analytical personnel (or locked) at all times. Chain of custody will be documented on forms that accompany the sample from collection through analysis.

6.4.5.3 Sample Blanks

Appropriate blanks (as defined by analytical method) will be provided for analysis.

6.4.5.4 Special Sample Storage/Handling Requirements

Special sample storage/handling requirements will conform to those of the OSHA or NIOSH analytical method in use.

## TABLE 6-1

## OCCUPATIONAL MONITORING AND ACTION LEVELS

| Contaminant | Permissible Exposure Limits (PEL) or Derived Air Concentration (DAC) | Action Levels - Worker Protection | Action Levels - Perimeter |
|---|---|---|---|
| Asbestos | 0.1 (f/cc) 8-hour time-weighted average (TWA) limit (OSHA) | Workers performing work inside regulated asbestos areas will be required to wear an air purifying respirator with HEPA cartridges.<br><br>≥0.1 f/cc.<br>Re-evaluate work practices and engineering controls (e.g., dust control) and ensure proper application. Ensure controls prescribed in the OSHA asbestos standard including the use of an air purifying respirators with HEPA cartridges have been implemented. | ≥0.01 f/cc.<br>Modify work practices and/or engineering controls to ensure fiber levels outside the asbestos work area are maintained below this level. (When fiber levels exceed 0.1 f/cc, further analysis of the sample by TEM may be used to confirm the presence/absence of asbestos fibers on the sample.) Expand the controlled area. |
| Nuisance Dust (Respirable) | 3 $mg/m^3$ 8-hour TWA (ACGIH) | ≥1.5 $mg/m^3$.<br>Re-evaluate work practices and engineering controls (e.g., dust control) and ensure proper application. Require use of half-mask or full-face air purifying respirator s with HEPA cartridges.<br><br>≥15 $mg/m^3$.<br>**Re-evaluate work practices and engineering controls (e.g., dust control) and ensure proper application.** Require use of full-face air purifying respirators with HEPA cartridges. | ≥1.5 $mg/m^3$.<br>Modify work practices and/or engineering controls to ensure dust levels outside the work area are maintained below this level. Expand the controlled area. |

**TABLE 6-1**

(Continued)

| Contaminant | Permissible Exposure Limits (PEL) or Derived Air Concentration (DAC) | Action Levels - Worker Protection | Action Levels - Perimeter |
|---|---|---|---|
| (Total or Inhalable) | 10 mg/m$^3$ 8-hour TWA (ACGIH) | ≥5 mg/m$^3$ 8-hour TWA or ≥ 10 mg/m$^3$ 15 minute average<br>Re-evaluate work practices and engineering controls (e.g., dust control) and ensure proper application. Require use of half-mask or full-face air purifying respirators with HEPA cartridges.<br>≥50 mg/m$^3$<br>**Re-evaluate work practices and engineering controls (e.g., dust control) and ensure proper application.** Require use of full-face air purifying respirators with HEPA cartridges. | ≥5 mg/m$^3$ 8-hour TWA or ≥ 10 mg/m$^3$ 15 minute average<br>Modify work practices and/or engineering controls to ensure dust levels outside the work area are maintained below this level. Expand the controlled area. |
| Metals | Various [1] e.g.;<br>lead: 0.050 mg/m$^3$ 8-hour TWA (OSHA);<br>arsenic: 0.010 mg/m$^3$ 8-hour TWA (OSHA) | ≥Action level [b]. (e.g., 0.030 mg lead/m$^3$ 8-hour TWA ≥0.005 mg arsenic/m$^3$ 8-hour TWA)<br>Re-evaluate work practices and engineering controls (e.g., dust control) and ensure proper application. Require use of half-mask or full-face air purifying respirators with HEPA cartridges, dependent on results. | ≥Action level [b].<br>Modify work practices and/or engineering controls to ensure metals levels outside the work area are maintained below this level (e.g., lead: 0.030 mg/m$^3$ 8-hour TWA; arsenic: 0.005 mg/m$^3$ 8-hour TWA). The controlled area will be expanded |

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**TABLE 6-1**

(Continued)

| Contaminant | Permissible Exposure Limits (PEL) or Derived Air Concentration (DAC) | Action Levels - Worker Protection | Action Levels - Perimeter |
|---|---|---|---|
| Organic Vapors | Various [a] (see action levels) | Detection to 5 ppm 8-hour TWA, or detection to 25 ppm STEL (PID).<br>Re-evaluate work practices and engineering controls (e.g., dust control) and ensure proper application, work practices, and engineering controls. Require use of respirators with combination cartridges. Perform monitoring with direct reading instruments, or collect air samples to identify and quantify contaminants. Re-establish controls and PPE (e.g., respirator requirements) based on action level for the specific contaminant.<br>> 5 ppm 8-hour TWA, or > 25 ppm STEL (PID).<br>Re-evaluate work practices and engineering controls (e.g., dust control) and ensure proper application. Perform monitoring with direct reading instruments, or collect air samples to identify and quantify contaminants. Re-evaluate respirator requirements. | > 5 ppm.<br>Modify work practices and/or engineering controls to ensure vapor levels outside the work area are maintained below this level. Expand the controlled area. Perform monitoring with direct reading instruments, or collect air samples to identify and quantify contaminants. Re-establish controls based on action level [2] for the specific contaminant. |

**TABLE 6-1**

(Continued)

| Contaminant | Permissible Exposure Limits (PEL) or Derived Air Concentration (DAC) | Action Levels - Worker Protection | Action Levels - Perimeter |
|---|---|---|---|
| Radiological | Applicable DAC's:<br>Uranium:<br>2E-11 :Ci/cc<br>Th-230:<br>3E-12 :Ci/cc<br>Th-232:<br>5E-13 :Ci/cc<br>Radon:<br>0.3 Working Levels (WL)<br>Thoron:<br>1.0 Working Levels (WL) | At 4 DAC-Hrs per week, as indicated by Breathing Zone air sample results with applied respiratory protection factor (if respirator worn), work practices, administrative controls, and engineering controls will be re-evaluated (e.g., dust control, respiratory protection) and proper application ensured. Respiratory protection types:<br>• Full Face Air Purifying Respirator (FFAPR) with HEPA or combination cartridge (50 PF)<br>• Full Face Powered Air Purifying Respirator (FFPAPR), Mask Mounted type (MM) with HEPA cartridge only or Belt mounted type (6A) with HEPA or combination cartridge (1000 PF). PAPR may be required for metal burning/torch cutting or highly contaminated work.<br><br>At ≥ 10% DAC, as indicated by General Area air sample results, re-evaluate work practices and engineering controls (e.g., dust control) and ensure proper application. Post the affected area as an Airborne Radioactivity Area.<br><br>At ≥ 1 DAC, as indicated by General Area air sample results, control occupational exposure by the use of respiratory protection (required at ≥ 1 DAC). Re-evaluate work practices, engineering controls, and any existing respiratory protection requirements (including applicable respiratory protection factors). | At 10% DAC, modify work practices and/or engineering controls to ensure airborne radiological contamination levels are maintained below 10% DAC at the perimeter and below 2% DAC outside of the posted construction area (based on a weekly average). If boundaries exceed 10% DAC (based on a weekly average) the radiological area boundary will be expanded. Perform monitoring with direct reading instruments, and collect air samples to verify boundaries are posted correctly. |

[a]Limit for occupational exposure control will be the current OSHA or ACGIH limit (whichever is lower).

[b]Action level for occupational exposure control will be the current OSHA or ACGIH limit (whichever is lower) x 0.5, or as otherwise established by OSHA.

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# 7.0 SOIL REMEDIATION DOCUMENTS

The Sitewide Excavation Plan (SEP) addresses sitewide planning for soil excavation and provides the management strategy and technical guidelines necessary to govern soil remediation at the Fernald Environmental Monitoring Project (FEMP). Information included in the SEP consists of methods, or protocols, that will be consistently used during each phase of remediation from pre-design investigation to final cleanup certification. The SEP also provides area-specific considerations regarding nature and extent of contamination as well as various physical conditions (e.g., depth of excavation) expected throughout the FEMP during remediation. These considerations have resulted in the area-specific conceptual implementation approaches as work elements of the sitewide strategy described in Section 4.0. Through presentation of both the sitewide management strategy, the area-specific conceptual implementation approaches, and the hierarchy of the planned remediation documents in the SEP, development and approval processes of future deliverables are expected to be more efficient.

Following approval of the SEP, area-specific integrated remedial design packages (IRDPs) will be prepared for each remediation area in phases that correlate to the sequence of implementing remedial action. Phasing of these remedial design deliverables will accomplish two goals: 1) expedite remediation to facilitate the accelerated plan and 2) accommodate the lessons learned. This concept was identified in the Operable Unit 5 FS Report (DOE 1996a), based on Guidance on Expediting Remedial Design and Remedial Action (EPA 1990a). The guidance suggests that accelerated cleanup can be achieved by phasing a project into meaningful remedial work elements that can be implemented on different schedules, an approach which results in acceleration of remedial design and remedial action. After completion of soil remedial action according to an area-specific IRDP, an area-specific Certification Design Letter and Certification Report will be prepared to guide and document the certification process that is necessary to demonstrate attainment of all the remedial requirements listed in the SEP.

Figure 7-1 and Table 7-1 summarize types and timing of the planned soil remediation documents during typical steps of area-specific soil remediation. Figure 7-2 shows the hierarchy of the soil remediation documents as well as phasing of the sitewide soil remediation. As shown on Figure 7-1, the IRDPs

address only the area-specific remedial actions. Following completion of the remedial action, certification will be conducted according to the general protocols provided in Sections 3.0 and 4.0 of this SEP and will be documented in the area-specific Certification Design Letter and the Certification Report. This section describes the purposes, contents, and hierarchy of the three major area-specific soil remediation documents (i.e., IRDP, Certification Design Letter, and Certification Report) to be prepared in phases during the FEMP soil remediation according to the SEP management strategy and technical guidelines. Finally, also described are three other sitewide future documents (i.e., Natural Resources Restoration Plan, Remedial Action Report, and Site Closeout Report) planned and/or required to complete the remediation process at the FEMP.

## 7.1 INTEGRATED REMEDIAL DESIGN PACKAGE

The IRDPs will be prepared for individual areas or a combination of the remediation areas shown in Figure 1-3. Area-specific information (e.g., results of the pre-excavation investigation) required to conduct soil remediation according to the SEP technical guidelines and appropriate area-specific implementation approaches (selected from Section 4.0 of the SEP) will be combined and presented in each IRDP. Each IRDP will also include an area-specific implementation plan that incorporates the area-specific elements of a Remedial Action (RA) work plan, design drawings, and specifications. The information to be provided in the general scope of work for each of these deliverables is summarized in Section 7.1.2. Each IRDP will incorporate the lessons learned concept so that remedial action can be streamlined for each subsequent phase of soil remediation.

### 7.1.1 Design Package Components

The IRDPs will provide area-specific details of implementation of the sitewide remediation strategy outlined in the SEP. The general content to be included in an IRDP is listed below.

Implementation Plan:

- Schedule of remedial activities
- Scope of work and boundaries of the data, including areas of remediation

- Summary of existing RI data, process knowledge, and/or additional pre-excavation investigation data to perform remediation
- Summary of subsurface conditions (e.g., piping, structure foundation, pile, perched water zone, and soil geotechnical properties), if necessary
- Summary of known extent of contamination and special materials
- Summary of applicable final remediation levels (FRLs) and waste acceptance criteria (WAC)
- Identification of area-specific constituents of concern
- Anticipated excavation boundaries
- Area-specific access control requirements
- Area-specific excavation approaches
- Excavation control elements (e.g., monitoring equipment)
- Erosion and surface water control, if necessary
- Dewatering and perched water control, if necessary
- Pre-certification evaluation protocols, to determine that actions are complete

Design Drawings:

- Site preparation and temporary facilities location
- Excavation plan and cross-sections
- Storm water control elements
- Erosion and sediment control
- Interim Grading Plan (to be conducted after certification)
- Decontamination facility utilities to be saved/removed
- Survey monuments

Specifications:

- General requirements
  - Summary of work
  - Submittal schedule
  - Health and safety requirements
  - Mobilization and site access
  - Quality assurance/quality control requirements
  - Management of impacted material
- Construction-related items
  - Dust control measures
  - Erosion control measures
  - Excavation requirements
  - Demolition requirements
  - Dewatering requirements
  - Waste handling/disposition
  - Interim restoration
  - Process piping.

### 7.1.2 Model Outline

Each Implementation Plan will be organized to efficiently present all the engineering details of an area-specific remediation approach to be developed under the SEP sitewide management strategy and technical guidelines. Following is a model outline for the future IRDPs.

**MODEL OUTLINE FOR THE FUTURE IMPLEMENTATION PLANS**

**EXECUTIVE SUMMARY**
**LIST OF TABLES**
**LIST OF FIGURES**
**LIST OF ACRONYMS AND ABBREVIATIONS**
**1.0 INTRODUCTION**
- 1.1 Scope and General Approach of the Implementation Plan
- 1.2 Background and Description of the Remediation Area
- 1.3 Summary of the Regulatory Drivers
- 1.4 Components of the Remedy
- 1.5 Lessons Learned

**2.0 PRE-DESIGN INVESTIGATION** 1
2.1 Summary of the Pre-Design Investigation 2
2.1.1 RI/FS Data Review 3
2.1.2 Additional Sampling/Measurement 4
2.2 Identification of Area-Specific Constituents of Concern 5
2.3 Summary of Surface and Subsurface Conditions 6
2.3.1 Surface Coverage and Drainage Pattern 7
2.3.2 Soil Stratigraphy and Geotechnical Properties 8
2.3.3 Perched Water Zone 9
2.3.4 At- and Below-Grade Structures and Debris 10
2.3.5 Groundwater Monitoring Wells 11
2.4 Anticipated Excavation Boundaries 12
2.4.1 Summary of the Extent of Contamination 13
2.4.2 Above WAC Material 14
2.4.3 Characteristic Waste, HWMU, and UST 15
**3.0 REMEDIAL ACTION APPROACH** 16
3.1 Site Preparation 17
3.1.1 Establishing Site Boundaries and Controls 18
3.1.2 Establishing the Support Area 19
3.1.3 Installation of Wheel Wash and Decontamination Facilities 20
3.1.4 Installation of Surface Water Management System 21
3.1.5 Installation of Erosion and Sediment Controls 22
3.1.6 Surveying and Excavation Layout 23
3.1.7 Monitoring Well Protection 24
3.2 At- and Below-Grade Structure Demolition 25
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**6.0 REMEDIAL ACTION MANAGEMENT STRATEGY**
6.1 Organization and Responsibilities
6.2 Configuration Management
6.3 Subcontractor Procurement and Award Strategy
6.3.1 Request for Proposal Process
6.3.2 Pre-Bid/Proposal Meeting and Tour
6.3.3 Excavation/Remediation Subcontractor Award
6.3.4 Equipment and Material Procurement
6.4 Excavation Management
6.4.1 Status Meetings
6.4.2 Surveillance and Inspection
6.4.3 Health and Safety Oversight
6.4.4 Radiological Monitoring and Oversight
6.5 Impacted Material Management
6.6 Contingency Management
6.7 Recordkeeping and Data Management
6.8 QA/QC and Regulatory Audit
6.9 Integration/Coordination with Other FEMP Activities
6.10 Schedule

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Any other relevant area-specific information and/or procedures that have not been already described in the SEP and are not suitable for the main text of an IRDP will also be presented in Appendices to facilitate more detailed review processes. Examples of topics to be presented in the appendix section may include:

- Pre-design investigation data summary tables
- IRDP Project-Specific Plans (PSPs)
- Project cost estimation
- Comment responses.

### 7.1.3 Schedule

The phasing of the remedial design deliverables is presented on Figure 7-2. Each IRDP is listed in the sequence in which remediation is anticipated to occur under the accelerated sitewide remediation plan. Integration with other projects' schedules were taken into consideration. Each IRDP will be submitted following completions of area-specific pre-excavation investigation and initial design activities. The

submittal schedule for the IRDP deliverable is defined in Table 7-2. As indicated in Table 7-2, individual IRDPs will be submitted for more than one area in some instances. Soil remedial actions will commence and continue, with the schedules for remedial actions to be identified in the individual IRDPs.

### 7.1.4 Review and Finalization of Design Deliverables

The DOE will formally address all EPA and OEPA comments on the design deliverables through the submittal of a comment response document within 30 days of receipt of the agencies' comments. Comments will be incorporated into each design document, although revisions will not be formally submitted for the IRDPs. If a remediation area is determined to provide unique or unanticipated remediation challenges, DOE may request a formal preliminary review for a design deliverable not already considered in the RD Operable Unit 5 Work Plan (DOE 1996e) and this SEP.

## 7.2 CERTIFICATION DESIGN LETTER

A Certification Design Letter will be prepared and submitted to the regulatory agencies following completion of the area-specific IRDP tasks, including pre-certification activities (see Section 3.3), as a notification to initiate the certification process for the remediated areas. The Certification Design Letters will first provide a summary of the area-specific remediation completed and results of the pre-certification activities conducted according to the SEP guidelines. The main focus of the Certification Design Letters will be the delineation of certification units (CUs), the CU-specific certification COCs, and the certification sampling approaches.

### 7.2.1 Contents

Although a formal regulatory review and comment-response process is not intended for the Certification Design Letters, they will provide the regulatory agencies opportunities to evaluate the certification approach before the actual certification process is completed. Modifications to the certification process can be incorporated upon specific regulatory requests, if necessary. Each certification design letter will also be combined into the final area-specific certification report at the end

of a certification process for formal regulatory review comment and approval. The general content to be included in a Certification Design Letter is as follows.

Implementation Plan:

- Schedule of the certification activities
- Scope of work and boundaries of the data, including areas of remediation
- Summary of the pre-certification scan and/or measurement data
- Summary of known pattern and/or extent of residual contamination
- Summary of applicable FRLs
- Identification of CU-specific constituents of concern for certification purposes
- Summary of the certification sampling/measurement and/or laboratory analysis methods

Design Drawings:

- CU delineation maps
- Certification sampling locations
- Storm water control elements during certification
- Erosion and sediment control during certification
- Survey monuments.

### 7.2.2 Schedule

In general, an area-specific Certification Design Letter will be prepared within 30 days after successful completion of the remedial action specified in a corresponding area-specific IRDP and the pre-certification activities in the remediated area according to the SEP guidelines. Certification sampling and analysis will commence immediately after a "fast-track" regulatory review of the Certification Design Letter.

## 7.3 CERTIFICATION REPORT

The SEP and area-specific Implementation Plans (as part of the area-specific IRDPs) together will satisfy the RAWP requirements as presented in the Amended Consent Agreement (ACA) (EPA 1991) . Certification Reports will be used to progressively demonstrate that the remedial action objectives are completed for soil remediation, although the Certification Report is not required in accordance with EPA guidance or the ACA. The intent of submitting a Certification Report for each phase of a remediation area is to receive acknowledgment that the pertinent operable unit remedial actions were

achieved so that natural resource restoration can proceed as rapidly as possible. The certification reporting process will occur in two steps:

- First, following evaluation, graphical presentations of important new certification data demonstrating remediation progress (e.g., residual concentration contours of the primary COCs, pictures of the excavated areas, etc.) will be prepared, updated, and quickly loaded onto a website on the Internet to allow electronic access of the latest site conditions for the regulatory agencies.

- Second, upon completion of all certification data demonstrating that FRLs are achieved for all the CUs in the remediated area, a formal certification report will be submitted to the agencies. Upon regulatory acceptance of certification, the remediated area will be ready for interim grading or final natural resource restoration activities.

An area-specific Certification Report will be prepared after the remedial action and pre-certification activities are completed for each of the nine remediation areas described in Section 1.0. As the final area-specific remediation deliverable, the main objectives of the Certification Reports are to document what remedial actions occurred in specific areas, describe the certification process, present the data supporting the certification that the ASCOCs do not exceed the FRLs specified in the relevant RODs, satisfy closure requirements of HWMU and UST, summarize the data/manifests generated during remediation for WAC attainment demonstration, and describe access controls implemented to prevent recontamination.

### 7.3.1 Contents

Each Certification Report will include the following:

- Introduction. A general description will be included of how the area-specific remedy was implemented.

- Chronology of Events. Major events associated with the remedial action will be provided, beginning with the approvals of the IRDP and a selected construction subcontractor.

- Performance Standards and Construction Quality Control. The criteria or requirements that are necessary to demonstrate completion of remedial action in a remediation area as defined in the IRDP and the Certification Design Letter will be included.

- Construction Activities. A narrative description of construction activities undertaken for the relevant phase of remediation will be included. This includes an estimate of quantities excavated/treated/disposed, achievement of FRLs, and materials and/or equipment used. Participants in the remedial action will also be identified, including federal and state agencies, and construction contractors.

- Summary of Material and Data Tracking. A summary of data, records, and manifests generated during the remediation for material balance, WAC attainment, treatment, transportation, and disposition purposes will be provided.

- Certification that the Remedy Is Operational and Functional. Certification will be an affirmation that performance standards have been met for the excavation of contaminated material. The basis for the determination will also be provided.

- Summary of Project Cost. The final costs for the remediation phase will be summarized and compared to the original remedial action estimate provided in the IRDP.

Information on lessons learned will also be provided to facilitate improvement in each subsequent phase of remediation. Identification of problems encountered during excavation will be supplemented with proposed solutions to streamline the next phase of remediation.

### 7.3.2 Certification Report Outline

Each certification report will be organized to efficiently present contents listed in Section 7.3.1 and all the details of an area-specific certification process conducted following pre-certification activities as described in the SEP sitewide management strategy and technical guidelines. Data generated throughout the remediation, pre-certification, and certification activities will also be presented and analyzed to support the certification conclusions. Following is a model outline for the future Certification Reports.

# MODEL OUTLINE FOR THE CERTIFICATION REPORTS

**EXECUTIVE SUMMARY**
**LIST OF TABLES**
**LIST OF FIGURES**
**LIST OF ACRONYMS AND ABBREVIATIONS**
**1.0 INTRODUCTION**
1.1 Purpose and Scope
1.1 Background and Description of The Certification Area
1.1.1 Surface and Subsurface Conditions
1.1.2 Nature and Extent Of Contamination
1.1.3 RCRA Units, Characteristic Areas, HWMUs, And USTs (as applicable)
1.3 Report Format
**2.0 SUMMARY OF THE REMEDIAL ACTION CONDUCTED**
1.1 Changes to the IRDP Scope Of Work
1.2 Excavation and Material Segregation
1.3 Material Handling and Treatment
1.4 Pre-Certification Activities
**3.0 CERTIFICATION APPROACH**
3.1 CU Delineation and Classification
3.2 CU-Specific Constituents of Concern
3.3 HWMU/UST Footprint Delineation (if applicable)
3.4 Certification Criteria
3.5 Certification Sample Size and Design
**4.0 ANALYTICAL METHODOLOGIES, DATA VALIDATION, AND DATA REDUCTION**
4.1 Analytical Methodologies
4.1.1 Chemical Methods
4.1.2 Radiochemical Methods
4.2 Data Verification and Validation
4.3 Data Reduction and Statistical Analysis
**5.0 CERTIFICATION EVALUATION AND CONCLUSIONS**
5.1 Comparison with Certification Criteria
5.1.1 FRLs Relative to the Residual Contaminations
5.1.2 Hot Spot Determination
5.1.3 HWMU and UST Closure (if applicable)

5.2 Additional Corrective Actions for Failing CU (if necessary)
5.3 Certification Conclusions
**6.0 PROTECTION OF CERTIFIED AREAS**
6.1 Summary of As-Builts
6.2 General Access Control
6.3 Interim Grading and Vegetation
6.4 Storm Water Run-On Control
6.5 Other Re-Contamination Prevention Controls

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Any other relevant area-specific information and/or procedures that have not been already described in the SEP and are not suitable for the main text of a Certification Report will also be presented in appendices to facilitate more detailed review processes. Examples of topics to be presented in the appendix section may include:

- CU maps and statistical tables
- Certification data summary tables
- Certification PSPs
- WAC attainment summary
- Project cost summary
- Comment responses.

7.3.3 Schedule, Review and Finalization

The area-specific Certification Reports will be prepared in similar phases established for the IRDPs as described in Section 7.1. An independent QA review will be conducted on the Certification Report to verify that the content and quality of reported information meets the QA/QC protocols discussed in the QAPP (Appendix E). A draft area-specific Certification Report will be submitted within 120 days following completion of the certification activities conducted for a remediated area (i.e., receipt of data satisfying the FRLs). The DOE will formally address all EPA and OEPA comments on the draft certification reports through the submittal of a comment-response document within 30 days of receipt of the agencies' comments. Comments will be incorporated into each certification report, and revisions will be formally submitted for the reports.

## 7.4 OTHER RELATED FUTURE DOCUMENTS

Three other major sitewide or operable-unit-specific documents are planned and/or required to guide and document the completion of the remediation at the FEMP. They include the Natural Resource Restoration Plan, the Remedial Action Report, and the Site Closeout Report. The Natural Resource Restoration Plan generally defines the site restoration strategy. The Remedial Action Report and the Site Closeout Report are prepared to document completions of major remedial milestones. Table 7-3 summarizes and compares the scopes and contents of the Certification Report (including the Certification Design Letter), Remedial Action Report, and Site Closeout Report intended for the area-specific, operable-unit-specific, and sitewide scales, respectively. The following subsections describe the purposes and contents of these documents. Figure 7-3 shows the organizational structure of and relationships between the major remediation documents to be prepared.

### 7.4.1 Natural Resources Restoration Plan

Strategy for restoration of the natural resources after site remediation will be provided in the Natural Resources Restoration Plan (NRRP). Final sitewide surface grading, vegetation, surface water management, and institutional controls will be designed and implemented according to the NRRP strategy. In general, the NRRP will be consistent with the final land use scenario selected during the Operable Unit 5 FS (DOE 1996a) in which the site will be maintained as an undeveloped park after remediation. Any local, interim grading to be conducted immediately after certification of a remediated area will be designed (in the IRDP) considering the final sitewide grading plan presented in the final NRRP, to minimize the potential amount of rework during the sitewide final grading and restoration. The NRRP will also fulfill the requirements in the Amended Consent Agreement (EPA 1991) for a land use plan and an institutional control plan for Operable Unit 5.

### 7.4.2 Remedial Action Report

Upon completion of remedial action, each operable unit must complete a Remedial Action Report (EPA 1992). The purpose and content of the Remedial Action Report is to document the activities that occurred under remediation for each operable unit. The Remedial Action Report shows how the remedial objectives for each operable unit were met and summarizes the information necessary for

inclusion in the Site Closeout Report. Coordination between operable units may be required when preparing the remedial action report to account for division of operable units in the remediation projects.

A Remedial Action Report contains the following basic elements, which are similar to the content of a Certification Report, with a few exceptions:

- Introduction. This section provides a short general description of the site and the remedy implemented.
- Chronology. A summary of the major events associated with the remedial action is included.
- Performance Standards and Construction Quality Control. This section summarizes the criteria or requirements that the remedial action contractor met in completing the project and the basis for determining that the standard was met. This section also provides a summary of the implementation of the construction quality control plan and provides an assurance that the remedial action is complete.
- Final Inspection. This section documents the pre-final and final inspections conducted by the contracting party and contractor at the completion of construction.
- Certification that the Remedy is Operational and Functional. An affirmation is presented that the performance standards have been met.
- Summary of Project Costs. This section provides the final costs for the project and compares them to the original remedial action estimate.

### 7.4.3 Site Closeout Report

After the Remedial Action Report of the last operable unit has been submitted to show the successful implementation of remedial action, a Site Closeout Report will be prepared for the entire site. The Remedial Action Reports for each operable unit are generally used as the basis for preparing the Site Closeout Report and contribute to the ultimate decision regarding deletion from the Superfund National Priorities List (NPL) (EPA 1989). The Site Closeout Report shows that remediation of the entire site has been completed. It is important to note that in cases where waste has been left on site, such as at the FEMP, the five-year review procedures established in Section 121(e) of CERCLA, as amended by SARA, will continue to be appropriate regardless of the completion or deletion status of the site.

Site completion occurs when the following conditions have been met:

- Cleanup levels have been achieved and all cleanup actions have been successfully implemented pursuant to the ROD(s)
- The site is protective of human health and the environment across all pathways of exposure
- The constructed remedy is operational and functional and performing according to engineering design specification
- The only activities remaining at the site are operations and maintenance (O&M) activities.

Operable Unit 5 may be considered to have a Long-Term Response Action (LTRA) for cleanup of the Great Miami Aquifer. If this is determined to be the case, an Interim Closeout Report will be prepared. It will contain final information for all completed operable units at the site and will describe the LTRA activities to be performed and the cleanup levels to be achieved for the LTRA portion of the site. Therefore, this report must be prepared after all the other operable unit cleanup activities have been finalized, and after those organizations have prepared their respective Remedial Action Reports. The interim report will act as the determining factor for designating sites as LTRA on the NPL and for internal Superfund tracking. At this point the OEPA will be expected to assume responsibility for the LTRA oversight. The Interim Closeout Report will be amended when cleanup levels are achieved to include final information for the LTRA operable unit (Operable Unit 5) to satisfy completion requirements. The Interim Closeout Report and the amendment together will constitute the final Site Closeout Report, which indicates that remediation of the entire site has been completed. This report should include the following:

- Summary of Site Condition: Site background, RI/FS results, ROD summary, design criteria, community relations, and cleanup activities performed will be summarized.
- Demonstration of QA/QC from Cleanup Activities: This includes documentation that QA/QC and sampling and analyses protocol were followed, results of on-site inspections, and equipment acceptance records.

- Monitoring Results: Sufficient data will be available to demonstrate that the cleanup levels specified in the RODs were achieved and that implemented remedies are performing at design specifications. This section would be contained in the amendment to the Interim Closeout Report for any LTRA operable units.

- Summary of Operation and Maintenance: Assurance will be given that:

  - O&M plans are in place and are sufficient to maintain the protectiveness of the remedy.

  - All necessary institutional controls (e.g., deed restrictions) are in place.

- Protectiveness: Results of the sitewide post-remedial risk assessment will demonstrate the relative protectiveness of remediation at the FEMP.

- Bibliography: All referenced documents and any other documents relevant to completion of the site will be included.

NPL Deletion Criteria allow sites to be deleted from, or re-categorized on, the NPL in instances where no further response is appropriate [Section 300.66(c)(7) of the NCP] when the EPA and the state agree that all response actions are completed. The deletion docket is not a continuation of the administrative record for the site, although documents contained in the administrative record should be referenced in the deletion docket if they are still available to the public.

TABLE 7-1

HIERARCHY AND CONTENT OF SOIL REMEDIATION DOCUMENTS

| Sitewide | Formal Area-specific | Reports Report content | Field Sitewide | Tasks Area-specific |
|---|---|---|---|---|
| Sitewide Excavation Plan (SEP) | | Sidewide soil remediation strategy, sequencing, and general procedures | Field scanning equipment evaluation/selection | |
| | | | | Pre-design investigation per SEP requirements |
| | IRDPs | Area-specific remedial design package per SEP requirements | | |
| | | | | Remedial action according to SEP/IRDP |
| | | | | Pre-certification scan per SEP requirements |
| | CERTIFICATION DESIGN LETTERs | Area-specific CU-delineation and certification sampling plan per SEP requirements | | Certification Sampling/Analysis per SEP requirements |
| | CERTIFICATION REPORTs | Area-specific WAC attainment, hot spot/FRL certification, and UST/HWMU closure records per SEP requirements | | |
| | | | | Interim grading/protection per SEP requirements |
| Natural Resources Restoration Plan (NRRP) | | Sitewide final land use and natural resource restoration strategy | | |
| | | | Final restoration per NRRP strategy | |

## TABLE 7-2

## SCHEDULE OF REMEDIAL DESIGN DELIVERABLES FOR SOIL

| Deliverable | Status | Submittal Date |
|---|---|---|
| Technology Report | Draft | May 24, 1996 |
| Sitewide Excavation Plan | Draft | July 14, 1997 |
| Integrated Remedial Design Packages: | | |
| Area 1, Phase I | Completed | |
| Area 1, Phase II | Pre-final | November 21, 1997 |
| Area 2, Phase I* | Pre-final | October 20, 1997 |
| Area 3 | Pre-final | July 2, 1998 |
| Area 4 and Area 5 | Pre-final | November 15, 2000 |
| Area 6; Area 7; Area 1, Phase III; and Area 2, Phase II | Pre-final | January 15, 2001 |
| Area 8, West of Paddys Run Area | Pre-final | TBD |
| Area 9, Off-Property Area | Pre-final | TBD |

* Area 2, Phase I consists of the Operable Unit 2 Southern Waste Units.

TABLE 7-3

REMEDIAL ACTION COMPLETION REPORTING

| Item | Certification Report* (Project-Level) | Remedial Action Report (Operable Unit-Specific) | Sitewide Closeout Report (All Operable Units) |
|---|---|---|---|
| 1. Chronology of events/summary of site conditions | Area-specific summary of major events associated with the remedial action | Site-wide summary of major events associated with the remedial action | Summary of site conditions from the RI/FS phase through completion of remedial action |
| 2. Demonstration of QA/QC and performance standards | Provides analytical assurance that the remedial action in an area is complete with a summary of the construction quality control plan | Demonstrates site-wide analytical assurance that the remedy is complete and summarizes the construction quality control plan | Demonstrates that QA/QC protocol was followed and sampling and analyses protocol was followed |
| 3. Final inspection | Summarize pre-final inspection | Summarize final inspection (including as-built drawings) | Summarize site-wide final inspections |
| 4. Certification that the remedy is operational and functional | Provide area-specific certification | Provide site-wide soil excavation certification | Provide assurance that site-wide post-remedial operation and maintenance plans are in place and effectively maintain the protectiveness of the remedy |
| 5. Project costs | Provide project costs | Provide overall remedial action costs and compare to original cost estimates | Not applicable |
| 6. Protectiveness | Not applicable | Not applicable | Summarize results of the post-remedial site-wide risk assessment |

* SCEP Certification Reports may also provide some of the information necessary to complete the Remedial Action Reports for Operable Units 2, 3, and 5.

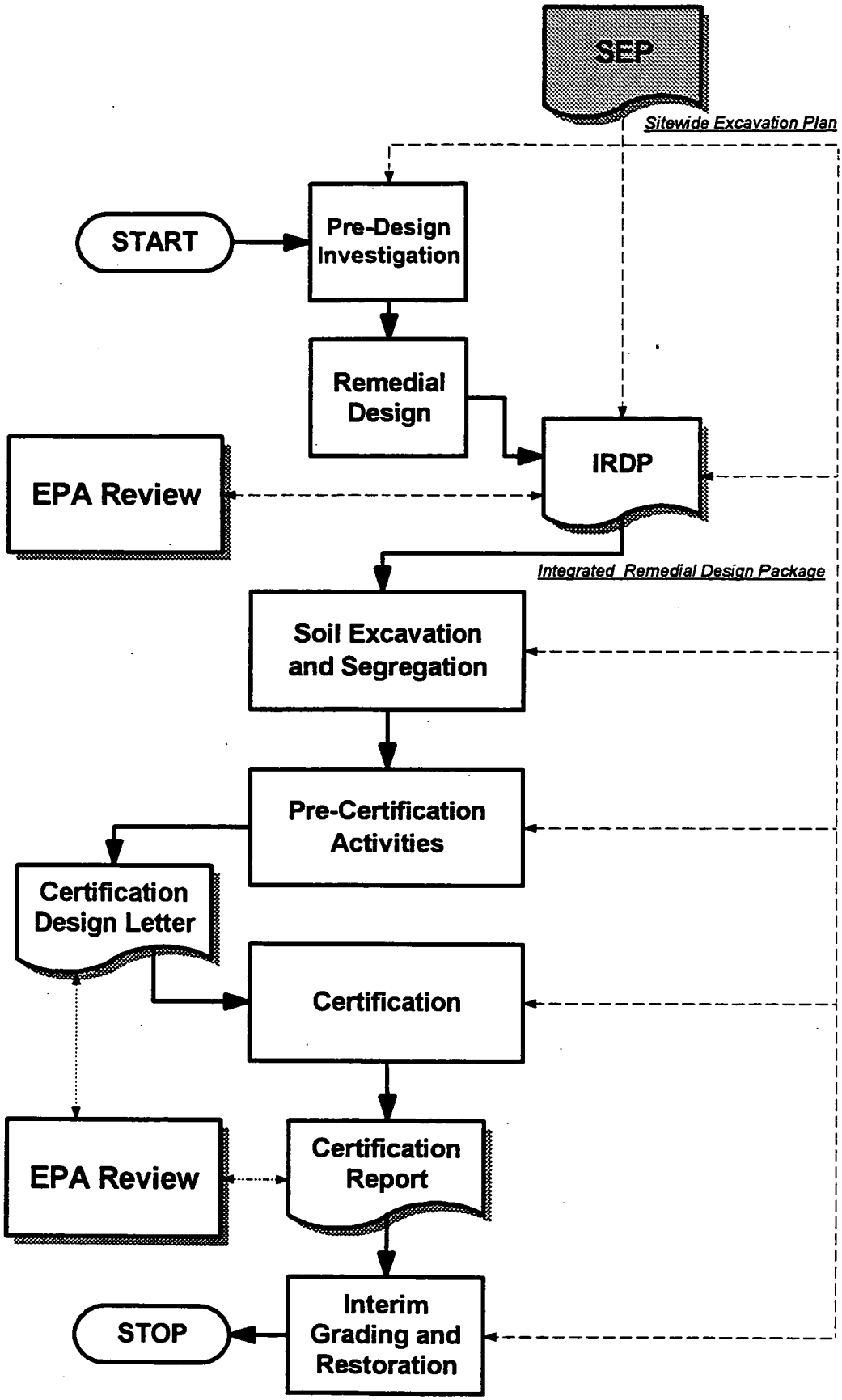


FIGURE 7-1 GENERAL AREA-SPECIFIC SOIL REMEDIATION PROCESS

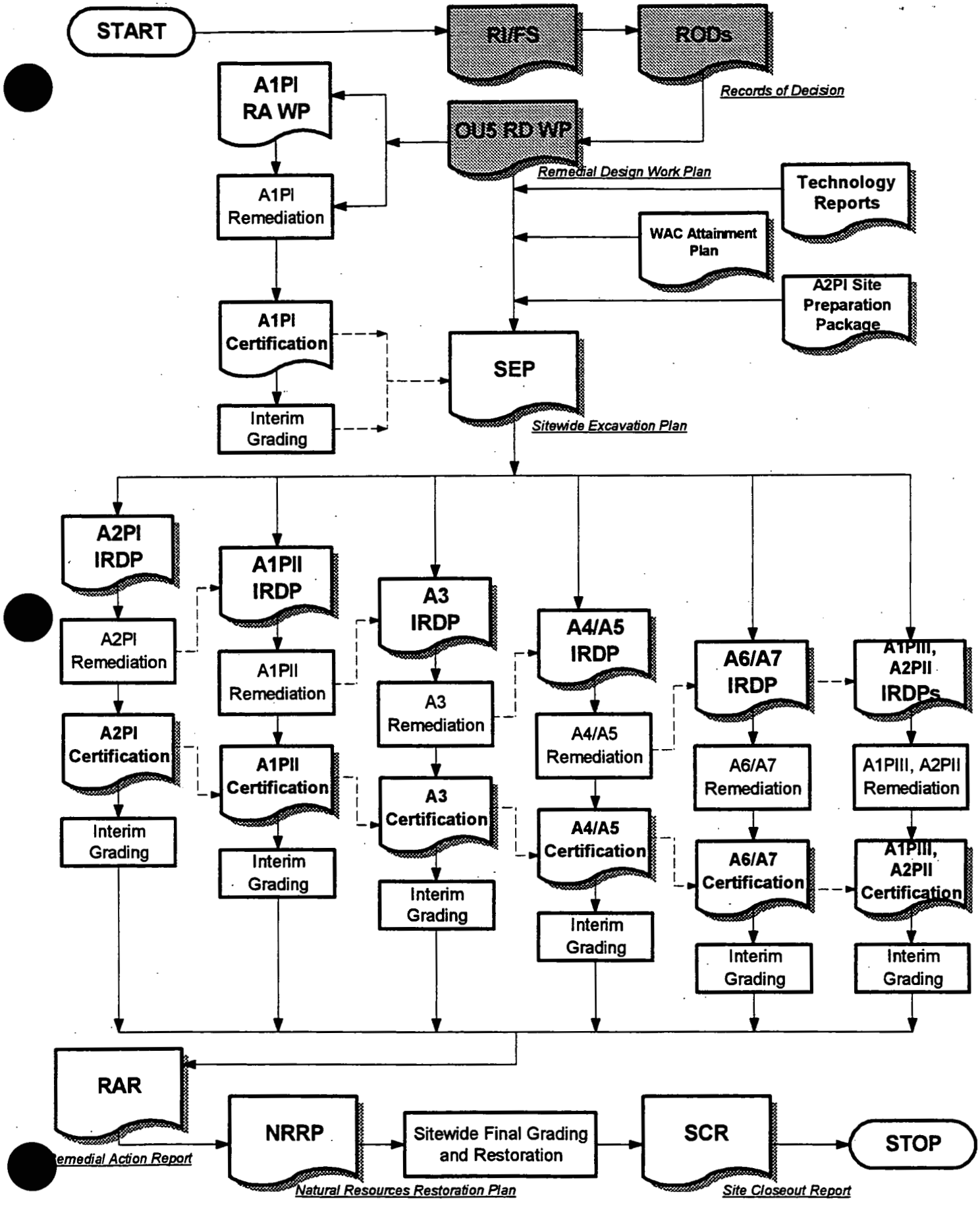


FIGURE 7-2 PHASING OF THE SITE-WIDE SOIL REMEDIATION AND DELIVERABLES

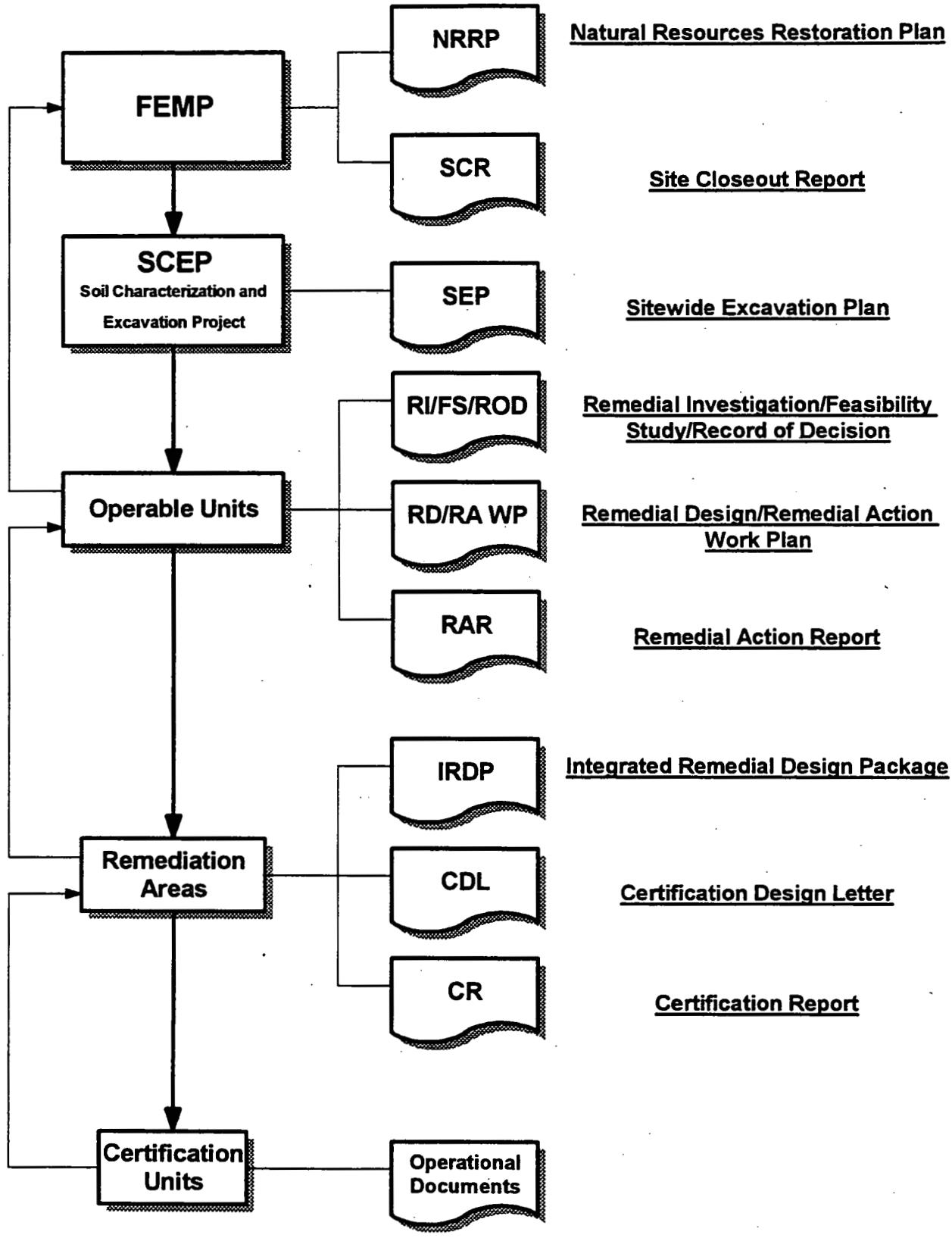


FIGURE 7-3 ORGANIZATIONAL STRUCTURE OF THE MAJOR REMEDIATION DOCUMENTS

# GLOSSARY

**Amended Consent Agreement (ACA)** - A legal agreement between the U.S. EPA and the DOE that defines the process by which CERCLA response actions will be managed at the FEMP. The ACA includes schedule and documentation requirements for remedial design and remedial action undertaken at the FEMP. The ACA also specifies periodic follow-up evaluations of the site by the U.S. EPA.

**Analytical Support Level (ASL)** - Level of defined quality assurance/quality control parameters used to assure data is satisfactory for its intended use.

**As Low As Reasonably Achievable (ALARA)** - The philosophy that exposure to radiation shall be maintained As Low As Reasonably Achievable below the regulatory limits as social, technical, economic, practical, and public policy considerations permit. The ALARA goal for residual radioactive material in soil is 50 ppm and is primarily based on the technical limitations of real-time analytical instrumentation.

**Baseline Risk Assessment (BLRA)** - The methodology used at a remedial site, such as the FEMP, to estimate the health impact from radiological and chemical exposures through all environmental pathways to ecological receptors before remediation begins.

**Benchmark Toxicity Value (BTV)** - The concentration of a constituent of concern, based on literature, that poses a potential risk to ecological receptors.

**Certification** - The final sampling, analysis, and reporting process agreed upon by DOE and the regulatory agencies whereby FEMP residual soils are designated as being remediated to the indicated standard.

**Certification Unit (CU)** - A certification unit is a sampling area delineated within a remediation area. The size of a CU depends on the homogeneity and concentration of contamination in the remediated area. The size categories of CUs are Group 1 CU (250-ft by 250-ft, with a high probability of encountering hot spots during remediation ) and Group 2 CU (500-fy by 500-ft, with a low probability of encountering hot spots and/or soil above established cleanup goals).

**Characteristic Waste** - A waste that is classified as a hazardous waste and regulated by RCRA because it exhibits ignitability, corrosivity, reactivity, or toxicity.

**Composite Sample** - A mixture of a number of samples used to represent the average properties of the parameters of concern over the extent of the area sampled.

**Comprehensive Environmental Response Compensation and Liability Act (CERCLA)** - A Federal regulation passed by Congress in 1980 that provides funding and enforcement authority to the EPA for the cost-effective cleanup of inactive or abandoned hazardous waste sites.

**Concentration** - The average abundance of a constituent per unit weight or volume of sample.

**Confidence Level** - A probability, based on natural variability, where a chosen difference is determined to be significant.

**Constituent of Concern (COC)** - A radiological or chemical constituent evaluated during the Feasibility Study because the risk estimates developed in the Baseline Risk Assessment exceeded certain toxicity benchmarks.

**Curie** - A unit of radioactivity equal to $3.7 \times 10^{10}$ disintegrations per second.

**Data Quality Objectives (DQOs)** - Quantitative and qualitative specifications for the minimum quality of data to be used in a specific decisionmaking investigation.

**Data Validation** - The process for determining the acceptability of sampling and analytical data for its intended use through review of field documentation, sample processing, and QA/QC analytical results.

**Decontamination and Dismantlement (D&D)** - The process of removing radioactive and/or hazardous materials from pipes, ducts, vents, and equipment, and structures within and of the facility as part of safe shutdown activities, stripping the sidings, and then bringing down the steel structural remains of the facility.

**Engineering Controls** - Controls designed to eliminate hazards by mechanical means or process design; primarily apparatus and/or mechanisms which physically prevent entry, minimize hazards, or create some kind of barrier.

**Excavation Control** - The selective removal of soil contaminated with one or more COCs above the action level as determined by field instrumentation.

**Field Scanning** - A qualitative or semi-quantitative determination of the presence or absence of a radiological COC or organic vapor within a area.

**Final Remediation Level (FRL)** - The average level of a contaminant to which a user of an undeveloped park can be safely exposed.

**Geographic Information System (GIS)** - A three-dimension graphic application system that provides "snapshot" data management and analysis software tools for assessing, modeling, and monitoring the surface and subsurface of soil.

**Hazard Quotient** - The ratio of a single substance exposure level over a specified time period (e.g., subchronic) to a reference dose for that substance derived from a similar exposure period.

**Hazardous Substance** - "Hazardous Substances" are defined in CERCLA Section 101(14). The EPA has prepared a list of hazardous substances in 40 CFR 302.

**Kriging** - An estimation technique used to obtain estimates of a regionalized variable at locations where measurements do not exist. In general, kriging is a "best linear unbiased estimate"; "linear" because

estimates are obtained as linear combinations of the measurements, "best" in that it attempts to minimize the variance of the estimation errors, and "unbiased" in that the estimation error is, on average, zero.

**Method Detection Limit (MDL)** - Three times the standard deviation at the lowest level of measurement of the methodology.

**Multi-Channel Analyzer** - An electronic device that separates the output of a sodium iodide or high-purity germanium (HPGe) detector into discrete and identified spectra.

**On-Site Disposal Facility Footprint** - The intended location of the On-Site Disposal Facility and buffer zone.

**Percentile** - A value below which a specified proportion or percent of the observations from a distribution will fall.

**Point Source** - A stationary location or fixed facility from which pollutants are or may be discharged or emitted. Also, any single identifiable source of pollution (e.g., pipe, ditch, stack).

**Polychlorinated Biphenyl (PCB)** - One of several aromatic compounds containing two benzene nuclei with two or more substitute chloride atoms. Formerly used as an isoelectric organic compound for insulating electrical equipment such as transformers or capacitors. Sale of PCBs was banned by law in 1979. PCBs have been demonstrated to be carcinogenic to animals and humans.

**Polynuclear Aromatic Hydrocarbon (PAH)** - Semivolatile organic compound having three or more aromatics in its structure which may be the same or different. Produced by burning coal and other fossil fuels. PAHs are possible dermal carcinogens.

**Primary Constituent of Concern** - Widespread radiological contaminants at the FEMP that represent 90 percent of the risk to human health. They consist of total uranium, radium-226, radium-228, thorium-228, and thorium-232.

**Process Knowledge** - Information about potential contaminants based on knowledge of the materials used or formed in a chemical or physical process.

**Process Wastewater** - Any water which, during manufacturing or processing, comes in contact with or results from the production or use of any raw material, intermediate product, finished product, or waste product, except non-contact cooling water and sanitary wastewater.

**Project-Specific Plan (PSP)** - A scoping document required for any program or project. A project-specific plan for FEMP sampling and analysis should include elements defined in Section 6 of the SCQ. Project-specific plans may include, but are not limited to, work plans, field sampling plans, health and safety plans, and standard operating procedures.

**Qualitative Analysis** - The analysis of a gas, liquid, or solid sample or mixture to identify the elements, radicals, or compounds of a sample.

**Quality Assurance** - An integrated system of management activities involving planning, quality control, quality assessment, reporting, and quality improvement to ensure that a product or service (e.g., environmental data) meets defined standards of quality with a stated level of confidence.

**Quality Control** - The overall system of technical activities whose purpose is to measure and control the quality of a product or service so that it meets the needs of the user. The aim is to provide quality that is satisfactory, adequate, dependable, and economical.

**Quantitation Limit** - The lowest level at which a chemical may be accurately and reproducibly quantified. Usually equal to the instrument detection limit multiplied by a factor of 3 to 5, but varies between chemicals and between samples.

**Quantitative Analysis** - The analysis of a gas, liquid, or solid sample or mixture to determine the precise percentage composition of the sample in terms of elements, radicals, or compounds.

**Radiological** - Of or relating to the process of emitting radiant energy in the form of waves, rays, or streams of energetic particles.

**Random Sample** - A sample drawn from a population in such a manner that all items or members of the population have an equal chance of being selected in the sample.

**Rapid Analytical Methods** - A method of field testing which provides a reasonable analytical measure of a COC (i.e., real time or quick turn methods such as the HPGe, OVA, and XRF).

**Real-Time Results** - Measurements taken in the field that identify the presence, concentration, or activity of a constituent with a quick or relatively short turnaround time. Analytical methods associated with real-time results usually have higher detection limits and are less precise than conventional laboratory methods.

**Regulatory Agency** - Any federal, state, or local government organization having jurisdiction over the FEMP.

**Remedial Action** - Those actions taken to permanently remove or mitigate releases or potential releases in accordance with the selected remedy for a site as defined in the approved Record of Decision (ROD).

**Remedial Action Work Plan (RAWP)** - A document that establishes the methods and specifications for remediation of a portion of a remedial site consistent with the previously agreed upon ROD.

**Remedial Design (RD)** - A phase of remedial action that follows the remedial investigation/feasibility study and ROD and includes development of engineering drawings and specifications for a site cleanup.

**Remedial Design Work Plan (RDWP)** - A work plan describing the technical analysis and procedures which will be followed to implement the selected remedy for a site. RDWPs are typically composed of detailed plans and specifications describing implementation of a selected remedy.

**Residual Soil** - Soil remaining in place after excavation is complete.

**Sample Density** - The number of samples required per specified area.

**Sampling Event** - A collection of one or more samples from one or more locations for a specific project during a specified time period for a similar purpose.

**Sensitivity** - The minimum amount of a radionuclide or other constituent of concern that an instrument, system, or procedure can repeatedly detect.

**Sitewide CERCLA Quality Assurance Project Plan (SCQ)** - A formal technical document that integrates CERCLA QA/QC requirements into all FEMP environmental sampling and analysis to ensure minimum Data Quality Objective standards are achieved based on the intended use of the data.

**Sitewide Closeout** - The release of a remediated site by the regulatory agencies for its intended final land use.

**Sitewide Environmental Database (SED)** - An Oracle-based database which stores environmental data generated through activities at the FEMP.

**Storm Water Retention Basin (SWRB)** - An engineered pond designed to retain stormwater run-off and provide quiescent settling of solids. SWRBs are designed to release stormwater run-off at a controlled rate through an outfall structure that typically consists of a riser pipe, barrel, and emergency overflow structure.

**Superfund** - The program operated under the legislative authority of CERCLA and SARA that funds and carries out the EPA solid waste emergency and long-term removal remedial activities. These activities include establishing the National Priorities List, investigating sites for inclusion on the list, determining their priority level on the list, and conducting and/or supervising the ultimately determined cleanup and other remedial actions.

**Surface Impoundment** - A natural topographic depression or man-made excavation which is designed to hold or store liquid wastes. Surface impoundments are usually formed primarily of earthen materials, but may be lined.

**t Distribution** - A sampling distribution for the t statistic. This distribution is similar to the normal distribution, but its exact shape depends on the size of the sample.

**t Statistic** - Also referred to as Student's t. An estimate of the standard normal deviate (Z statistic) when the sample size is relatively large or approximately normally distributed and the population standard deviation is unknown. A value which depends on the probability level chosen and on the degrees of freedom upon which the estimate of the population standard deviation is based.

**Treatment** - Any method, technique, or process, including neutralization, designed to change the physical, chemical, or biological character or composition of any hazardous waste so as to neutralize the waste and render the waste as less hazardous, or nonhazardous.

**Turnaround Time (TAT)** - The time period from sample delivery to the reporting of results.

**Variability** - In statistics, the spread of values about their centralized value.

**Variance** - One-half the mean squared difference of paired sample measurements.

**Variogram** - A plot of the variance (one-half the mean squared difference of paired sample measurements) as a function of the distance (and optionally the direction) between samples. Typically, all possible sample pairs are examined according to distance and direction. Variograms provide a means of quantifying the commonly observed relationship that samples close together will tend to have more similar values than samples far apart.

**Verification Testing** - Sampling and analysis performed to confirm or deny RI/FS data and/or to confirm or delineate contamination boundaries.

**Volatile Organic Compound (VOC)** - Any organic compound which participates in atmospheric photochemical reactions except for those designated by the EPA Administrator as having negligible photochemical reactivity.

**Waste** - Unwanted materials left over from a manufacturing process or habitation.

**Waste Acceptance Criteria (WAC)** - The maximum concentration of a given constituent that may be present in refuse material in order for that material to be appropriately discarded.

**Wastewater** - The spent or used water generated from work force sanitary activities and ongoing cleanup activities that contains dissolved or suspended matter.

**X-Ray Fluorescence (XRF)** - Analytical technique capable of rapidly distinguishing and quantifying the concentration of metals in surface soil by using X-rays.

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# SITEWIDE EXCAVATION PLAN

## FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
## FERNALD, OHIO

INFORMATION ONLY

**VOLUME II**
**APPENDICES A through I**

**JULY 1997**

**U.S. DEPARTMENT OF ENERGY**
**FERNALD AREA OFFICE**

**2500-WP-0028**
**REVISION C**
**DRAFT**

# APPENDIX A

## SOIL REMEDIATION ARARs AND TBCs

## LIST OF ABBREVIATIONS, ACRONYMS AND INITIALS

| | |
|---|---|
| ALARA | as low as reasonably achievable |
| ARAR | Applicable or Relevant and Appropriate Requirement |
| AWWT | Advanced Wastewater Treatment [Facility] |
| BAT | Best Available Technology |
| BMP | Best Management Practice |
| CAMU | Corrective Action Management Unit |
| CEDE | Committed Effective Dose Equivalent |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CFR | Code of Federal Regulations |
| COC | Constituent of Concern |
| CWA | Clean Water Act |
| DCG | Derived Concentration Guide |
| DF&O | Director's Findings and Orders |
| DOE | U. S. Department of Energy |
| EPA | U. S. Environmental Protection Agency |
| FEMP | Fernald Environmental Management Project |
| FR | Federal Register |
| FRL | Final Remediation Level |
| FS | Feasibility Study |
| GMA | Great Miami Aquifer |
| HSWA | Hazardous and Solid Waste Amendments |
| HWMU | Hazardous Waste Management Unit |
| IEMP | Integrated Environmental Monitoring Plan |
| IRDP | integrated remedial design package |
| LDR | Land Disposal Restriction |
| MCL | Maximum Contaminant Level [under SDWA] |
| MCL | Maximum Concentration Limit [under RCRA] |
| MCLG | Maximum Contaminant Level Goal [under SDWA] |
| mg | milligram |
| mg/kg | milligrams/kilogram |
| mg/L | milligrams/liter |
| mm | millimeter |
| mrem | millirem |
| MTR | Minimum Technology Requirements |
| NAAQS | National Ambient Air Quality Standards |
| NCP | National Oil and Hazardous Substances Pollution Contingency Plan |
| NESHAP | National Emission Standards for Hazardous Air Pollutants |

| | |
|---|---|
| NHPA | National Historic Preservation Act |
| NPDES | National Pollutant Discharge Elimination System |
| NRC | Nuclear Regulatory Commission |
| NRIMP | Natural Resource Impact Monitoring Plan |
| NRRP | Natural Resources Restoration Plan |
| NWP | Nationwide Permit [Program] |
| OAC | Ohio Administrative Code |
| OEPA | Ohio Environmental Protection Agency |
| OHPO | Ohio Historic Preservation Office |
| ORC | Ohio Revised Code |
| OSDF | On-Site Disposal Facility |
| OSWER | (EPA) Office of Solid Waste and Emergency Response |
| OU | Operable Unit (as numbered) |
| PAH | polycyclic aromatic hydrocarbon |
| PCB | polychlorinated biphenyl |
| pCi | picoCurie |
| pCi/L | picoCuries/liter |
| ppm | parts per million |
| PRG | Preliminary Remediation Goal |
| R&A | relevant and appropriate |
| RCRA | Resource Conservation and Recovery Act |
| RD | remedial design |
| RM | river mile |
| ROD | Record of Decision |
| SCEP | Soil Characterization and Excavation Project |
| SDWA | Safe Drinking Water Act |
| SEP | Sitewide Excavation Plan |
| SIP | State Implementation Plan |
| TBC | to be considered |
| USC | United States Code |
| mCi | microCurie |
| mCi/L | microCurie/liter |
| mg | microgram |
| mg/L | micrograms/liter |
| VOC | volatile organic compound |

The Amended Consent Agreement (EPA 1991) requires that the compliance strategy for addressing the substantive requirements of permits which would otherwise be required, as well as other applicable or relevant and appropriate requirements (ARARs), be initiated at the start of remedial action. The Amended Consent Agreement requires the following specific information:

- Identification of each permit that would have been required in the absence of the CERCLA 121(e)(1) permitting exemption
- Identification of the standards, requirements, criteria, or limitations that would normally have to be met to obtain the permits
- Explanation of how the remedial action will meet the substantive requirements, criteria, or limitations identified above.

The Amended Consent Agreement further states that a permitting plan containing the above items should be submitted as a design deliverable. As presented in Section 1.3.1.2 of the SEP, EPA and OEPA concurred with the submission of a compliance cross-reference (including substantive permitting requirements) as a substitute for a formal permitting plan.

This appendix has been prepared to fulfill those requirements. It presents a detailed listing of the substantive requirements of the ARARs and to be considered criteria (TBCs), provides remarks, where appropriate, on how the requirements pertain to the Soil Characterization and Excavation Project (SCEP), and presents appropriate cross-reference to where the substantive requirements are addressed.

The sitewide excavation work under the scope of the Soil Characterization and Excavation Project (SCEP) involves work in the areas of all operable units: the Waste Pit (Operable Unit 1), other Waste Units (Operable Unit 2), Former Production Area (Operable Unit 3), Silos (Operable Unit 4), and site soil under and around these operable units (Operable Unit 5). Although the soil in the Operable Unit 5 areas presented above includes soil within the geographic boundaries of Operable Units 1 and 4, as defined in the Amended Consent Agreement, the selected remedies for these operable units are clearly focused on remediation of the waste materials, not the underlying soils.

Thus, ARARs and TBCs from three Records of Decision (RODs) — the Final Record of Decision for Remedial Actions at Operable Unit 2 (DOE 1995d), the Final Record of Decision for Remedial Actions at Operable Unit 5 (DOE 1996d), and the Operable Unit 3 Record of Decision for Final Remedial Action (DOE 1996c) — are pertinent to the soil (and associated at- and below-grade debris) remediation activities. The ARARs and TBCs listed in Table A-2 are compiled sequentially from those RODs. Although these ARARs and TBCs are consistent with each other, variations exist based on various remediation waste types that will be generated during remediation.

In the same manner as the RODs, the following three agreements with regulatory entities clarified and established enforceable regulatory requirements for the remediation activities under this remedial action project:

- RCRA/CERCLA Integrated Closures Director's Final Findings and Orders (June 4, 1996)
- Programmatic Agreement Regarding Disposition of Facilities under the Operable Unit 3 Record of Decision for Interim Remedial Actions at the Fernald Environmental Management Project (January 16, 1996)
- Programmatic Agreement Regarding Archeological Investigations at the Fernald Environmental Management Project (March 6, 1997).

Thus, entries summarizing the requirements of each of these have also been included.

The entries presented in Table A-2 are those that pertain directly to the scope of the remediation activities under this remedial action project. Those previously determined ARARs and TBCs that pertain to other projects which are implementing other components of the selected remedial actions that are outside the direct scope of the SCEP are not included:

- Those that pertain to on-site disposal are within the direct scope of the On-Site Disposal Facility (OSDF) remedial action project (see the OSDF remedial action project documents).
- Those that pertain to groundwater remediation are within the direct scope of the Aquifer Restoration remedial action project (see the aquifer restoration remedial action project documents).

Those that pertain to environmental monitoring, that are not environmental-control oriented, are within the scope of the Integrated Environmental Monitoring Project (see the Integrated Environmental Monitoring Plan, IEMP).

As briefly mentioned above, the individual entries are identified in the corresponding column on Table A-2 as to the ROD which was its source, using the abbreviation "Appl" or "R&A" or "TBC" to indicate the determination in the ROD as either "Applicable" or "Relevant and Appropriate" or "To Be Considered," respectively. Similarly, a checkmark (√) is used to indicate the pertinence of either the requirements identified under a new entry (primarily the agreements discussed above), or an ARAR/TBC entry identified in another ROD, to activities undertaken to implement the remediation activities under this remedial action project. This approach to identification of pertinent requirements is necessary because of the scope of the SEP remediation activities encompassing implementation of components of the selected remedies under three RODs.

To facilitate analysis of alternatives, the RODs presented ARARs and TBCs in chemical-specific, location-specific, and action-specific groupings. To facilitate planning and implementation of individual soil remediation projects under this SEP, the ARARs/TBCs presented in Table A-2 are grouped as shown on Table A-1.

## TABLE A-1

## GROUPINGS OF ARARS AND TBCS USED IN TABLE A-2

| Presentation Group | Topical Subdivision(s) | Page |
|---|---|---|
| Natural and Cultural Resources | threatened and endangered species protection | A-5 |
| | archeological, historic, and cultural resource protection | A-6 |
| Air Pathway | noise pollution control | A-11 |
| | air emissions | A-11 |
| Surface Water Pathway | floodplain/wetlands protection | A-23 |
| | discharge to surface water | A-30 |
| Groundwater Pathway | groundwater protection | A-34 |
| | wells - construction | A-34 |
| | wells - abandonment | A-34 |
| Soil Remediation | closure of underground storage tanks | A-35 |
| | closure of hazardous waste management units | A-35 |
| | radionuclide concentrations | A-40 |
| | lead concentration | A-43 |
| | PCB concentration | A-43 |
| | certification of cleanup | A-44 |
| Impacted Material Management | definitions and general facility standards | A-45 |
| | management of low-level radioactive waste material | A-59 |
| | management of hazardous remediation waste | A-59 |
| | management of PCB-tainted material | A-66 |
| Post-Closure | description of post-closure care | A-68 |
| | modifications to post-closure care plan or period | A-69 |
| | property use restrictions | A-70 |
| | post-closure notice/survey plat | A-71 |
| | deed notation | A-71 |

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# TABLE A-2

## PERTINENT ARARS AND TBCS

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| **NATURAL & CULTURAL RESOURCES** | | | | | | |
| **THREATENED & ENDANGERED SPECIES PROTECTION** | | | | | | |
| Procedures for Implementing the National Environmental Policy Act<br><br>40 CFR §6.302(h)<br><br>10 CFR Part 1021<br><br>Endangered Species Act<br>16 U.S.C. §1531, et seq.<br><br>Endangered and Threatened Wildlife and Plants<br>50 CFR §17.21, §17.31, §17.61, §17.71, and §17.94<br><br>Interagency Cooperation-Endangered Species Act<br>50 CFR §402.01 | All federal agencies must ensure that any action authorized, funded, or carried out by them is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of the constituent elements essential to the conservation of a listed species within a defined critical habitat. Additional requirements apply if it is determined that a proposed activity could adversely affect these species or their habitat. | Appl | Appl | Appl | Findings of 1993-94 updated surveys at the FEMP property:<br>• Populations of the state-listed threatened Sloan's crayfish (*Orconectes sloanii*) are located in sections of Paddy's Run.<br>• Good habitat for the federally-listed endangered Indiana bat (*Myotis sodalis*) exists along Paddy's Run and the storm sewer outfall ditch.<br>• Suitable habitat exists in limited areas for the federal-listed endangered running buffalo clover (*Trifolium stoloniferum*), and only in the northern woodlot for the state-listed threatened spring corralroot (*Corallorhiza wisteriana*).<br>• Marginal habitat for the state-listed endangered cave salamander (*Eurycea lucifuga*) exists in a very limited single area.<br>• Neither habitat nor populations were located for the state-listed endangered mountain bindweed (*Polygonum cilinode*) and slender fingergrass (*Digitaria filiformis*). | Addressed in Section 5.1 of this Sitewide Excavation Plan, and will be addressed in the IEMP's Natural Resource Impact Monitoring Plan (NRIMP); however, DOE does not expect to encounter any federal- or state-listed threatened or endangered species in the area of this remedial action project. |
| Interagency Cooperation-Endangered Species Act<br>50 CFR §402.12(a), (b) | A biological assessment shall evaluate the potential effects of the action on listed and proposed critical habitat and determine whether any such species or habitat are likely to be adversely affected by the action and is used in determining whether formal consultation or a conference is necessary.<br><br>These procedures are required for federal actions that are "major construction activities." | Appl | Appl | Appl | No critical habitat is present on the Fernald property. Updated surveys of the FEMP property in 1993 found marginal habitat for the state-listed endangered cave salamander (*Eurycea lucifuga*) exists in a very limited single area. | See preceding |



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# TABLE A-2
# (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| **THREATENED & ENDANGERED SPECIES PROTECTION, continued** | | | | | | |
| Endangered Species Regulations<br>ORC 1531.25 | No person shall take or possess any native species of wild animal, or any eggs or offspring thereof, that is endangered with state-wide extinction. | Appl | Appl | Appl | Updated surveys of the FEMP property in 1993-94 found populations of the state-listed threatened Sloan's crayfish (*Orconectes sloanii*) in sections of Paddy's Run. | Addressed in Section 5.1 of this Sitewide Excavation Plan, and will be addressed in the IEMP's Natural Resource Impact Monitoring Plan (NRIMP); however, DOE does not expect to encounter any federal- or state-listed threatened or endangered species in the area of this remedial action project. |
| Endangered Species Regulations<br>ORC 1518.02<br>OAC 1501:18-1 | No person shall root-up, injure, destroy, remove, or carry away on or from public highways, public property, or waters of the state, or on or from the property of another, without the written permission of the owner, lessee, or other person entitled to possession, any endangered plant listed in OAC 1501:18-1. | Appl | Appl | Appl | Surveys of the FEMP property in 1994 did not locate populations of the following plants: the federal-listed endangered running buffalo clover (*Trifolium stoloniferum*); the state-listed endangered mountain bindweed (*Polygonum cilinode*) and slender fingergrass (*Digitaria filiformis*); and the state-listed threatened spring corralroot (*Corallorhiza wisteriana*). | Addressed in Section 5.1 of this Sitewide Excavation Plan, and will be addressed in the IEMP's Natural Resource Impact Monitoring Plan (NRIMP); however, DOE does not expect to encounter any federal- or state-listed threatened or endangered species in the area of this remedial action project. |
| **ARCHAEOLOGICAL, HISTORIC AND CULTURAL RESOURCE PROTECTION** | | | | | | |
| Antiquities Act of 1906<br>16 U.S.C. §431 | No person may appropriate, excavate, injure, or destroy any historic or prehistoric ruin or monument, or any object of antiquity situated or controlled by the Government of the United States without an applicable permit. Identification and preservation of cultural resources on federal lands is required, including natural landmarks. | Appl | Appl | Appl | Proposed areas of disturbance associated with the soil remedial action projects will be surveyed and the Advisory Council on Historic Preservation and the State of Ohio Historic Preservation Office (OHPO) will be consulted as agreed upon in the Programmatic Agreements (later entries) with DOE, OHPO, and the Advisory Council. | Appendix F.4 of this Sitewide Excavation Plan |
| Historic Sites Preservation Act<br>16 U.S.C. §461-467 | | √ | Appl | Appl | | |



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## TABLE A-2
## (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| **ARCHAEOLOGICAL, HISTORIC AND CULTURAL RESOURCE PROTECTION, continued** | | | | | | |
| Archaeological Resources Protection Act<br>16 U.S.C. § 470aa-470ll<br><br>Procedures for Implementing the National Environmental Policy Act<br>40 CFR §6.301©<br><br>Protection of Archaeological Resources<br>43 CFR §7.4(a) | Whenever any Federal agency finds, or is notified, in writing, by an appropriate historical or archaeological authority, that its activities in connection with any Federal construction project or federally licensed project, activity, or program may cause irreparable loss or destruction of significant scientific prehistorical, historical, or archaeological data, such agency shall notify the Secretary of the Interior, in writing, and shall provide the Secretary with appropriate information concerning the project, program, or activity.<br><br>No person may excavate, remove, damage, or otherwise alter or deface or attempt to excavate, remove, damage, or otherwise alter or deface any archaeological resource located on public lands unless such activity is pursuant to a permit.<br><br>If an EPA activity may cause irreparable loss or destruction of significant scientific, prehistoric, historic, or archaeological data, the responsible official or the secretary of the Interior is authorized to undertake data recovery and preservation activities. | Appl | Appl | Appl | See preceding. | Appendix F.4 of this Sitewide Excavation Plan |
| National Historic Preservation Act (NHPA)<br>16 U.S.C. §470<br><br>Protection of Historic Properties<br>36 CFR Part 800<br><br>Procedures for Implementing the National Environmental Policy Act<br>40 CFR §6.301(a), (b) | A federal agency (DOE) must take into account the effect of an undertaking on historic properties and accord the Advisory Council on Historic Preservation a reasonable opportunity to comment. Historic properties are defined as any prehistoric or historic district, building, site, structure, or object included in or eligible for inclusion in the National Register of Historic Places. This term includes artifacts, records, and persons released to and located within such properties. Historic properties that are to be substantially altered or demolished must be recorded for future use and reference. The purpose of this Act is not only to protect those properties listed in or eligible for the National Register of Historic Places, but also those properties that have not been listed or formally determined eligible for the listings.<br><br>The heads of all Federal agencies shall assume responsibility for the preservation of historic properties which are owned or controlled by such agency.<br><br>Prior to any Federal undertaking which may directly and adversely affect any National Historic Landmark, the head of the responsible agency shall, to the extent possible, minimize the harm to such landmark. | Appl | Appl | Appl | See preceding. | Appendix F.4 of this Sitewide Excavation Plan |
| Archaeological and Historic Preservation Act<br>16 U.S.C. §469 | Upon discovery that a project may cause the irreparable loss, destruction, significant scientific finding, prehistorical finding, or loss of historical or archaeological data, DOE must notify the Dept. of the Interior in writing and provide appropriate information concerning the project. DOE must, with possible assistance from the OHPO, undertake recovery, protection, and preservation of the data. | √ | Appl | Appl | Met through compliance with NHPA (see preceding entry). | Appendix F.4 of this Sitewide Excavation Plan, the Natural Resources Restoration Plan (NRRP), and the IEMP's Natural Resource Impact Monitoring Plan (NRIMP) |



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# TABLE A-2
## (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **ARCHAEOLOGICAL, HISTORIC AND CULTURAL RESOURCE PROTECTION**, *continued* | | | | | |
| Executive Order 11593, Protection and Enhancement of Cultural Environment<br><br>3 CFR Part 54 | An inventory of a site with potential historic places is required for eligibility in the National Register of Historic Places. | √ | Appl | Appl | See preceding and following entries. | Appendix F.4 of this Sitewide Excavation Plan |
| Programmatic Agreement Regarding Disposition of Facilities under the Operable Unit 3 Record of Decision for Interim Remedial Action at the Fernald Environmental Management Project (January 16, 1996) | • Prepare a report package describing the primary buildings and structures at the FEMP, using existing information to provide information regarding construction details, production process descriptions, design changes, current structural conditions, and current use. The report package is to include written descriptions, photographs, representative engineering drawings, and videotape, as appropriate. If existing documentation is not adequate, additional documentation will be obtained (i.e., additional photographs). Representative support buildings and structures are to be documented with photographs and written summaries as well.<br><br>• Prepare a separate report package describing the FEMP's role in the DOE weapons complex and the significance of the FEMP contribution to the U.S. defense. | | √ | √ | Draft reports have been submitted to the Ohio Historic Preservation Office (OHPO). Once finalized, both documents will be available to the public in the Public Environmental Information Center and archived as appropriate. | See preceding |



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## TABLE A-2
## (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **ARCHAEOLOGICAL, HISTORIC AND CULTURAL RESOURCE PROTECTION**, continued | | | | | |
| Programmatic Agreement Regarding Archaeological Investigations at the Fernald Environmental Management Project (March 6, 1997) | Annual report packages, the first of which must be submitted on July 1,1997, must be submitted to the Ohio Historic Preservation Office (OHPO) and the Advisory Council on Historic Preservation (the Advisory Council) containing the following information:<br>1 .list of all response actions and associated activities initiated within the year reported on;<br>2. map showing locations of above response actions/ associated activities;<br>3. list of response actions/associated activities conducted in previously surveyed (archeological survey) areas;<br>4. a list of surveys which identified no eligible historic properties;<br>5. a list of eligible historic properties that were avoided when implementing response actions and/or associated activities;<br>6. a list of Phase I-III reports generated; and<br>7. a map of locations of areas identified in item 6 and all properties identified.<br><br>DOE-FEMP must also submit any and all Phase I reports generated within the last year, and not previously submitted, with the annual report.<br><br>By September 2, 1997 (within 180 days of the signing of the Programmatic Agreement), submit to the OHPO and the Advisory Council a literature search, examination of aerial photographs, and use of a predictive model for all disturbed and/or contaminated areas of the FEMP (as defined in the Agreement). The predictive model is to utilize existing archeological data from the FEMP and surrounding area to determine the likelihood of additional archeological sites within the contaminated/disturbed areas and the spatial distribution, physical characteristics, and uses. | √ | √ | √ | Draft reports are under preparations for submission to the OHPO and the Advisory Council. Once finalized, the reports will be available to the public in the Public Environmental Information Center and archived as appropriate. | |



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# TABLE A-2
# (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| **ARCHAEOLOGICAL, HISTORIC AND CULTURAL RESOURCE PROTECTION, continued** | | | | | | |
| Native American Graves Protection and Repatriation Act<br>25 U.S.C. §3001 et seq.<br><br>43 CFR Part 10 | Identification and preservation of cultural resources on federal lands is required, including natural landmarks. DOE must consult with appropriate Indian tribes before the intentional excavation or removal after an inadvertent discovery of Native American cultural items including human remains and objects of cultural significance. | Appl | Appl | Appl | DOE will consult with likely culturally affiliated tribes to determine the excavation, treatment, analysis and preparation of any extra reviews, associated funerary objects, unassociated funerary objects, sacred objects, or objects of cultural patrimony. Consultation will be coordinated with NHPA compliance when possible. | Appendix F.4 of this Sitewide Excavation Plan |
| | Provides for the return of human remains and cultural objects from Native American graves to affiliated tribes. | Appl | ✓ | ✓ | | |
| American Indian Religious Freedom Act<br>42 U.S.C. §1996 | Provides for tribal access by native peoples to grave sites and sites of cultural, symbolic, or religious significance. | Appl | Appl | Appl | | Appendix F.4 of this Sitewide Excavation Plan |



000364

# TABLE A-2
# (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| **AIR PATHWAY** | | | | | | |
| | **NOISE POLLUTION CONTROL** | | | | | |
| Noise Control Act, as amended<br>42 U.S.C. §4901, *et seq.*<br><br>Noise Pollution and Abatement Act<br>42 U.S.C. §7641 | The public must be protected from noises that jeopardize health and welfare. | Appl | Appl | R&A | Appropriate engineering controls and best management practices will be implemented so that nuisance noise from vehicles and equipment will be reduced to the maximum practicable extent during conduct of the actions. | Section 5.0 of this Sitewide Excavation Plan |
| | **AIR EMISSIONS** | | | | | |
| Solid Waste and Infectious Waste Regulations,<br><br>Authorized, Limited, and Prohibited Solid Waste Disposal Methods<br>OAC 3745-27-05<br>ORC 3734.03 | Open dumping of solid waste is prohibited [OAC 3745-27-05(C)].<br><br>Solid waste disposal by means of open burning, as defined in OAC 3745-19, is permitted only as provided therein [OAC 3745-27-05(B)]. | Appl | Appl | Appl | | Addressed through the description of the selected remedy in the OU2 ROD (Section 9.0), OU5 ROD (Section 9.0), and OU3 ROD (Section 8.0) |
| Criteria for Classification of Solid Waste Disposal Facilities and Practices,<br>Air<br>40 CFR §257.3-7] | Open burning of residential, commercial, institutional or industrial solid waste is prohibited. This requirement does not apply to infrequent burning of agricultural wastes in the field, silvicultural wastes for forest management purposes, land-clearing debris, diseased trees, debris from emergency clean-up operations, and ordnance [40 CFR §257.3-7]. | √ | √ | Appl | | |
| Open Burning Standards,<br><br>Open Burning in Unrestricted Areas<br>OAC 3745-19-04° | Open burning is allowed for the following purposes [OAC 3745-19-04(C)]:<br><br>• Recognized horticultural, silvicultural, range, or wildlife management practices [OAC 3745-19-04(C)(5)].<br><br>• Disposal of land clearing waste if the following conditions are met [OAC 3745-19-04(C)(4)]:<br>- The fire is set only when atmospheric conditions will readily dissipate contaminants;<br>- The fire does not create a visibility hazard on roadways, railroad tracks, or air fields;<br>- The fire is located at a point on the premises no less than 1000 feet from any inhabited building not located on said premises. | √ | √ | Appl | | |



000365

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# TABLE A-2
# (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **AIR EMISSIONS**, continued | | | | | |
| General Provisions on Air Pollution Control,<br><br>Air Pollution Nuisances Prohibited<br>OAC 3745-15-07<br><br>ORC 3704.01-.05 | Measures shall be taken to adopt and maintain a program for the prevention, control, and abatement of air pollution in order to protect and enhance the quality of the state's air resource so as to promote the public health, welfare, and economic vitality of the people of the state.<br><br>The emission or escape into open air from any source whatsoever of smoke, ashes, dust, dirt, grime, acids, fumes, gases, vapors, odors and combinations of the above in such a manner or in such amounts as to endanger the health, safety, and welfare of the public, or to cause unreasonable injury or damage to property shall be declared to be a public nuisance. It is unlawful for any person to cause, permit, or maintain any such public nuisance. | Appl | Appl | Appl | Only fugitive dust (dirt, flyash, bottom ash) is anticipated from this soil remedial action project.<br><br>Air pollution nuisance prohibitions will be met by employing best management practices for control of fugitive dust. | FEMP Fugitive Dust Control BAT Determination, and Section 5.0 of this Sitewide Excavation Plan |
| ORC 3734.02(I) | No owner or operator of a hazardous waste facility, in the operation of the facility, shall cause, permit, or allow the emission therefrom of any particulate matter, dust, fumes, gas, mist, smoke, vapor, or odorous substances that, in the opinion of the Director [of Environmental Protection, a.k.a., the Director of the OEPA], unreasonably interferes with comfortable enjoyment of life or property by persons living or working in the vicinity of the facility, or that is injurious to public health. Any such action is hereby declared to be a public nuisance. | ✓ | ✓ | R&A | | |
| Particulate Matter Standards,<br><br>Ambient Air Quality Standards<br>OAC 3745-17-02(B), (C), (D)<br><br>[National Primary and Secondary Ambient Air Quality Standards<br>40 CFR §50.6(a), (b), (c)] | The level of the primary and secondary 24-hour ambient air quality standards for particulate matter is a 150 $\mu g/m^3$, 24-hour average concentration [OAC 3745-17-02(C)].<br><br>The level of the primary and secondary annual ambient air quality standards for particulate matter is 50 $\mu g/m^3$, annual arithmetic mean (average) [OAC 3745-17-02(D)].<br><br>Particulate matter shall be measured in the ambient air as $PM_0$ (particles with an aerodynamic diameter less than or equal to a nominal 10 $\mu m$). | Appl | Appl | ✓ | The National Ambient Air Quality Standards (NAAQS) were established as regional goals that states were required to meet and maintain. These ambient air quality standards were never intended, nor are they appropriate, as air quality standards for individual facilities. The methods used by the states to comply with the NAAQS are the State Implementation Plan (SIPs), which include state-level regulations for emission controls or emission standards (included as separate entries). By meeting these pertinent individual requirements, FEMP emissions will not cause an exceedance of the NAAQS/Ohio Ambient Air Quality Standards. | See preceding |



000366

# TABLE A-2
# (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **AIR EMISSIONS**, continued | | | | | |
| Particulate Matter Standards,<br><br>Non-Degradation Policy<br>OAC 3745-17-05 | The significant and avoidable deterioration of air quality in any part of the area where presently existing air quality is better than the particulate ambient air quality standards in OAC 3745-17-02 (described above) shall be prohibited. | Appl | Appl | ✓ | Appropriate control measures will be applied to all construction grading, excavation, loading/unloading and material management activities to reduce fugitive emissions.<br><br>Also see preceding entry. | FEMP Fugitive Dust Control BAT Determination, and Section 5.0 of this Sitewide Excavation Plan |
| Particulate Matter Standards,<br><br>Control of Visible Particulate Emissions from Stationary Sources<br>OAC 3745-17-07(A)(1)(a) | Visible particulate emissions from any point source shall not exceed 20 percent opacity, as a six-minute average, but shall not exceed 60 percent opacity, as a six-minute average, at any time. Transient exceedance limits are included in this regulation. | Appl | Appl | Appl | All point sources associated with a remedial action project (i.e., sludge dewatering, etc.) will employ best available emissions control technologies to mitigate particulate emissions. | As necessary, monitoring requirements will be addressed in the appropriate IRDP. |
| Particulate Matter Standards,<br><br>Control of Visible Particulate Emissions from Stationary Sources<br>OAC 3745-17-07(B)(1) | Visible particulate emissions from any fugitive dust source shall not exceed 20 percent opacity, as a three-minute average. | ✓ | ✓ | ✓ | Appropriate control measures will be applied to all construction grading, excavation, loading/unloading and material management activities to reduce fugitive emissions. | See preceding |



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# TABLE A-2
## (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **AIR EMISSIONS**, continued | | | | | |
| Particulate Matter Standards,<br><br>Control of Visible Particulate Emissions from Stationary Sources<br>OAC 3745-17-07 (B)(4), (5), (6) | There shall be no visible particulate emissions from any paved roadway or paved parking area except for a period of time not to exceed six minutes during any 60-minute observation period.<br><br>There shall be no visible particulate emissions from any unpaved roadway or unpaved parking area except for a period of time not to exceed 13 minutes during any 60-minute observation period.<br><br>There shall be no visible particulate emissions from any material storage piles except for a period of time not to exceed 13 minutes during any 60-minute observation period. | Appl | R&A | ✓ | Appropriate control measures will be applied to all construction grading, excavation, loading/unloading and material management activities to reduce fugitive emissions. | FEMP Fugitive Dust Control BAT Determination, and Section 5.0 of this Sitewide Excavation Plan |
| Particulate Matter Standards,<br><br>Restriction of Emission of Fugitive Dust<br>OAC 3745-17-08(B) | No person shall cause or permit any fugitive dust source to be operated; or any materials to be handled, transported, or stored; or a building (or its appurtenances) or a road to be used, constructed, altered, repaired, or demolished without taking or installing reasonably available control measures to prevent fugitive dust from becoming airborne. Such reasonably available control measures shall include, but are not limited to, one or more of the following which are appropriate to minimize or eliminate visible particulate emissions of fugitive dust.<br><br>• The use of water or other suitable dust suppression chemicals for the control of fugitive dust from the demolition of existing buildings or structures, construction operations, the grading of roads, or the clearing of land; or<br><br>• The periodic application of asphalt, oil, water, or other suitable dust suppression chemicals on dirt or gravel roads and parking lots, and any other surfaces that may cause emissions of fugitive dust. | Appl | R&A | Appl | This requirement is applicable only to certain cities in Butler and Hamilton Counties.<br><br>Appropriate control measures will be applied to all construction grading, excavation, loading/unloading and material management activities to reduce fugitive emissions. | FEMP Fugitive Dust Control BAT Determination, and Section 5.0 of this Sitewide Excavation Plan |



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## TABLE A-2
## (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **AIR EMISSIONS**, continued | | | | | |
| Particulate Matter Standards,<br><br>Restrictions on Particulate Emissions from Industrial Processes<br>OAC 3745-17-11 | The following are restrictions for particulates from any operation, process, or activity which releases or may release particulate emissions into the ambient air. These limits are based on the weight of material being processed.<br><br>Process Weight at Maximum Capacity (lb/hr) — Allowabke Particulate Emission Rate (lb/hr)<br>100 — 0.551<br>200 — 0.877<br>400 — 1.40<br>600 — 1.83<br>800 — 2.22<br>1000 — 2.58<br><br>*These limits do not apply to generation of fugitive dust* subject to OAC 3745-17-08 (listed above). | Appl | | R&A | All point sources associated with a remedial action project (i.e., sludge dewatering, etc.) will employ best available emissions control technologies to mitigate particulate emissions. | See preceding |
| Ambient Air Quality Standards for Non-methane Hydrocarbons<br>OAC 3745-21-02(C), -03(D) | The ambient air quality guidelines for nonmethane hydrocarbons is a maximum three hour arithmetic mean concentration of 160 $\mu g/m^3$, not to be exceeded between the hours of six and nine a.m.<br><br>Hourly and three-hour concentrations must be determined in accordance with prescribed methods. | | Appl | | The National Ambient Air Quality Standards (NAAQS) were established as regional goals that states were required to meet and maintain. These ambient air quality standards were never intended, nor are they appropriate, as air quality standards for individual facilities. The methods used by the states to comply with the NAAQS are the State Implementation Plan (SIPs), which include state-level regulations for emission controls or emission standards. By meeting these pertinent individual requirements, FEMP emissions will not cause an exceedance of the NAAQS/Ohio Ambient Air Quality Standards. | See 5.0 of this Sitewide Excavation Plan |



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# TABLE A-2
## (Continued)

| Citation | Requirement | | | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|---|---|
| | **AIR EMISSIONS**, continued | | | | | | | |
| National Primary and Secondary Ambient Air Quality Standards<br>40 CFR §50.12 | The ambient air quality standards for lead shall be a maximum arithmetic mean of 1.5 micrograms per cubic meter during any calendar quarter. | | | R&A | R&A | | See preceding. | See preceding |
| Ohio Lead Emissions, Ambient Air Quality Standards—Lead<br>OAC 3745-71-02(A) | | | | | | | | |
| National Primary and Secondary Ambient Air Quality Standards<br>40 CFR Part 50 | The following are the primary National Ambient Air Quality Standards (NAAQS): | | | R&A | | | Note that other NAAQSs are presented in preceding entries. See preceding. | |
| | Criteria Pollutant | Primary Standard | Averaging Time | | | | | |
| | Carbon Monoxide | 9 ppm | 8-hour | R&A | | | | |
| | | 35 ppm | 1-hour | | | | | |
| | Nitrogen Dioxide | 0.053 ppm | Annual | R&A | | | | |
| | Ozone | 0.12 ppm | 1-hour | R&A | | | | |
| | Sulfur oxides | 0.03 ppm | Annual | R&A | | | | |
| | | 0.14 ppm | 24-hour | | | | | |



000370

# TABLE A-2
# (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **AIR EMISSIONS**, continued | | | | | |
| Permit to Install New Sources of Pollution<br>OAC 3745-31-05 (A)(3) | The installation or modification and operation of an air contaminant source, solid waste disposal facility, water pollution source, disposal system, land application of sludge, or public water system, must employ the best available technology.<br><br>The terms used in the above are defined in OAC 3745-15-01, unless otherwise defined in OAC 3745-31-01. | R&A | Appl | R&A | Appropriate control measures will be applied to all construction grading, excavation, loading/unloading and material management activities to reduce fugitive emissions.<br><br>All point sources associated with a remedial action project (i.e., sludge dewatering, etc.) will employ best available emissions control technologies to mitigate particulate emissions. | FEMP Fugitive Dust Control BAT Determination, and Section 5.0 of this Sitewide Excavation Plan |
| Standards of Performance for New Stationary Sources, Subpart OOO—Standards of Performance for Nonmetallic Mineral Processing Plants<br>40 CFR §60.672(a), (d), (e) | No owner or operator shall cause to be discharged into the atmosphere from a crusher any emissions which:<br>• Contain particulate matter in excess of 0.05 grams per dry cubic meter at standard conditions (g/dscm); and<br>• Exhibit greater than 7 percent opacity<br><br>Truck dumping of nonmetallic minerals into any crusher is exempt from these requirements. | R&A | ✓ | | It is not anticipated that a crusher will be used during this remedial action project.<br><br>All point sources associated with a remedial action project (i.e., sludge dewatering, etc.) will employ best available emissions control technologies to mitigate particulate emissions. | See preceding |



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# TABLE A-2
# (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **AIR EMISSIONS**, continued | | | | | |
| 40 CFR Part 61, Subpart M-National Emission Standard for Asbestos,<br><br>Standard for Waste Disposal for Manufacturing, Fabrication, Demolition, Renovation, and Spraying Operation<br>40 CFR §61.150 | (a) Discharge no visible emissions to the outside air during the collection, processing, packaging, or transporting of any asbestos-containing waste material, or use one of the emission control methods specified in paragraphs (a)(1) through (4) of this section:<br><br>(1) Adequately wet asbestos-containing material. After wetting, seal all asbestos-containing waste material in leak-tight containers while wet; or, put materials that will not fit into containers without additional breaking into leak-tight wrapping. Label the containers or wrapped materials in accordance with 29 CFR 1910.1001(j)(2) or 1926.58(k)(2)(iii). ...<br><br>(4) Use an alternative emission control and waste treatment method that has received prior approval from the Administrator.<br><br>(5) As applied to demolition and renovation, the requirements above under paragraph (a) of this section do not apply to Category I non-friable ACM waste and Category II non-friable ACM waste that did not become crumbled, pulverized, or reduced to powder. | ✓ | ✓ | Appl | | See preceding |



000372

# TABLE A-2
## (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **AIR EMISSIONS**, continued | | | | | |
| Asbestos Emission Control,<br><br>Standard for Active Asbestos Disposal Sites<br>OAC 3745-20-06(A)&(B)<br><br>[40 CFR Part 61, Subpart M-National Emission Standard for Asbestos,<br><br>Standard for Active Waste Disposal Sites, 40 CFR §61.154] | (A) Each owner or operator of an active asbestos waste disposal site shall cause or permit no visible emissions [of asbestos] to the outside air; or shall comply with the requirements of paragraph (B) of this rule.<br><br>(B) Rather than meet the no visible emissions requirement of paragraph (A) of this rule, each owner or operator of an active asbestos waste disposal site shall comply with the following:<br><br>(1) There shall be no visible emissions from asbestos-containing waste materials during the on-site transportation, transfer, deposition or compacting operations.<br><br>(2) Deposition and burial operations shall be conducted in a manner which prevents handling by equipment or persons that causes asbestos-containing waste materials to be broken-up or dispersed before the materials are buried.<br><br>(3) As soon as practicable after deposition of the asbestos-containing waste materials but no later than at the end of each operating day, the asbestos-containing waste material deposited at the site during the operating day shall be buried with at least twelve inches of compacted nonasbestos-containing material. Alternatively, any owner or operator of an active asbestos waste disposal site may apply for approval of the Director [of Environmental Protection, a.k.a. Director of the OEPA] to utilize alternative control measures to bind dust, control wind erosion or convert [friable] asbestos to non-friable forms.<br><br>(4) During the unloading, deposition, burial, and initial compaction of asbestos-containing materials, the owner or operator of the active [asbestos] waste disposal site shall establish a restricted area adequate to deter the unauthorized entry of the general public and any unauthorized personnel from any location within one hundred feet of the operations, and shall display the following information on a sign not less than twenty by fourteen inches, so that it is visible before entering the restricted area:<br><br>ASBESTOS DUST HAZARD<br>Do Not Remain In Area Unless Your Work Requires It<br>Breathing Asbestos Dust Is Hazardous To Your Health | ✓ | ✓ | Appl | Pertinent to the management of asbestos-containing materials.<br><br>Also note that requirements from paragraphs (A) and (B) which are pertinent to disposal of asbestos-containing materials, are included in the OSDF Impacted Materials Placement Plan..<br><br>NOTE:<br>The sizing & language for warning signs under (B)(4) at left conflicts with that required by OSHA under 29 CFR §1926.1101(k)(7).<br><br>The FEMP will follow the OSHA requirements.<br><br>Sign language:<br><br>DANGER<br><br>ASBESTOS<br><br>CANCER & LUNG DISEASE HAZARD<br><br>AUTHORIZED PERSONNEL ONLY<br><br>OSHA does not impose a minimum sign size. | Section 2.5 and Appendix F of this Sitewide Excavation Plan |



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# TABLE A-2
## (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **AIR EMISSIONS**, continued | | | | | |
| Asbestos Emission Control,<br><br>Standard for Inactive Asbestos Disposal Sites<br>OAC 3745-20-07°<br><br>[40 CFR Part 61, Subpart M-National Emission Standard for Asbestos,<br><br>Standard for Inactive Waste Disposal Sites, for Asbestos Mills and Manufacturing and Fabricating Operations<br>40 CFR §61.151] | The owner or operator may use an alternate control method that has received prior approval of the Director [of Environmental Protection, a.k.a. Director of the OEPA] rather than comply with the requirements of paragraph (A) [emissions and cover requirements] or (B) [posting and access control requirements] of this rule. | ✓ | ✓ | Appl | These requirements for inactive asbestos waste disposal sites are very similar to those for active asbestos waste disposal sites under OAC 3745-20-06 (preceding entry). During soil remediation activities under this remedial action project, the requirements for active asbestos disposal sites (preceding entry) will be followed while managing friable asbestos-containing material.<br><br>Also note that requirements pertinent to disposal of asbestos-containing materials under paragraphs (A) and ° of OAC 3745-20-07 are included in the OSDF Impacted Materials Placement Plan. | Section 2.5 and Appendix F of this Sitewide Excavation Plan |



000374

# TABLE A-2
# (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **AIR EMISSIONS**, continued | | | | | |
| Asbestos Emission Control,<br><br>Standard for Inactive Asbestos Disposal Sites<br>OAC 3745-20-07(D)<br><br>[40 CFR Part 61, Subpart M-National Emission Standard for Asbestos,<br><br>Standard for Inactive Waste Disposal Sites for Asbestos Mills and Manufacturing and Fabricating Operations,<br>40 CFR §61.151(d)] | Each owner or operator of an inactive asbestos waste disposal site shall notify the Director [of Environmental Protection, a.k.a. the Director of the OEPA] in writing prior to disturbing or removing any asbestos-containing waste material. The notice shall contain: | ✓ | ✓ | ✓ | Submission of the project-specific IRDPs to OEPA constitute this notification. | |
| | • the reason for disturbing the waste, | | | | | The reason for disturbing the material is documented in the OU2, OU5 and OU3 RODs. |
| | • the procedures to be used to control emissions, | | | | | FEMP Fugitive Dust Control BAT Determination, Section 5.0 of this Sitewide Excavation Plan, and the OSDF Impacted Materials Placement Plan. |
| | • the duration of the operation, and | | | | Project schedules contained in project-specific IRDPs. | |
| | • the location of the final disposal site. | | | | | The OSDF, unless the OSDF WAC is not met; else, an off-site permitted/licensed disposal facility. |



000375

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# TABLE A-2
## (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **AIR EMISSIONS**, continued | | | | | |
| National Emission Standards for Hazardous Air Pollutants, Subpart H—National Emission Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities, 40 CFR §61.90, §61.91 and §61.92 - .97<br><br>[Radiation Protection of the Public and the Environment<br><br>DOE Order 5400.5 Chapter II (1)(b)] | Emissions of radionuclides (except radon-220 and radon-222) to the ambient air from DOE facilities shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent of 10 mrem/yr.<br><br>To determine compliance with the standard, radionuclide emissions shall be determined and effective dose equivalent values to members of the public calculated using EPA-approved sampling procedures, computer models CAP-88 or AIRDOS-PC, or other procedures for which EPA has granted prior approval. | Appl | Appl | Appl | | Section 6 of the Integrated Environmental Monitoring Plan (IEMP) and Section 5.0 of this Sitewide Excavation Plan |
| National Emission Standards for Hazardous Air Pollutants, Subpart Q—National Emission Standards for Radon Emissions From Department of Energy Facilities 40 CFR §61.190, §61.192 | No source at a DOE facility shall emit more than 20 pCi/m²/sec of radon-222 as an average for the entire source into the air. | Appl | Appl | R&A | The existing distribution of contaminants within the site soils attains compliance with this requirement.<br><br>Will be addressed sitewide as necessary by the Integrated Environmental Monitoring Plan (IEMP). | |



000376

## TABLE A-2
## (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| **SURFACE WATER PATHWAY** | | | | | | |
| | **FLOODPLAIN/WETLANDS PROTECTION** | | | | | |
| Executive Order 11990, Protection of Wetlands | Federal agencies are required to take action to avoid adversely impacting wetlands wherever possible, to minimize wetland destruction, and to preserve the values of wetlands. | Appl | Appl | | Floodplain and wetland impacts associated with soil remediation activities will be minimized and avoided to the maximum extent practicable. Projects with unavoidable impacts will be undertaken in accordance with 33 CFR Parts 323 and 330. | Approximately 35.9 acres of jurisdictional wetlands and 8.9 acres of waters of the United States were identified on the FEMP property as a result of the 1993 Jurisdictional Wetlands & Waters of the U.S. (1993 FEMP Wetland Delineation). The U.S. Army Corps of Engineers officially approved the delineation on August 19, 1993. See also: Appendix H of the OU2 FS Report; Appendix J of the OU5 FS Report, and Appendix J of OU3 RI/FS.<br><br>The Natural Resources Restoration Plan (NRRP),; also, operable unit closure reports must include NEPA compliance, as per Section 1.4.2 of this Sitewide Excavation Plan. |



000327

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# TABLE A-2
## (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| **FLOODPLAIN/WETLANDS PROTECTION**, continued | | | | | | |
| Procedure for Implementing the National Environmental Policy Act<br>40 CFR §6.302(a) | Federal agencies conducting certain activities must avoid, to the extent possible, the adverse impacts associated with the destruction or loss of wetlands, and avoid support of new construction in wetlands when a practicable alternative exists. | Appl | Appl | | | NRRP |
| Executive Order 11988, Floodplain Management<br><br>Procedures for Implementing the National Environmental Policy Act<br>40 CFR §6.302(b) | Federal agencies must evaluate the potential effects of actions they may take in a floodplain to avoid, to the extent possible, adverse effects associated with direct and indirect development of a floodplain. | Appl | Appl | | A wetland/floodplain assessment was conducted. Remediation is needed in the floodplain, and can not be avoided. Nationwide Permit # 38 (subsequent entry) authorizes such remedial activity in a floodplain. The floodplain will not be developed as a result of this federal agency action. | An updated floodplain determination was conducted in October 1992 for Paddy's Run using the U.S. Army Corps of Engineers' standard HEC2 water surface profile analysis program. The 100-year flood elevations reach the western slope of the Inactive Flyash Pile and the toe of the South Field slope. |



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# TABLE A-2
## (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **FLOODPLAIN/WETLANDS PROTECTION**, continued | | | | | |
| DOE Compliance with Floodplain/ Wetlands Environmental Review Requirements<br>10 CFR §1022.3(a), 3(b)(1), 3(b)(2), 3(b)(3), 3(b)(5), 3(b)(6), 3(c), 3(d), 3(e) | DOE shall exercise leadership and take action to:<br>• Avoid to the extent possible the long- and short-term adverse impacts associated with the destruction of wetlands and the occupancy and modification of floodplains and wetlands, and avoid direct and indirect support of floodplain and wetland development wherever there is a practicable alternative.<br>• Incorporate floodplain management goals and wetlands protection considerations into its planning, regulatory, and decision-making processes and shall to the extent practicable:<br>- Reduce the hazard and risk of flood loss.<br>- Minimize the impact of floods on human safety, health, and welfare.<br>- Restore and preserve natural and beneficial values served by the floodplain.<br>- Minimize the destruction, loss, or degradation of wetlands.<br>- Preserve and enhance the natural and beneficial values of wetlands.<br>• Undertake a careful evaluation of the potential effects of any DOE action taken in a floodplain and any new construction undertaken by DOE in wetlands not located in a floodplain.<br>• Identify, evaluate, and as appropriate, implement alternative actions which may avoid or mitigate adverse floodplain/wetlands impacts.<br>• Provide opportunity for early public review of any plans or proposals for actions in floodplains and new construction in wetlands. | Appl | Appl | Appl | 10 CFR Part 1022 is the DOE implementing regulation for Executive Orders 11988 and 11990 (see above).<br>See preceding. | Remediation decisions included avoidance to/ minimization of wetlands impacts. See: Appendix H of the OU2 FS Report; Appendix J of the OU5 FS Report, and Appendix J of OU3 RI/FS.<br>Also, see preceding. |
| DOE Compliance with Floodplain/ Wetlands Environmental Review Requirements<br>10 CFR §1022.5(b), (h) | This part shall apply to all proposed floodplain/wetlands actions, including those sponsored jointly with other agencies, where practicable alternatives to the proposed actions are still available.<br>The policies and procedures of this part which are applicable to floodplain actions shall apply to all proposed actions which occur in a wetlands located in a floodplain. | Appl | Appl | Appl | See preceding. | See preceding. |



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# TABLE A-2
# (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **FLOODPLAIN/WETLANDS PROTECTION**, continued | | | | | |
| DOE Compliance with Floodplain/ Wetlands Environmental Review Requirements<br>10 CFR §1022.11 (a), (b), ° | Concurrent with its review of a proposed action to determine appropriate NEPA requirements, DOE shall determine applicability of the floodplain management and wetlands protection requirements of this part.<br><br>In making a floodplain determination, DOE shall utilize the Flood Insurance Rate Maps (FIRMs) or the Flood Hazard Boundary Maps (FHBMs) prepared by the Federal Insurance Administration of the Department of Housing and Urban Development to determine if a proposed action is located in the base or critical action floodplain, as appropriate. For a proposed action in an area of predominately federal or state land holdings where FIRM or FHBM maps are not available, information shall be sought from the land administering agency (e.g., Bureau of Land Management, Soil Conservation Service, etc.) or from agencies with floodplain analysis expertise. | Appl | Appl | | See preceding. | See preceding. |
| DOE Compliance with Floodplain/ Wetlands Assessments<br>10 CFR §1022.12(a) | If DOE determines, pursuant to 10 CFR §§ 1022.5 and 1022.11, that this part is applicable to the proposed action, DOE shall prepare a floodplain/wetlands assessment, according to the requirements in this section (10 CFR §1022.12). | Appl | Appl | | See preceding. | See preceding. |
| DOE Compliance with Floodplain/ Wetlands Environmental Review Requirements<br>10 CFR §1022.15(a) | If DOE finds that no practicable alternative to locating in the floodplain/wetland is available, consistent with the policy set forth in Executive Order 11988, DOE shall, before taking action, design, or modify its action in order to minimize potential harm to or within the floodplain or wetland. | Appl | Appl | | See preceding. | See preceding. |
| Federal Water Pollution Control Act (a.k.a., Clean Water Act) General Regulatory Policies<br>33 CFR §323.3 | Permits will be required for the discharge of dredged or fill material into waters of the United States including wetlands. Certain discharges specified in 33 CFR Part 330 are permitted by that regulation (nationwide permits).<br><br>If a discharge of dredged or fill material is not permitted by 33 CFR Part 330 (Nationwide Permits), an individual section 404 permit will be required for the discharge of dredged or fill material into waters of the United States.<br><br>Discharges of dredged or fill material into waters of the United States done by or on behalf of any Federal agency, other than the Corps of Engineers, are subject to the authorization procedures of these regulations.<br><br>Remedial actions involving the discharge of dredge and fill material into these areas shall meet the substantive requirements of this section and 40 CFR Part 230. | Appl | <br><br><br><br><br><br><br><br>Appl | | Discharges of dredged and fill material not authorized by a NWP will be conducted in accordance with the substantive requirements of these regulations. | The Natural Resources Restoration Plan (NRRP),; also, operable unit closure reports must include NEPA compliance, as per Section 1.4.2 of this Sitewide Excavation Plan. |



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# TABLE A-2
# (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **FLOODPLAIN/WETLANDS PROTECTION**, continued | | | | | |
| Federal Water Pollution Control Act (a.k.a., Clean Water Act) Nationwide Permit (NWP) Program<br>33 CFR Part 330 | The U.S. Army Corps of Engineers has authorized certain categories of activities involving the discharge of dredged and fill material into wetlands and waters of the United States under the NWP program. Impacts involving the discharge of dredged and fill material will be conducted in accordance with the substantive requirements of applicable NWPs as required. Discharges not authorized by NWP will be conducted in accordance with the substantive requirements of 33 CFR Part 323 and 40 CFR Part 230. | ✓ | Appl | R&A | Approximately 35.9 acres of jurisdictional wetlands and 8.9 acres of waters of the United States have been identified on site. Impacts to these areas will be avoided and minimized to the maximum extent practicable. Discharges of dredged and fill material authorized by NWPs will be conducted in accordance with the substantive requirements of the respective NWPs. | Section s 3.3.1 and 5.0 of this Sitewide Excavation Plan |
| Federal Water Pollution Control Act (a.k.a., Clean Water Act) Nationwide Permit Program<br>33 U.S.C. §1341(a)(1), (d)<br><br>33 CFR §330.1[c] | An activity is authorized under an Nationwide Permit (NWP) only if that activity and the permittee satisfy all of the individual NWP's terms and conditions. Potentially applicable NWPs include:<br><br>• Nationwide Permit #38 — Cleanup of Hazardous and Toxic Waste<br><br>- This permit authorizes specific activities required to affect the containment, stabilization or removal of hazardous or toxic waste materials that are performed, ordered, or sponsored by a government agency with established legal or regulatory authority provided the permittee notifies the district engineer.<br>- For discharges in special aquatic sites, including wetlands, the notification must include a delineation of affected special aquatic sites, including wetlands.<br>- This nationwide permit does not authorize the establishment of new disposal sites or the expansion of existing sites used for the disposal of hazardous or toxic waste. | Appl | Appl | R&A | It is anticipated that these requirements will not be pertinent to many of this remedial action's projects because there will be no discharge of dredged or fill material to waters of the United States, or no impacts to wetlands. | January 17, 1992 letter from Donald R. Schregardus, Director of the OEPA, to the U.S. Army Corps of Engineers, "401 Certification — Grant," the OEPA conditionally certified that projects authorized by NWP #s 38 and 26 will comply with the applicable provisions of the Federal Water Pollution Control Act. |
| | • Nationwide Permit #26 — Headwaters and Isolated Waters Discharges<br><br>- The discharge does not cause the loss of more than 10 acres of waters of the United States.<br>- The permittee notifies the district engineer if the discharge would cause the loss of waters of the United States greater than one acre.<br>- For discharges in special aquatic sites, including wetlands, the notification must also include a delineation of affected special aquatic sites, including wetlands.<br>- The discharge, including all attendant features, both temporary and permanent, is part of a single and complete project. | | | | Effective February 11, 1997, NWP #26 applies only to parcels ≤3 acres; after an 18-24 month phase-down, the U.S. Army Corps of Engineers intends to repeal NWP #26. | |



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# TABLE A-2
# (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **FLOODPLAIN/WETLANDS PROTECTION**, continued | | | | | |
| Federal Water Pollution Control Act (a.k.a., Clean Water Act) Nationwide Permit Program<br><br>Section B(26) to Appendix A of 33 CFR Part 330 | Discharges of dredged or fill material into headwaters and isolated waters [under Nationwide Permit # 26] are approved provided:<br><br>• The discharge does not cause the loss of more than 10 acres of waters of the United States.<br><br>• The permittee notifies the district engineer if the discharge would cause the loss of waters of the United States greater than one acre.<br><br>• For discharges in special aquatic sites, including wetlands, the notification must also include a delineation of affected special aquatic sites, including wetlands.<br><br>• The discharge, including all attendant features, both temporary and permanent, is part of a single and complete project. | ✓ | ✓ | ✓ | See preceding and following entries. | See preceding and following entries. |
| Federal Water Pollution Control Act (a.k.a., Clean Water Act) Nationwide Permit Program<br>33 CFR §330.4 (c)(1)<br><br>Ohio Section 401 State Water Quality Certifications<br>OAC 3745-32-02 | Section 401 State Water Quality Certification pursuant to Section 401 of the Clean Water Act, or waiver thereof, is required to prior to issuance or reissuance of individual or nationwide permits authorizing (dredge and fill) activities which may result in a discharge into waters of the United States. State Water Quality Certification is granted provided:<br><br>1. The discharge does not prevent or interfere with the attainment or maintenance of applicable water quality standards; and<br><br>2. The discharge does not result in a violation of any applicable provisions of the Federal Water Pollution Control Act (a.k.a., Clean Water Act). | Appl | Appl | | It is anticipated that these requirements will not be pertinent to many of the soil remedial action projects because there will be no discharge of dredged or fill material to waters of the United States, or no impacts to wetlands. | January 17, 1992 letter from Donald R. Schregardus, Director of the OEPA, to the U.S. Army Corps of Engineers, "401 Certification — Grant," the OEPA conditionally certified that projects authorized by the NWP #s 38 and 26 (see previous entry) will comply with the applicable provisions of the Federal Water Pollution Control Act. |
| Federal Water Pollution Control Act (a.k.a., Clean Water Act) Nationwide Permit Program<br><br>Section C of Appendix A to 33 CFR Part 330 | In addition to the General Conditions, the following [Section 404 only] conditions apply only to activities that involve the discharge of dredge or fill material and must by followed in order for authorization of the nationwide permits to be valid:<br><br>• No discharge of dredged or fill material may consist of unsuitable material (e.g., trash, debris, car bodies, etc.). And material discharged must be free from toxic pollutants in toxic amounts (see Section 307 of the Clean Water Act).<br><br>• Discharges of dredged or fill material into waters of the United States must be minimized or avoided to the maximum extent practicable at the project site, unless the District Engineer has approved a compensation mitigation plan for the specific regulated activity. | ✓ | ✓ | | | Natural Resources Restoration Plan (NRRP) |



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TABLE A-2
(Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **FLOODPLAIN/WETLANDS PROTECTION**, continued | | | | | |
| Federal Water Pollution Control Act (a.k.a., Clean Water Act) Nationwide Permit Program<br><br>Section C of Appendix A to<br>33 CFR Part 330 | Factors that the District Engineer will consider when determining the acceptability of appropriate and practicable mitigation include, but are not limited to:<br><br>• To be practicable, the mitigation must be available and capable of being done considering costs, existing technology, and logistics in light of overall project purposes.<br><br>• To the extent appropriate, permittees should consider mitigation banking and other forms of mitigation including contribution to wetland trust funds, which contribute to the restoration, creation, replacement, enhancement, or preservation of wetlands.<br><br>• Furthermore, examples of mitigation that may be appropriate and practicable include but are not limited to: reducing the size of the project; establishing buffer zones to protect aquatic resource values; and replacing the loss of aquatic resource values by creating, restoring, and enhancing similar functions and values. In addition, mitigation must address impacts and cannot be used to offset the acreage of wetland losses that would occur in order to meet the acreage limits of some of the nationwide permits. | ✓ | ✓ | | | Natural Resources Restoration Plan (NRRP) |
| Federal Water Pollution Control Act (a.k.a., Clean Water Act) §404<br>(33 U.S.C. §1344)<br><br>Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material,<br>Subpart B—Compliance With the Guidelines, Restrictions on Discharge<br>40 CFR §230.10 | No discharge of dredged or fill material shall be permitted:<br>• If there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as, the alternative does not have other significant adverse environmental consequences.<br>• Unless appropriate and practicable steps have been taken which will minimize potential adverse impacts of the discharge on the aquatic ecosystem.<br><br>No discharge of dredged or fill material shall be permitted if it:<br>• Causes or contributes, after consideration of disposal site dilution and dispersion, to violations of any applicable state water quality standard.<br>• Violates any applicable toxic effluent standard or prohibition under section 307 of the Clean Water Act.<br>• Jeopardizes the continued existence of species listed as endangered or threatened under the Endangered Species Act of 1973, as amended, or results in likelihood of the destruction or adverse modification or a habitat which is determined to be a critical habitat under the Endangered Species Act of 1973, as amended. | Appl | ✓ | ✓ | It is anticipated that these requirements will not be pertinent to many of this remedial action's projects because there will be no discharge of dredged or fill material to waters of the United States, or no impacts to wetlands. | Appendix H of the OU2 FS Report; Appendix J of the OU5 FS Report, and Appendix J of OU3 RI/FS. |



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# TABLE A-2
## (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **DISCHARGE TO SURFACE WATER** | | | | | |
| Pollution to Waters of the State<br>ORC 6111.04 | No person shall cause pollution or place or cause to be placed any sewage, industrial waste, or other wastes in a location where they cause pollution of any waters of the state.<br><br>No person to whom a permit has been issued shall place or discharge, or cause to be placed or discharged, in any waters of the state any sewage, industrial waste, or other wastes in excess of the permissive discharges specified under such existing permit without first receiving a permit from the Director to do so.<br><br>Pollution to waters of the state is prohibited. | Appl | Appl | R&A | | FEMP Site NPDES Permit Number 1IO00004*ED, the Stormwater Pollution Prevention Plan, and Section 5.0 of this Sitewide Excavation Plan. |
| Compliance with Ohio Water Pollution Control Requirements<br>ORC 6111.07(A), ° | Failure to comply with water pollution control requirements is prohibited. | ✓ | Appl | Appl | | See preceding |
| Water Quality Standards,<br><br>Criteria Applicable to All Waters<br>OAC 3745-1-04 | To every extent practical and possible, all surface waters of the State of Ohio shall be free from:<br><br>• Suspended solids or other substances that enter the waters as a result of human activity that will form putrescent or otherwise objectionable sludge deposits<br>• Floating debris, oil, scum and other floating materials entering the waters as a result of human activity in amounts sufficient to be unsightly or cause degradation<br>• Materials entering the waters as a result of human activity producing color, odor or other conditions in such a degree as to create a nuisance<br>• Substances entering the waters as a result of human activity in concentrations that are toxic or harmful to human, animal or aquatic life and/or are rapidly lethal in the mixing zone<br>• Nutrients entering the waters in concentrations that create nuisance growths of aquatic weeds or algae | ✓ | R&A | R&A | | FEMP Site NPDES Permit Number 1IO00004*ED and the FEMP Stormwater Pollution Prevention Plan.<br><br>Section 4 of the Integrated Environmental Monitoring Plan (IEMP); Section 5.1.3 of this Sitewide Excavation Plan. |
| Water Quality Standards,<br><br>Antidegradation Policy<br>OAC 3745-1-05(A)&(B) | (A) Existing instream water uses as defined in OAC 3745-1-07 [subsequent entry] shall be maintained and protected. No further water quality degradation which would interfere with or become injurious to designated uses is allowable.<br><br>(B) Waters in which existing water quality is better than the criteria prescribed in these rules and exceeds those levels necessary to support propagation of fish, shellfish and wildlife and recreation in and on the water shall be maintained and protected. ... Degradation of water quality shall not interfere or become injurious to existing or planned uses, and the Director shall require that ... feasible management or regulatory programs pursuant to Section 208 and 303 of the Act [Clean Water Act], 33 U.S.C. Sections 1288 and 1313, be applied to nonpoint sources. | ✓ | ✓ | Appl | Soil remedial action projects will ensure that existing instream water uses of the Great Miami River and Paddy's Run will be maintained as health protective. | FEMP Site NPDES Permit Number 1IO00004*ED, FEMP Stormwater Pollution Prevention Plan, Section 4 of the Integrated Environmental Monitoring Plan (IEMP), and Section 5.0 of this Sitewide Excavation Plan. |



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## TABLE A-2
## (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **DISCHARGE TO SURFACE WATER**, continued | | | | | |
| Water Quality Standards,<br><br>Great Miami River<br>OAC 3745-1-21 | Paddy's Run and the Great Miami River are designated as:<br>• Warm water aquatic life habitat<br>• Agricultural and industrial water supply<br>• Primary contact recreation | Appl | Appl | Appl | Discharges to the Great Miami River and Paddy's Run must not cause a violation of applicable numeric or narrative water quality standards for these designations.<br><br>The Great Miami River between Ross Road (RM 95.7) to Taylorsville Dam (RM 92.6) is a state resource water, and RM 130 and 118 are public water supplies.<br><br>The FEMP effluent discharge pipe, located at River Mile (RM) 24.73 on the Great Miami River, is downstream of the state resource waters and public water supplies. | FEMP Site NPDES Permit Number 1IO00004*ED and the FEMP Stormwater Pollution Prevention Plan.<br><br>Section 4 of the Integrated Environmental Monitoring Plan (IEMP). |
| National Pollutant Discharge Elimination System<br>40 CFR §122.26(a)(l)(ii),<br>40 CFR §122.26(b)(14)(v), (x) | A discharge composed entirely of storm water associated with industrial activity is required to obtain a NPDES permit.<br><br>These categories of facilities are considered to be engaging in "industrial activity":<br><br>• Landfills, land application sites, and open dumps that receive or have received any industrial wastes (waste that is received from any of the facilities described under this subsection), including those that are subject to regulation under Subtitle D of RCRA; and<br><br>• Construction activities including clearing, grading, and excavation that disturbs five acres or more of total land area. | Appl | Appl | Appl | Discharges of stormwater associated with industrial and/or construction activities are regulated in accordance with the existing FEMP NPDES Permit, and the FEMP Stormwater Pollution Prevention Plan. | FEMP Site NPDES Permit (Ohio EPA Number 1IO00004*ED, and the FEMP Stormwater Pollution Prevention Plan, and Section 5.0 of this Sitewide Excavation Plan. |
| Ohio NPDES Permits,<br><br>Ohio NPDES Permits Required<br>OAC 3745-33-02(A) | No person may discharge any pollutant or cause, permit, or allow a discharge of any pollutant [from a point source] without applying for and obtaining an Ohio NPDES permit in accordance w with the requirements of this Chapter, 3745-33. | ✓ | ✓ | ✓ | See preceding and following entries. | FEMP Site NPDES Permit (Ohio EPA Number 1IO00004*ED, and the FEMP Stormwater Pollution Prevention Plan (RM-0039). |



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# TABLE A-2
# (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **DISCHARGE TO SURFACE WATER**, continued | | | | | |
| Ohio NPDES General Permits,<br><br>Ohio NPDES Permit Required<br>OAC 3745-38-02(A) | No person may discharge any pollutant or cause, permit, or allow a discharge of any pollutant from a point source without either applying for and obtaining an Ohio NPDES permit in accordance w with the requirements of Chapter 3745-33 of the Administrative Code [preceding entry], ... or have authorization to discharge under an Ohio NPDES general permit in accordance with the requirements of this chapter [3745-38].<br><br>NOTE: In September 1992, the FEMP applied for an individual stormwater permit to cover its industrial stormwater discharges to Paddy's Run. On the basis of the information provided in the original FEMP Stormwater Permit Application , Ohio EPA has chosen to regulate FEMP site industrial stormwater discharges under the individual permit process (OAC 3745-33, preceding entry), by incorporating stormwater monitoring requirements at Paddy's Run into the NPDES Permit. The site NPDES permit also addresses discharges of stormwater associated with construction activities by requiring a Stormwater Pollution Prevention Plan that defines the manner in which these discharges will be managed. | ✓ | ✓ | ✓ | In accordance with the note at left, the general permitting process described in OAC 3745-38 is not applicable to the FEMP site stormwater discharges. Rather, these are regulated within the context of the existing FEMP NPDES permit and Stormwater Pollution Prevention Plan, both of which derive their regulatory basis from OAC 3745-33 (preceding entry). | See preceding. |
| Rules and Regulations of the Hamilton County Soil and Water Conservation District Governing Earthwork for Unincorporated Hamilton County, Ohio | Temporary and/or permanent erosion and sediment control features and devices shall be designed and constructed in general accordance with the State of Ohio Temporary Erosion Control Specifications.<br><br>*Exempted* from these requirements are:<br><br>• *any public work performed by or under control of any governmental agency*, provided such operations do not cause instability of any adjacent or contiguous property and substantially equivalent sediment control policies are applied [3.10 E].<br><br>• *operations involving process and stockpiling of soils or rock materials where controlled by other regulations*, provided such operations do not cause instability of any adjacent or contiguous property [3.10 H]. | ✓ | TBC | TBC | | FEMP Site NPDES Permit Number 1IO00004*ED, and the FEMP Stormwater Pollution Prevention Plan, and Appendix F and Section 5.0 of this Sitewide Excavation Plan |



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# TABLE A-2
# (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **DISCHARGE TO SURFACE WATER**, continued | | | | | |
| Federal Water Pollution Control Act (a.k.a., Clean Water Act)<br><br>Subpart K—Best Management Practices (BMP) Programs<br>40 CFR §125.104 | BMP programs shall be developed in accordance with good engineering practices and:<br>1) Be documented in narrative form and include any necessary plot plans, drawings or maps;<br>2) Establish specific objectives for the control of toxic and hazardous pollutants:<br>(a) Each facility component or system shall be examined for its potential for causing a release of significant amounts of toxic or hazardous pollutants to waters of the United States due to equipment failure, improper operation, natural phenomena such as rain or snowfall, etc.<br>(b) Where experience indicates a reasonable potential for equipment failure (e.g., a tank overflow or leakage), natural condition (e.g., precipitation), or other circumstances to result in significant amounts of toxic or hazardous pollutants reaching surface waters, the program should include a prediction of the direction, rate of flow and total quantity of toxic or hazardous pollutants which could be discharged from the facility as a result of each condition or circumstance;<br>3) Establish specific BMPs to meet the objectives identified in (2) above, addressing each component or system capable of causing a release of significant amounts of toxic or hazardous pollutants to the waters of the United States. | | Appl | R&A | BMP requirements will be met by implementing FEMP's BMP Plan. The BMP Plan will be progressively updated to accommodate changing site activities during the conduct of CERCLA remedial actions. | Addressed as part of the selected remedy described in the OU5 ROD.<br><br>FEMP Stormwater Pollution Prevention Plan, and Appendix F and Section 5.0 of this Sitewide Excavation Plan. |



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# TABLE A-2
## (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| **GROUNDWATER PATHWAY** | | | | | | |
| **GROUNDWATER PROTECTION** | | | | | | |
| Safe Drinking Water Act<br>42 U.S.C. §1424(e) | All Federal financially assisted projects constructed in the area of a sole source aquifer and its principal recharge zone will be subject to EPA's review to insure that these projects are designed and constructed so that they do not create a significant hazard to public health. | Appl | Appl | Appl | A notice in 53 FR 15876 (May 4, 1988) designated the Buried Valley Aquifer System of the Great Miami/ Little Miami River Basins of southwestern Ohio as a sole or principal source of drinking water. The Fernald site is located above this aquifer. | EPA and OEPA review of project submittals |
| **WELLS — CONSTRUCTION** | | | | | | |
| Water Well Standards,<br><br>Pumping Wells<br>OAC 3745-9-08° | Pumps may only be primed with potable water. | | Appl | | Pertains to all well pumps that require priming. | The Sitewide CERCLA Quality Assurance Project Plan (SCQ), the Integrated Environmental Monitoring Plan (IEMP), and individual project-specific plans for sampling events. |
| Water Well Standards,<br><br>Monitoring Well Maintenance and Modification<br>OAC 3745-9-09(A) through (C), and (E) through (G) | Monitoring wells must be maintained or modified to avoid cross-contamination of groundwater. | | Appl | | Pertains to all groundwater wells and piezometers. | The Sitewide CERCLA Quality Assurance Project Plan (SCQ), the Integrated Environmental Monitoring Plan (IEMP), and individual project-specific plans for sampling events. |
| **WELLS — ABANDONMENT** | | | | | | |
| Water Well Standards,<br><br>Abandonment of Test Holes and Wells<br>OAC 3745-9-10 | Upon completion of testing, a test hole shall be either completely filled with grout or such other material as will prevent contaminants from entering groundwater.<br><br>If a well [or similar device] containing walls is not being used for obtaining groundwater or for determining the quality, quantity, or level of groundwater, it shall be completely filled with grout or other similar material as will prevent contaminants from entering groundwater, or maintained in strict accordance with all applicable requirements of OAC 3745-9-09. | | Appl | Appl | After they are no longer needed, wells, peizometers and lysimeters are to be properly plugged and abandoned in accordance with these requirements. | The Sitewide CERCLA Quality Assurance Project Plan (SCQ), the Integrated Environmental Monitoring Plan (IEMP), and IRDPs. |



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# TABLE A-2
## (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| **SOIL REMEDIATION** | | | | | | |
| **CLOSURE OF UNDERGROUND STORAGE TANKS** | | | | | | |
| General Requirements<br><br>OAC 1301:7-7-36<br><br>40 CFR §§280.61 through .66 | Owner or operators of petroleum or hazardous substance underground storage tank (UST) systems must, in response to a confirmed release from the UST system, comply with abatement measures, site characterization, product removal, investigations for soil and groundwater cleanup, and corrective action plan, except for USTs excluded under 40 CFR §280.10(b) and UST systems subject to RCRA Subtitle C corrective action requirements under Section 3004(u) of RCRA, as amended. | | Appl | ✓ | Risk-based closures are to be performed for USTs with media contamination as integrated with the CERCLA soil remediation activities. | Risk-based soil cleanup levels, known as FRLs, are established in the RODs.<br>Following sections of this SEP:<br>2.1.1.2<br>2.2.5<br>3.3.4.5<br>4.0 |
| **CLOSURE OF HAZARDOUS WASTE MANAGEMENT UNITS** | | | | | | |
| OEPA Closure Plan Review Guidance for RCRA Facilities (Interim Final)<br>September 1, 1993 | Federal Regulations of May 2, 1986 (50 FR 16422) and March 19, 1987 (52 FR 8704) modified the closure performance standard such that risk assessment, or what constitutes "decontamination" of a site, may be considered by EPA as a closure option. On December 8, 1988 (see OAC 3745-67-28), the OEPA adopted the equivalent of the EPA's March 19, 1987 regulations, clarifying that risk assessment may be a closure option. It is OEPA and its Division of Hazardous Waste Management (DHWM) practice to consider risk assessment/risk-based closure as a possible third option for closure for all types of units [hazardous waste management units (HWMUs) and solid waste management units (SWMUs)]. | | TBC | ✓ | Risk-based closures are to be performed for HWMUs with media contamination as integrated with the CERCLA soil remediation activities. | Risk-based soil cleanup levels, known as FRLs, are established in the RODs. |



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# TABLE A-2
## (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| **CLOSURE OF HAZARDOUS WASTE MANAGEMENT UNITS**, continued | | | | | | |
| RCRA/CERCLA Integrated Closure Director's Final Findings and Orders (June 4, 1996)<br><br>Section V.1 | The Respondent ... shall comply with the closure regulations contained in OAC rules 3745-66-11(A) and (B), 3745-66-11° as applicable, 3745-66-14, and 3745-66-16 through 3745-66-20 as applicable for the HWMUs [hazardous waste management units] listed in Attachment A [to these Orders]. | | ✓ | ✓ | Pertinent to closures of HWMUs listed in Attachment A therein during the CERCLA soil remediation activities. | See subsequent entries in this table for those OAC rules determined by the RODs as ARARs. While OAC 3745-66-11 and -14 are presented in the next two entries, entries for 3745-66-16 through -20 for post-closure are addressed in the subsequent post-closure subsection of this table. |
| Closure and Post-Closure Under Interim Standards<br><br>Closure Performance Standard<br>OAC 3745-66-11<br><br>[40 CFR §265.111] | The owner or operator shall close his facility or hazardous waste management unit (HWMU) in a manner that:<br><br>(A) minimizes the need for further maintenance;<br><br>(B) controls, minimizes, or eliminates, to the extent necessary to protect public health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere; and<br><br>° complies with these closure requirements. | ✓ | Appl | Appl | Pertinent to closures of HWMUs during the CERCLA soil remediation activities; also cited in RCRA/CERCLA Integrated Closure DF&O @ V.1.<br><br>**NOTE:** These requirements are the same as those for new hazardous waste facilities under OAC 3745-55-11 (40 CFR §264.111). | Following sections of this SEP:<br>2.1.1.1<br>2.2.4<br>3.3.4.4<br>4.0 |



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# TABLE A-2
# (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **CLOSURE OF HAZARDOUS WASTE MANAGEMENT UNITS, continued** | | | | | |
| Closure and Post-Closure Under Interim Standards<br><br>Disposal or Decontamination of Equipment, Structures and Soils OAC 3745-66-14<br><br>[40 CFR §265.114] | During the partial and final closure periods, all contaminated equipment, structures, and soils must be properly disposed of or decontaminated [to risk-based cleanup levels] [i.e., clean closed, have risk-based closure, or be closed in place], unless otherwise specified in:<br><br>OAC 3745-66-97<br>Closure and Post-Closure Under Interim Standards: [Tank System] Closure and Post-Closure Care<br><br>OAC 3745-67-28<br>Surface Impoundments: Closure and Post-Closure Care<br><br>OAC 3745-67-58<br>Surface Impoundments: [Waste Piles] Closure and Post-Closure Care<br><br>OAC 3745-67-80<br>Surface Impoundments: [Land Treatment Facility] Closure and Post-Closure<br><br>OAC 3745-68-10<br>Landfills, Incinerators, Thermal Treatment, Miscellaneous Units: Closure and Post-Closure | ✓ | Appl | Appl | Pertinent to closures of HWMUs during the CERCLA soil remediation activities; also cited in RCRA/CERCLA Integrated Closure DF&O @ V.1.<br><br>**NOTE:** These requirements are the same as those for new hazardous waste facilities under OAC 3745-55-14 (40 CFR §264.114), with corresponding cross-references presented therein. | Risk-based soil cleanup levels, known as FRLs, are established in the RODs.<br>Following sections of this SEP:<br>2.1.1.1<br>2.2.4<br>3.3.4.4<br>4.0 |
| Closure and Post-Closure Under Interim Standards: [Tank System] Closure and Post-Closure Care<br>OAC 3745-66-97(A) and (B)<br><br>[40 CFR §265.197] | At closure of a tank system HWMU, the owner or operator must remove or decontaminate [to risk-based cleanup levels] all waste residues, contaminated containment system components (liners, etc.), contaminated soils, and structures and equipment contaminated with waste.<br><br>If the owner or operator demonstrates that not all contaminated soils can be practically removed or decontaminated [to risk-based cleanup levels], he must close the HWMU and perform post-closure care in accordance with the closure and post-closure care requirements that apply to landfills under OAC 3745-68-10 (40 CFR §264.310). | | R&A | Appl | Pertinent to closures of tank system HWMUs during the CERCLA soil remediation activities.<br><br>**NOTE:** These requirements are the same as those for new hazardous waste facilities under OAC 3745-55-97 (40 CFR §264.197). | Risk-based soil cleanup levels, known as FRLs, are established in the RODs.<br>Following sections of this SEP:<br>2.1.1.1<br>2.2.4<br>3.3.4.4<br>4.0 |



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# TABLE A-2
## (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **CLOSURE OF HAZARDOUS WASTE MANAGEMENT UNITS**, continued | | | | | |
| Surface Impoundments: [Surface Impoundments] Closure and Post-Closure Care<br>OAC 3745-67-28 | At closure of a surface impoundment HWMU, the owner or operator must remove or decontaminate [to risk-based cleanup levels] all waste residues, contaminated waste containment system components (liners, etc.), contaminated subsoils, and structures and equipment contaminated with waste and leachate.<br><br>If the owner or operator demonstrates that not all contaminated soils can be practically removed or decontaminated [to risk-based cleanup levels], he must close the HWMU and perform post-closure care in accordance with the closure and post-closure care requirements that apply to landfills under OAC 3745-66-10 to 3745-66-20 and OAC 3745-68-10 (40 CFR §264.310). | | ✓ | ✓ | Pertinent to closures of surface impoundment HWMUs during the CERCLA soil remediation activities, as cited in a preceding entry..<br><br>**NOTE:** These requirements are the same as those for new hazardous waste facilities under OAC 3745-56-28 (40 CFR §264.228). | Risk-based soil cleanup levels, known as FRLs, are established in the RODs.<br>Following sections of this SEP:<br>2.1.1.1<br>2.2.4<br>3.3.4.4<br>4.0 |
| Surface Impoundments: [Waste Piles] Closure and Post-Closure Care<br>OAC 3745-67-58(A) and (B) | At closure of a waste pile HWMU, the owner or operator must remove or decontaminate [to risk-based cleanup levels] all waste residues, contaminated containment system components (liners, etc.), contaminated subsoils, and structures and equipment contaminated with waste and leachate.<br><br>If the owner or operator demonstrates that not all contaminated soils can be practically removed or decontaminated [to risk-based cleanup levels], he must close the HWMU and perform post-closure care in accordance with the closure and post-closure care requirements that apply to landfills under OAC 3745-68-10 (40 CFR §264.310). | ✓ | ✓ | ✓ | Pertinent to closures of waste pile HWMUs during the CERCLA soil remediation activities.<br><br>**NOTE:** These requirements are the same as those for new hazardous waste facilities under OAC 3745-56-58 (40 CFR §264.258). | Risk-based soil cleanup levels, known as FRLs, are established in the RODs.<br>Following sections of this SEP:<br>2.1.1.1<br>2.2.4<br>3.3.4.4<br>4.0 |



0003392

# TABLE A-2
## (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **CLOSURE OF HAZARDOUS WASTE MANAGEMENT UNITS**, continued | | | | | |
| Hazardous Waste New Facility Corrective Action, Closure and Post-Closure Requirements<br><br>[Container Storage Area]<br>Closure<br>OAC 3745-55-78<br><br>[40 CFR §264.178] | At closure of a container storage area HWMU, the owner or operator must remove all hazardous waste and hazardous waste residues from the containment system. Remaining containers, liners, bases, and soil containing or contaminated with hazardous waste or hazardous waste residues must be removed or decontaminated [to risk-based cleanup levels]. | ✓ | R&A | ✓ | Pertinent to closures of container storage area HWMUs during the CERCLA soil remediation activities.<br><br>**NOTE:** There are no corresponding requirements for interim status hazardous waste facilities under OAC 3745-65, -66, or -67 (40 CFR Part 265). | Risk-based soil cleanup levels, known as FRLs, are established in the RODs.<br>Following sections of this SEP:<br>2.1.1.1<br>2.2.4<br>3.3.4.4<br>4.0 |
| Landfills, Incinerators, Thermal Treatment, Miscellaneous Units: Closure and Post-Closure<br>OAC 3745-68-10(A)<br><br>[40 CFR §265.310(a)] | At final closure of a HWMU as a landfill ... the owner or operator must cover the HWMU ... with a final cover designed and constructed to:<br><br>• provide long-term minimization of migration of liquids through the closed HWMU;<br>• function with minimum maintenance;<br>• promote drainage and minimize erosion or abrasion of the cover;<br>• accommodate settling and subsidence so that the cover's integrity is maintained; and<br>• have a permeability less than or equal to the permeability of any bottom liner system or natural subsoil present. | ✓ | R&A | ✓ | Pertinent to HWMUs that are "closed in place" — i.e., all contaminated soils can not practically be removed or decontaminated [to risk-based cleanup levels] — during the CERCLA soil remediation process. | Risk-based soil cleanup levels, known as FRLs, are established in the RODs. |
| RCRA/CERCLA Integrated Closure Director's Final Findings and Orders (June 4, 1996)<br><br>Section V.2<br><br>in lieu of<br><br>Closure and Post-Closure Under Interim Standards<br><br>Closure Plan; Amendment of Closure Plan<br>OAC 3745-66-12 | The Respondent ... are hereby exempted from complying with OAC rule 3745-66-12 for the HWMUs identified in Attachment A of these Orders, provided that the Respondent:<br><br>a. Submits the documents contained in Attachment C [of these Orders] to Ohio EPA in accordance with the dates established pursuant to the ACA [Amended Consent Agreement]. Within one week after submitting these documents to Ohio EPA, the Respondent shall submit a cross-reference index which contains pertinent page and section s identifications for each HWMU that is contained in the documents and said index shall be cumulative and reference all previous document locations. ...<br><br>d. Implements the final remedies as reflected in the Records of Decision issued in accordance with the ACA. | | ✓ | ✓ | Pertinent to closures of HWMUs listed in Table 2-1 herein during the CERCLA soil remediation activities. | Section 3.0 of this Sitewide Excavation Plan |



000393

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# TABLE A-2
## (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **RADIONUCLIDE CONCENTRATIONS** | | | | | |
| Radiation Protection of the Public and the Environment<br><br>DOE Order 5400.5 Chapter I (4) and Chapter II (2) | An "as low as reasonably achievable (ALARA)" process is to be used in planning and carrying out all DOE activities that have the potential to cause radiation exposure to the public. ALARA requires judgement with respect to what is reasonably achievable. Factors that relate to societal, technological, economic, and other public policy considerations shall be evaluated to the extent practicable.<br><br>Factors to be considered, at a minimum, include:<br><br>• Maximum dose to members of the public;<br>• Collective dose to the population;<br>• Alternative processes, such as alternative treatment of discharge streams, operating methods, or controls;<br>• Doses for each process alternative;<br>• Cost for each of the technological alternatives;<br>• Examination of the changes in cost among alternatives; and<br>• Changes in societal impact associated with process alternatives (e.g., differential doses from various pathways).<br><br>Except for meeting requirements of NEPA, qualitative analyses are acceptable, in most instances, for ALARA judgements, especially when the potential doses are well below the dose limit. The bases for these judgements should be documented. More detailed analyses should be considered if the decision might result in doses that approach the limit. | TBC | TBC | | In addition to the evaluations conducted as part of the CERCLA selection of remedy process (the short- and long-term risk assessments of the Comprehensive Remedial Action Risk Evaluation (CRARE) within the feasibility studies (FSs)), documentation of "equivalent evaluations" for environmental ALARA are performed in accordance with the "FEMP Environmental ALARA Plan" and retained as part of the site and project records. | Addressed through the approved selected remedy in the RODs. An ALARA goal is set in the OU5 ROD for the total uranium FRL. |
| 10 CFR Part 834 (PROPOSED) | | | TBC | | | |
| Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings,<br><br>Subpart B—Standards for Cleanup of Land and Buildings Contaminated with Residual Radioactive Materials from Inactive Uranium Processing Sites<br>40 CFR §192.12(a)<br><br>Subpart C—Implementa[illegible] | Remedial actions shall be conducted so as to provide reasonable assurance that, as a result of residual radioactive materials, the concentration of radium-226 in land averaged over any area of 100 $m^2$ shall not exceed the background level by more than:<br><br>• 5 pCi/g averaged over the first 15 cm of soil below the surface, and<br><br>• 15 pCi/g, averaged over 15-cm-thick layers of soil more than 15 cm below the surface.<br><br>Compliance with this requirement should be shown through measurements perfo[illegible] within the accuracy of currently available types of field and laboratory instrume[illegible] | R&A | R&A | R&A | Met through the selection of FRLs based on risk assessment, followed by use of certification of cleanup. | The selected remedy in the OU2 and OU5 RODs established more stringent clean-up levels for radium-226 of 1.7 pCi/g, as opposed to 5.0 pCi/g above background. |



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## TABLE A-2
## (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **RADIONUCLIDE CONCENTRATIONS**, continued | | | | | |
| Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings, Subpart C— Implementation 40 CFR §192.21(f) and §192.22(b) | Where radionuclides other than radium-226 and its decay product are present in sufficient quantity and concentration to constitute a significant radiation hazard from residual radioactive materials, remedial actions shall, in addition to satisfying the standards of Subpart A in 40 CFR §192.02 and Subpart B in 40 CFR §192.12 (both listed above), reduce other residual radioactivity to levels that are ALARA. | R&A | R&A | R&A | | The approved selected remedy in the OU5 ROD set an ALARA goal for the total uranium FRL. |
| Postclosure Standards for Uranium and Thorium Mill Tailings, Subpart D— Standards for the Management of Uranium Byproduct Materials Pursuant to Section 84 of the Atomic Energy Act of 1954, as Amended 40 CFR §192.32 (b)(2) | The requirements for the management of uranium byproduct materials after closure of a disposal area [40 CFR §192.32(b)(1)] shall not apply to any portion of a disposal site which contains a concentration of radium-226 in land, averaged over areas of 100 $m^2$, which, as a result of uranium byproduct material, does not exceed the background level by more than the limits specified in 40 CFR §192.12(a) (see above). | R&A | R&A | R&A | | See precedings |
| Management of Thorium Mill Tailings, Subpart E— Standards for the Management of Thorium Byproduct Materials Pursuant to Section 84 of the Atomic Energy Act of 1954, as Amended 40 CFR §192.40 - §192.42 | The following are requirements for the management of thorium byproduct materials:<br>• The provisions for the management of uranium byproduct material (40 CFR §192.32) shall apply to thorium byproduct material and:<br>- Provisions applicable to the element uranium shall also apply to the element thorium<br>- Provisions applicable to radon-222 shall also apply to radon-220<br>- Provisions applicable to radium-226 shall also apply to radium-228<br>With the concurrence of EPA, alternative provisions may be substituted for any of the above requirements provided the alternative provisions will provide at least an equivalent level of protection for human health and environment. | R&A | R&A | R&A | | See precedings |
| Radiation Protection of the Public and the Environment, DOE Order 5400.5 Chapter IV (4)(a) | Guidelines for residual concentrations of radionuclides other than thorium and radium shall be derived from the basic dose limits by means of an environmental pathway analysis using specific property data where available. Procedures for these derivations are given in DOE/CH-8901. Residual concentrations of radioactive material in soil are defined as those in excess of background concentrations averaged over an area of 100 $m^2$. | TBC | | | | Considered in the development of the selected remedy in the OU2 and OU5 RODs. |



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# TABLE A-2
# (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **RADIONUCLIDE CONCENTRATIONS**, continued | | | | | |
| Radiation Protection of the Public and the Environment,<br><br>DOE Order 5400.5 Chapter IV (4)(a)(1)<br><br>10 CFR Part 834 (PROPOSED) | If the average residual concentration of radionuclides in any surface or below- surface area less than or equal to 25 $m^2$ exceeds the limit or guideline by a factor of $(100/A)^{0.5}$ [where A is the area (in square meters) of the region in which the concentrations are elevated], limits for "hot spots" shall also be developed and applied.<br><br>Procedures for calculating these hot spots limits, which depend on the extent of the elevated local concentrations, are given in DOE/CH-8901. In addition, reasonable efforts shall be made to remove any source of radionuclide that exceeds 30 times the appropriate limit in the soil, irrespective of the average concentration in the soil. | TBC | TBC | | | Considered in the development of the selected remedy in the OU2 and OU5 RODs. |
| Radiation Protection of the Public and the Environment,<br><br>DOE Order 5400.5 Chapter IV (4)(a)(2)(3)<br><br>10 CFR Part 834 (PROPOSED) | The generic guidelines for residual concentrations of radium-226, radium-228, thorium-230, and thorium-232 are:<br><br>• 5 pCi/g, averaged over the first 15 cm of soil below the surface; and<br><br>• 15 pCi/g, averaged over 15-cm-thick layers of soil more than 15 cm below the surface.<br><br>These guidelines take into account ingrowth of radium-226 from thorium-230 and of radium-228 from thorium-232, and assume secular equilibrium. If both thorium-230 and radium-226, or both thorium-232 and radium-228, are present and not in secular equilibrium, the appropriate guideline is applied as a limit for the radionuclide with the higher concentration. If other mixtures of radionuclides occur, the concentrations of individual radionuclides shall be reduced so that either the dose for the mixture will not exceed the basic dose limit or the sum of the ratios of the soil concentration of each radionuclide to the allowable limit for that radionuclide will not exceed 1. Explicit formulas for calculating residual concentrations guidelines for mixtures are given in DOE/CH-8901. | TBC | TBC | | Included as it is more restrictive than the federal standard in 40 CFR §192, .02, .12(a), .20, .21(f), .22(b), .32(b)(2), .40-.42. | Considered in the development of the selected remedy in the OU2 and OU5 RODs. |
| Guidelines for Residual Radioactive Material—Surface Contamination<br><br>DOE Order 5400.5 Chapter IV (4)(d)<br><br>10 CFR Part 834 (PROPOSED) | These generic surface contamination guidelines are applicable to existing structures and equipment. These guidelines are generally consistent with standards of the NRC (1982) and functionally equivalent to Section 4, "Decontamination for Release for Unrestricted Use," of Regulatory Guide 1.86, but apply to nonreactor facilities. These limits apply to both interior equipment and building components that are potentially salvageable or recoverable scrap. If a building is demolished, the guidelines in paragraph IV (6)(a) are applicable to the resulting contamination in the ground. | | TBC | | Will be used for any process facility building or structures built and/or used for the remedial action, including the AWWT, soil staging, etc. | The operable unit closure reports identified in Section 7.4 of this Sitewide Excavation Plan. |



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# TABLE A-2
## (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **LEAD CONCENTRATION** | | | | | |
| Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities, OSWER Directive # 9355.4-12 (July 14, 1994) | EPA recommends using 400 ppm soil lead as a screening level for lead in soil for residential scenarios at CERCLA sites and at RCRA Corrective Action sites. Residential areas with soil lead below 400 ppm generally require no further action. Site-specific preliminary remediation goals (PRGs) at CERCLA sites and media cleanup standards at RCRA corrective action facilities for residential land use are described. | TBC | TBC | | Applies only to the South Field Firing Range. | The selected remedy in the OU2 and OU5 RODs established this value as the lead FRL. |
| | **PCB CONCENTRATION** | | | | | |
| Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution In Commerce, And Use Prohibitions, Subpart A— Applicability, Definitions 40 CFR §761.3 | PCB materials which appear at concentrations less than 50 ppm are excluded from the PCB disposal requirements in this regulation. | R&A | √ | R&A | Operable Unit 2 does not contain PCB materials which have a concentration greater than 50 ppm. | Section 3.0 of this Sitewide Excavation Plan |
| Subpart G— PCB Spill Cleanup Policy, Requirements for PCB Spill Cleanup 40 CFR §761.125° | PCBs at a concentration of greater than 50 ppm are subject to TSCA decontamination requirements in 40 CFR §761.120(b).<br><br>Soil in restricted access areas contaminated by a PCB spill shall be cleaned to 25 ppm PCBs by weight [40 CFR §761.125(c)(3)(v)]. At such times as restricted access areas (other than outdoor electrical substations) are converted to another use, the spill site shall be cleaned up to the non-restricted access area requirements of 40 CFR §761.125(c)(4)(v).<br><br>Soils in non-restricted access areas contaminated by a PCB spill shall be cleaned to 10 ppm PCBs by weight, provided that the soil is excavated to a minimum depth of 10 inches. The excavated soil will be replaced with clean soil (i.e., containing less than 1 ppm PCBs by weight), and the spill site will be restored (e.g., replacement of turf) [40 CFR §761.125(c)(4)(v)]. | | TBC | TBC | Soil containing PCBs will be excavated as necessary to attain FRLs; soil concentrations are expected to be less than 50 ppm by weight. | The OU5 ROD established FRLs for the PCBs Arochlor-1254 and Arochlor-1260 as 0.13 mg/kg (ppm by weight). |
| Subpart G— PCB Spill Cleanup Policy, Sampling Requirements 40 CFR §761.130 | Criteria that the EPA uses to determine the adequacy of the cleanup of spills resulting from the release of regulated PCB materials at concentrations of ≥50 ppm by weight. Applies to spills which occur after May 4, 1987. | | | TBC | Applies to spills of regulated PCB materials (i.e., those that have a concentration ≥50 ppm by weight) that occurred after May 4, 1987. | See preceding. |



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# TABLE A-2
## (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **CERTIFICATION OF CLEANUP** | | | | | |
| Methods for Evaluating the Attainment of Cleanup Standards, Volume 1: Soils and Solid Media<br>EPA 230/02-89-042<br>NTIS PB89-234959<br>February 1989 | This EPA guidance document describes methods for testing whether soil chemical concentrations at a site are statistically below a cleanup standard or ARAR. If it can be reasonably concluded that the remaining soil or treated soil at a site has concentrations that are statistically less than relevant cleanup standards then the site can be judged protective of human health and the environment. | TBC | ✓ | | | |
| RCRA/CERCLA Integrated Closure Director's Final Findings and Orders<br>(June 4, 1996)<br><br>Section V.4<br><br>in lieu of<br><br>Closure and Post-Closure Under Interim Standards<br><br>Certification of Closure<br>OAC 3745-66-15 | For the HWMUs identified in Attachment A of these Orders, the Respondent ... are hereby exempted from complying with OAC rule 3745-66-15 provided that they submit Remedial Action Reports for the HWMUs contained in operable units 1, 3, and 5 within sixty (60) days from completion of remedial activities at each operable unit, which is determined by the U.S. EPA, in accordance with CERCLA. These Remedial Action Reports shall certify that the HWMUs contained in operable units 1 and 3 have been closed, and that the environmental media in operable unit 5 has been managed, in accordance with the final remedies contained in the Records of Decision and in accordance with the Director's closure performance standards. Attachment C [of these Orders] summarizes the documents that will be provided during remediation process. These CERCLA documents contain the substantive requirements of the RCRA and Ohio hazardous waste closure regulations. | | ✓ | ✓ | Pertinent to closures of HWMUs listed in Attachment A therein (Table 2-1 herein) during the CERCLA soil remediation activities. | Section 3 of this Sitewide Excavation Plan. |



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# TABLE A-2
## (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| **IMPACTED MATERIAL MANAGEMENT** | | | | | | |
| | **DEFINITIONS & GENERAL FACILITY STANDARDS** | | | | | |
| Resource, Conservation, and Recovery Act<br>42 U.S.C. §6903 (27) | Solid waste means any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations and from community activities, but does not include source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954. | Appl | ✓ | ✓ | | Section 3.0 and Appendix F of this Sitewide Excavation Plan |
| Solid Waste and Infectious Waste Regulations,<br><br>Definitions<br>OAC 3745-27-01 (B)(40) | Solid wastes means such unwanted residual solid or semisolid material as results from industrial, commercial, agricultural, and community operations, *excluding earth or material from construction, mining, or demolition operations, or other waste materials of the type that would normally be included in demolition debris, nontoxic flyash, spent nontoxic foundry sand, and slag and other substances that are not harmful or inimical to public health,* and includes, but is not limited to, garbage, tires, combustible and noncombustible material, street dirt, and debris.<br><br>Solid waste does not include any material that is an infectious waste or a hazardous waste.<br><br>For the purpose of this definition, "semisolid material" does not contain liquids which can be readily released under normal climatic conditions, as determined by method 9095 (paint filter liquids test) in SW-846: "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods". | Appl | ✓ | ✓ | | See preceding |
| Solid Waste and Infectious Waste Regulations,<br><br>Definitions<br>OAC 3745-27-01 (B)(15)<br>OAC 3745-27-30 (A), (E), (H)<br><br>ORC 3734.021 (A)(1)(c), (d) | Infectious waste is defined by nine categories of waste including human blood specimens and blood products, sharp wastes used in the treatment or inoculation of human beings, and any other waste materials generated in the diagnosis, treatment, or immunization of human beings.<br><br>A generator who places all sharp infectious wastes and all unused hypodermic needles, syringes, and scalpel blades into a "SHARPS" container before they are transported and who generates less than 50 lbs. of infectious wastes each month and does not hold a certificate of registration as a generator of infectious wastes may transport and dispose of infectious wastes in the same manner as solid wastes.<br><br>Treated infectious wastes can be transported and disposed in the same manner as noninfectious waste.<br><br>Infectious waste that is also radioactive shall be managed in accordance with applicable Ohio Department of Health and U.S. Nuclear Regulatory Commission regulations. | Appl | ✓ | | | See preceding |



000399

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# TABLE A-2
## (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **DEFINITIONS & GENERAL FACILITY STANDARDS, continued** | | | | | |
| Identification and Listing of Hazardous Waste,<br><br>Definition of Hazardous Waste<br>OAC 3745-51-03(A)<br><br>[Identification and Listing of Hazardous Waste, Subpart A—General, Definition of Hazardous Waste<br>40 CFR §261.3(a)] | A solid waste is a hazardous waste, if:<br><br>(1) it is not excluded from regulation as a hazardous waste under OAC 3745-51-04(B) [40 CFR §261.4(b)]; and<br><br>(2)(a) it exhibits any of the characteristics of hazardous waste identified in OAC 3745-51-20 to 3745-51-24, with certain exceptions noted therein; or<br><br>(2)(b) it is listed as hazardous waste in OAC 3745-51-31 to 3745-51-33 [40 CFR §§ 261.30 - 261.35]; or<br><br>(2)(c) it is a mixture of solid and hazardous wastes;<br><br>(2)(d) it is a mixture of hazardous wastes as defined in OAC 3745-51-03(A)(2)(a) to 3745-51-03(A)(2)(c) [three previous bullets in this entry] and source material, special nuclear material, or by product material, as defined by the Atomic Energy Act of 1954, as amended, 42 U.S.C. 2011 et seq., or other radionuclides. However, only the hazardous components of the mixture are subject to regulation for purposes of this [OAC 3745-51] chapter. | Appl | ✓ | ✓ | | See preceding |
| Identification and Listing of Hazardous Waste,<br><br>Exclusions<br>OAC 3745-51-04(B)(4)<br><br>[Identification and Listing of Hazardous Waste, Subpart A—General, Exclusions<br>40 CFR §261.4(b)(4)] | The following are not hazardous wastes: fly ash waste, bottom ash waste, slag waste, and flue gas emission control waste generated primarily from the combustion of coal or other fossil fuels. | Appl | ✓ | ✓ | | See preceding |



000600

# TABLE A-2
## (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **DEFINITIONS & GENERAL FACILITY STANDARDS**, continued | | | | | |
| Identification and Listing of Hazardous Wastes,<br><br>Requirements for Recyclable Materials OAC 3745-51-06(A)(3)<br><br>[40 CFR §261.6] | The following recyclable materials are not subject to regulation under rules 3745-50-40 to 3745-50-62 or Chapters 3745-52 to 3745-57 and 3745-65 to 3745-69 of the Ohio Administrative Code [Parts 262 through 266 or 268, 270, or 124 of 40 CFR], and are not subject to the notification requirements of Chapter 3734 of the Ohio Revised Code [Section 3010 of RCRA]:<br><br>(b) used batteries (or used battery cells) returned to a battery manufacturer for regeneration;<br><br>• used oil that exhibits one or more of the characteristics of hazardous waste but is recycled in some other manner than being burned for energy recovery;<br><br>(d) scrap metal. | ✓ | ✓ | Appl | Pertinent to remediation generated materials. Recycling of remediation generated materials may be conducted. | Operable Unit 3 Integrated RD/RA Work Plan |
| Termination of Operating Licenses for Nuclear Reactors<br><br>Section C.4 Decontamination for Release for Unrestricted Use<br><br>U.S. Nuclear Regulatory Commission Regulatory Guide 1.86<br>(June 1974) | A reasonable effort shall be made to eliminate residual surface radiological contamination and to achieve the acceptable surface contamination levels stated in this guide. | ✓ | ✓ | TBC | Pertinent to releasing to off-site any potentially radiologically-contaminated materials.<br><br>Radiation surveys will be performed prior to releasing any potentially radiologically-contaminated materials off-site to demonstrate compliance with the surface contamination levels stated in this guide. | Operable Unit 1 Design Criteria Package |
| Identification and Listing of Hazardous Waste, Subpart A—General, Definition of Hazardous Waste<br>40 CFR §261.3 | Debris means solid material exceeding a 60-mm particle size that is intended for disposal and that is a manufactured object, plant or animal matter, or natural geologic material. | ✓ | Appl | Appl | Applicable to hazardous debris that will be disposed of off-site. | Operable Unit 1 Design Criteria Package |



000401

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# TABLE A-2
# (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **DEFINITIONS & GENERAL FACILITY STANDARDS**, continued | | | | | |
| Land Disposal Restrictions, Subpart A—General, Definitions Applicable to This Part<br>40 CFR §268.2 | Hazardous debris means debris that contains a listed hazardous waste, or that exhibits a characteristic of hazardous waste. | ✓ | Appl | Appl | "contains a listed hazardous waste" portion is not applicable to on-property disposal within a CAMU under the CAMU Rule as invoked under the OU5 ROD. | Section 1.3.2.6 of this Sitewide Excavation Plan |
| Hazardous Waste Regulations<br><br>Contained-In Policy<br><br>58 FR 48092<br>(September 14, 1993)<br>Proposed rule.<br><br>58 FR 59976<br>(November 12, 1993)<br>Notice to extend comment.<br><br>59 FR 10778<br>(March 8, 1993)<br>Clarification, partial withdrawal. | Hazardous soil means soil that contains RCRA hazardous waste(s) listed in Subpart D of 40 CFR Part 261, or that exhibits one or more of the characteristics of a hazardous waste as defined in Subpart C of 40 CFR Part 261.<br><br>This proposed rule recommends contained-in determinations for hazardous debris, hazardous soil and other environmental media.<br><br>Any person may petition the Regional Administrator to exclude, under 261.3(f)(2) or 261.3(g) of this chapter, hazardous debris and hazardous soil or other environmental media, including but not limited to groundwater, surface water, and sediment, from regulation as hazardous waste. The petition for a contained-in determination must include information sufficient to demonstrate that specific constituent concentrations in the hazardous debris, hazardous soil, or other environmental media to be excluded do not pose a hazard to human health and the environment at that site. (Such a petition is not necessary for remedial actions conducted pursuant to RCRA or CERCLA authorities provided that a similar determination is made by the Regional Administrator based on substantially equivalent information including public notice and comment requirements). | | TBC | TBC | Will be considered for managing treated soil that is contaminated with RCRA waste. | Addressed in the selected remedy in the OU5 ROD.<br><br>The strategy identified in Section 3.3 and Appendix F of this Sitewide Excavation Plan. |
| Ohio Petroleum Contaminated Soil Policy<br>OEPA Policy<br>PP.01-03-200 | The basis of the "contained in" policy is that environmental media, such as soil or groundwater, are not considered to be waste material. Because they are not a solid waste, the mixture rule, as set forth in OAC 3745-51-03, does not apply when they become contaminated with a listed hazardous waste but only contains the waste.<br><br>The result of this policy is that if the waste constituents can be removed, the soil is no longer considered to contain a hazardous waste. Therefore, since soil is not a waste material it does not have to be de-listed in order for it to be used for its intended purpose. However, as long as the soil contains the waste material, it must be managed as a hazardous waste.<br><br>If this concept is applied to petroleum-contaminated soil, the soil containing a petroleum hydrocarbon would not need to be managed as a solid waste if the contaminants were removed. | TBC | TBC | | Allows for treated/ clean soil to be used as backfill. Thus, all soil below FRLs can be backfilled as clean soil. | Addressed as part of the selected remedy in the OU5 ROD. Appendix F of this Sitewide Excavation Plan |



000402

# TABLE A-2
## (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **DEFINITIONS & GENERAL FACILITY STANDARDS**, continued | | | | | |
| Hazardous Waste Management System: General, Subpart B—Definitions<br>40 CFR §260.10 | Remediation waste means all solid and hazardous waste, and all media (including groundwater, surface water, soils, and sediments) and debris, which contain listed hazardous wastes or which themselves exhibit a hazardous waste characteristic, that are managed for the purpose of implementing corrective action requirements under 40 CFR §264.101 and RCRA section 3008(h). For a given facility, remediation wastes may originate only from within the facility boundary, but may include waste managed in implementing RCRA sections 3004(v) or 3008(h) for releases beyond the facility boundary. | R&A | ✓ | ✓ | Under the Consent Agreement as amended in 1991 (a.k.a., the ACA), remediation at the FEMP is conducted under the authorities of CERCLA as well as RCRA sections 3004(v) and 3008(h). | Section 1.0 of this Sitewide Excavation Plan |
| CERCLA Compliance with Other Laws Manual Section 2.7 | Placement/disposal of waste does not occur under the following circumstances:<br>• waste is consolidated within a unit (including an area of contamination that can be viewed as a single unit);<br>• waste is capped in place, including grading prior to capping;<br>• waste is treated in situ; and<br>• waste is processed within the unit in order to improve its structural stability for closure or for movement of equipment over the area. | TBC | ✓ | TBC | | OU5 FS Report and ROD |



000403

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# TABLE A-2
# (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **DEFINITIONS & GENERAL FACILITY STANDARDS**, continued | | | | | |
| Corrective Action Management Unit<br><br>Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities,<br>Subpart S-<br>40 CFR §264.552<br>(58 FR 865829, February 16, 1993) | For the purpose of implementing remedies under Sec. 264.101 or RCRA Section 3008(h), the EPA Regional Administrator may designate an area at the facility as a corrective action management unit (CAMU). One or more CAMUs may be designated at a facility under the following conditions:<br>1) Emplacement of remediation wastes into or within a CAMU does not constitute land disposal of hazardous wastes.<br>2) Consolidation or emplacement of remediation wastes into or within a CAMU does not constitute creation of a unit subject to minimum technology requirements.<br>3) The CAMU shall facilitate the implementation of reliable, effective, protective, and cost-effective remedies.<br>4) Waste management activities associated with the CAMU shall not create unacceptable risks to humans or to the environment resulting from exposure to the wastes.<br>5) The CAMU shall include uncontaminated areas of the facility only if including such areas for the purpose of managing remediation waste is more protective than management of such wastes at contaminated areas of the facility.<br>6) Areas within the CAMU, where wastes remain in place after closure of the CAMU, shall be managed and contained so as to minimize future releases, to the extent practicable.<br>7) The CAMU shall expedite the timing of remedial activity implementation, when appropriate and applicable.<br>8) The CAMU shall enable the use, when appropriate, of treatment technologies (including innovative technologies) to enhance the long-term effectiveness of remedial actions by reducing the toxicity, mobility, or volume of wastes that will remain in place after closure of the CAMU.<br>9) The CAMU shall, to the extent practicable, minimize the land area of the facility upon which wastes will remain in place after closure of the CAMU.<br>The owner/operator shall provide sufficient information to enable the Regional Administrator to designate a CAMU in accordance with the criteria in Sec. 264.552.<br>**Note:** RCRA regulated units (HWMUs) within a CAMU are fully subject to RCRA closure regulations. | R&A | Appl | R&A | Per the selected remedy in the OU5 ROD:<br>• the FEMP site (bounded by its property boundaries) is designated as a CAMU;<br>• consolidation or management of on-site remediation wastes into or within the CAMU does not constitute creation of a unit subject to minimum technology requirements (MTRs) [OAC 3745-68-101 and 40 CFR §265.301(a)] and does not invoke land disposal restrictions (LDRs)[OAC 3745-59 and 40 CFR§§268.40 through .44]. | Section 9.1.8 of the OU5 ROD. |



000404

# TABLE A-2
## (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **DEFINITIONS & GENERAL FACILITY STANDARDS**, continued | | | | | |
| Generator Standards,<br><br>Hazardous Waste Determination<br>OAC 3745-52-11(A) through (F)<br><br>[Standards Applicable to Generators of Hazardous Waste, Subpart A—General, Hazardous Waste Determination<br>40 CFR §262.11] | A person who generates a solid waste must determine if that waste is a hazardous waste using the following method:<br><br>1) First determine if the waste is excluded from regulation (not a solid waste) under OAC 3745-51-04 (40 CFR §261.4). | ✓ | R&A | R&A | | Section 3.3 of this Sitewide Excavation Plan. |
| | 2) If the waste is not excluded from regulation, then determine if the waste is listed as a waste ("listed waste") in OAC 3745-51-30 to 3745-51-33 (Subpart D of 40 CFR Part 261). | | | | Not pertinent for on-site disposal because of the CAMU rule (see preceding entry); pertinent for off-site treatment or disposal. | See preceding |
| | 3) For purposes of complying with OAC 3745-59 (40 CFR Part 268), or if the waste is not a "listed waste" per step 2 above, then determine if the waste is a "characteristic waste" as identified in OAC 3745-51-20 through 3745-51-24 (Subpart C of 40 CFR Part 261), by either (a) testing the waste using appropriate methods, or (b) applying knowledge of the hazardous characteristic of the waste in light of the materials or processes used ("process knowledge"). | | | | Per the RODs, pertinent only to the following areas:<br><br>In OU2:<br>approx. 300 cubic yards of lead-containing soil in the South Field Firing Range.<br><br>In OU5:<br>1) Abandoned sump west of Pilot Plant;<br>2) Area between KC-2 Warehouse and RR tracks;<br>3) Trap Range;<br>4) Paddy's Run streambank fill materials west of OU4's Silos 1-4;<br>5) Scrap Metal Pile area; and<br>6) Area north of maintenance building. | Sections 7.4 (@ p. 7-5), 9.1 (@ p. 9-2), and 10.2.2 (@ p. 10-4) of the OU2 ROD; Section 9.1.1 (@ p. 9-6) and Table 9-1 of the OU5 ROD |



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# TABLE A-2
## (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **DEFINITIONS & GENERAL FACILITY STANDARDS**, continued | | | | | |
| Interim [Status Hazardous Waste Facility] Standards —General Provisions,<br><br>General Provisions OAC 3745-65-13 through -16<br><br>[Interim Status Hazardous Waste Facility Standards, Subpart B—General Facility Standards 40 CFR §§265.13 through .16] | Owners/operators of a facility must obtain chemical and physical analyses of a representative sample of each hazardous or nonhazardous waste to be treated, stored or disposed of at the facility prior to treatment, storage or disposal. At a minimum, the analysis must contain all the information which must be known to treat, store or dispose of the waste, and may include using existing published or documented data on the waste or on waste generated from similar processes ("process knowledge") [OAC 3745-65-13]. | ✓ | R&A | R&A | Pertinent to management of hazardous waste. | Section 3.0 and Appendix F of this Sitewide Excavation Plan and IRDPs. |
| | The facility owner/operator must prevent the unknowing entry, and minimize the possibility of unauthorized entry, to the active portion of the facility unless certain conditions apply [OAC 3745-65-14]. | | | | Controls which limit access to the FEMP will remain in place throughout remediation activities. | |
| | The facility operator must maintain and inspect all monitoring equipment, safety and emergency equipment, security devices, and operating and structural equipment that are important to preventing human health hazards. The frequency of inspection may vary by item, and should be based on the rate of possible deterioration of the equipment/item and the probability of an environmental or human health incident if the deterioration, malfunction, or operator error goes undetected [OAC 3745-65-15]. | | | | | |
| | The facility operator must train personnel for procedures relevant to the positions in which they are employed [OAC 3745-65-16]. | | | | | |
| Hazardous Waste Facility Environmental Impact<br><br>ORC 3734.05(D)(6)(c) | A hazardous waste facility installation and operation permit shall not be approved unless it is proven that the facility represents the minimum adverse environmental impact, considering the state of available technology, the nature and economics of various alternatives and other pertinent considerations | ✓ | Appl | ✓ | **NOTE:** Incorrectly cited in RODs as OAC 3745.05(D)(6)(c). | Appendix H of OU2 FS, Appendix J of OU5 FS, and Appendix J of OU3 RI/FS. |



000406

## TABLE A-2
## (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **DEFINITIONS & GENERAL FACILITY STANDARDS**, continued | | | | | |
| Hazardous Waste Facility Minimum Risk<br><br>ORC 3734.05(D)(6)(d) | A hazardous waste facility installation and operation permit shall not be approved unless it is proven that the facility represents the minimum risk of all the following:<br><br>1) contamination of groundwater and surface water;<br>2) fires or explosions from treatment, storage, or disposal methods;<br>3) accidents during transportation;<br>4) impact to public health and safety;<br>5) air pollution; and<br>6) soil contamination. | ✓ | Appl | ✓ | **NOTE:** Incorrectly cited in RODs as OAC 3745.05(D)(6)(d). | OU2, OU5, and OU3 FS Reports and RODs.<br><br>Also, see preceding. |
| Interim [Status Hazardous Waste Facility] Standards—General Provisions,<br><br>Preparedness and Prevention<br>OAC 3745-65-31 through -35, and -37<br><br>[Interim Status Hazardous Waste Facility Standards, Subpart C—Preparedness and Prevention<br>40 CFR §§265.31 through .35, and .37] | TSD facility operators must design, construct, maintain and operate facilities to minimize the possibility of fire, explosion or any unplanned sudden or non-sudden release of hazardous waste to air, soil, or surface water which might threaten human health or the environment. | ✓ | R&A | R&A | | See two preceding entries.<br><br>For waste that is dispositioned for off-site disposal, see the Operable Unit 1 Design Criteria Package. |



000407

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# TABLE A-2
# (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **DEFINITIONS & GENERAL FACILITY STANDARDS**, continued | | | | | |
| Interim [Status Hazardous Waste Facility] Standards—General Provisions,<br><br>Contingency Plan and Emergency Procedures<br>OAC 3745-65-51, -52, -55 and -56<br><br>[Interim Status Hazardous Waste Facility Standards, Subpart D—Contingency Plan and Emergency Procedures<br>40 CFR §265.51, .52, .55 and .56] | Each facility operator must have a contingency plan designed to minimize hazards to human health and the environment due to fires, explosions, or any unplanned releases of hazardous waste constituents to air, soil or surface/groundwater. | ✓ | R&A | R&A | Pertinent to on-site facilities that treat, store, or dispose of hazardous waste. | FEMP Emergency Plan (PL-3020); all HWMUs identified in Table 2-1 herein are addressed in Section G: Contingency Plan of the RCRA Part B Permit Application.<br>Also, see three preceding entries.<br><br>For waste that is dispositioned for off-site disposal, see the Operable Unit 1 Design Criteria Package. |
| Hazardous Waste Incinerators [and Miscellaneous Units],<br><br>Environmental Performance Standards<br>OAC 3745-57-91 and -92<br><br>[Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities,<br>Subpart X—Miscellaneous Units,<br>40 CFR §§264.601 through .603] | Prevention of any release that may have adverse effects on human health or the environment includes, but is not limited to:<br><br>A. Migration of waste constituents in the groundwater or subsurface environment.<br><br>B. Migration of waste constituents in surface water, or wetlands or on the soil surface.<br><br>C. Migration of waste constituents in the air.<br><br>Monitoring, tests, analytical data, inspections, response, and reporting procedures and frequencies must ensure compliance with pertinent portions of the OAC. | ✓ | R&A | ✓ | Pertinent to on-site facilities that treat, store, or dispose of hazardous waste in miscellaneous units unless the CAMU Rule is applied. | See preceding |



000408

## TABLE A-2
## (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **DEFINITIONS & GENERAL FACILITY STANDARDS**, continued | | | | | |
| Radioactive Waste Management<br><br>DOE Order 5820.2A Chapter III (3)(d) | Low-level waste shall be characterized with sufficient accuracy to permit proper segregation, treatment, storage, and disposal. This characterization shall ensure that, upon generation after processing, the actual physical and chemical characteristics and major radionuclide content are recorded and known during all stages of the waste management process.<br><br>Waste characterization data shall be recorded on a waste manifest and shall include:<br><br>• the physical and chemical characteristics of the waste;<br>• volume of the waste (total of waste and any solidification or absorbent media);<br>• weight of the waste (total of waste and any solidification or absorbent media);<br>• major radionuclides and their concentrations; and<br>• packaging date, package weight, and external volume. | TBC | ✓ | TBC | The CERCLA RI/FS process established the nature and extent of contamination at the FEMP. During excavation, monitoring will be performed in accordance with of this Sitewide Excavation Plan and individual IRDPs, and results will be documented in order to determine if impacted material meets the OSDF WACs or offsite WACs. These sources of characterization information (RI/FS sampling, pre-design investigations, FRL attainment, WAC attainment) will provide the required manifest information. | Addressed throughout the CERCLA RI/FS and selection of remedy process, culminated in the OU2, OU5 and OU3 RODs; OSDF Impacted Materials Placement Plan; Section 3.3 of this Sitewide Excavation Plan, and individual IRDPs. |



000409

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# TABLE A-2
## (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **DEFINITIONS & GENERAL FACILITY STANDARDS**, continued | | | | | |
| Waste Treatment<br><br>DOE Order 5820.2A Chapter III (3)(f) | Waste treatment techniques such as incineration, shredding, and compaction to reduce volume and provide more stable waste forms shall be implemented as necessary to meet performance requirements. Use of waste treatment techniques to increase the life of the disposal facility and improve the long-term facility performance, by improved site stability and reduction of infiltrating water, is required to the extent it is cost effective.<br><br>The development of large scale waste treatment facilities shall be supported by the appropriate National Environmental Policy Act documentation.<br><br>Operation of waste treatment facilities shall be supported by adequate documentation. | TBC | TBC | TBC | Based upon CERCLA RI/FS data, the majority of the impacted material from OU2, OU5 & OU3 will meet the OSDF WACs and thus the performance objectives of the OSDF & DOE Order 5820.2A without treatment. This has been demonstrated through the modeling performed in the FSs to establish the OSDF WACs.<br><br>Two categories of impacted materials may need to be treated before disposal. Characteristically hazardous materials from seven areas will be quantified & treated to the extent necessary to remove the characteristic(s) that cause them to be regulated as hazardous. Physical sizing & treatment as per the OSDF Impacted Material Placement Plan will be conducted as needed on debris for proper waste placement and stability within the OSDF. Some physical treatment may also be necessary for the sludge from the OU2 Lime Sludge Ponds to decrease the moisture content before placement into the OSDF. | Addressed throughout the CERCLA RI/FS and selection of remedy process, culminated in the OU2, OU5 and OU3 RODs; OSDF Impacted Materials Placement Plan; Section 3.3 of this Sitewide Excavation Plan, and individual IRDPs.<br><br>Section 1.3.2.7 and Appendix F of this Sitewide Excavation Plan |



000420

## TABLE A-2
## (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **DEFINITIONS & GENERAL FACILITY STANDARDS**, continued | | | | | |
| Radioactive Waste Management<br><br>DOE Order 5820.2A Chapter III (3)(g) | The volume of waste and number of shipments of low-level wastes shall be minimized and the shipments will be conducted based on plans developed by field organizations.<br><br>Generators shall provide an annual forecast in the third quarter of the fiscal year to the field organizations managing the off-site disposal facility to which the waste is to be shipped.<br><br>Generators must receive advance approval from the receiving facility and shall certify prior to shipment that waste meets the receiving facility waste acceptance criteria. The certification program shall be auditable and able to withstand independent review. | TBC | TBC | TBC | The volume of impacted material to be disposed onsite in the OSDF will be minimized through a number of programs. First, extensive sampling has been performed during the CERCLA RI/FS process and the extent of excavation has been established using this data. Combined with the sampling/monitoring that will be performed during excavation in accordance with Section 3.3 of this Sitewide Excavation Plan and individual IRDPs, this will confirm that only impacted materials are excavated and sent to disposal. Compliance with the FEMP Pollution Prevention and Waste Minimization Awareness Plan will minimize the amount of low-level waste (i.e., equipment and personal protective equipment) generated during remediation. | Addressed throughout the CERCLA RI/FS and selection of remedy process, culminated in the OU2, OU5 and OU3 RODs; OSDF Impacted Materials Placement Plan; FEMP Pollution Prevention and Waste Minimization Awareness Plan; Section 3.3 of this Sitewide Excavation Plan, and individual IRDPs. |



000411

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# TABLE A-2
# (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **DEFINITIONS & GENERAL FACILITY STANDARDS**, continued | | | | | |
| Control of Residual Radioactive Material<br><br>DOE Order 5400.5 Chapter IV (6)(b)<br><br>10 CFR Part 834 (PROPOSED) | Interim storage must provide:<br><br>1) Control and stabilization features shall be designed to provide, to the extent reasonably achievable, an effective life of 50 years with a minimum life of at least 25 years. | ✓ | TBC | | The selected remedies are for a permanent remedy, not for interim storage; any short-term management of impacted material to be employed is to facilitate the permanent remedy. | Addressed through the approved selected remedy in the OU2 and OU5 RODs, associated remedial design documents (i.e., IRDPs). |
| | 2) Controls shall be designed such that radon-222 concentrations in the atmosphere above facility surfaces or openings in addition to background levels, will not exceed:<br>(a) 100 pCi/L at any given point;<br>(b) An annual average concentration of 30 pCi/L over the facility site; and<br>(c) An annual average concentration of 3 pCi/L at or above any location outside the facility site.<br>(d) Flux rates from the storage of radon producing wastes shall not exceed 20 pCi/m$^2$/sec, as required by 40 CFR Part 61. | | | | | |
| | 3) Controls shall be designed such that concentrations of radionuclides in the groundwater and quantities of residual radioactive material will not exceed applicable federal or state standards. | | | | | Section 5.0 of this Sitewide Excavation Plan, for environmental controls to be implemented during remediation. |
| | 4) Access to a property and use of on-site material contaminated by residual radioactive material should be controlled through appropriate administrative and physical controls such as those described in 40 CFR Part 192. These control features should be designed to provide, to the extent reasonable, an effective life of at least 25 years. | | | | | Section 3.0 and Appendix F of this Sitewide Excavation Plan and IRDPs, for access controls to be implemented during remediation. |



000412

## TABLE A-2
## (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **MANAGEMENT OF LOW-LEVEL RADIOACTIVE MATERIAL** | | | | | |
| Low-level Radioactive Waste Generation<br><br>DOE Order 5820.2A Chapter III (3)(c) | Technical and administrative controls shall be directed to reducing the gross volume of waste generated and/or the amount of radioactivity requiring disposal. Waste reduction efforts shall include consideration of process modification, process optimization, materials substitution, and decontamination.<br><br>All DOE low-level waste generators shall establish auditable programs to assure that the amount of low-level waste generated and/or shipped for disposal is minimized.<br><br>Each DOE low-level waste generator shall separate uncontaminated waste from low-level waste to facilitate cost-effective treatment and disposal.<br><br>Each DOE low-level waste generator preparing a design for a new process or process change shall incorporate principles into the design that will minimize the generation of low-level waste. | TBC | TBC | TBC | Implementation of the FEMP Pollution Prevention and Waste Minimization Awareness Plan will confirm that all newly generated waste is minimized during remediation. Additionally, excavation controls such as rapid test methodology and additional laboratory sampling will be implemented to confirm that only impacted material with contamination that is potentially above the FRLs is being excavated and sent to disposal. Physical sampling of the impacted materials and/or rapid test method methodology will also confirm that only material that exceeds the OSDF WAC is sent offsite for disposal. | Addressed throughout the CERCLA RI/FS and selection of remedy process, culminated in the OU2, OU5 and OU3 RODs; also, FEMP Pollution Prevention and Waste Minimization Awareness Plan. |
| | **MANAGEMENT OF HAZARDOUS REMEDIATION WASTE** | | | | | |
| Identification and Listing of Hazardous Waste,<br><br>Residues of Hazardous Waste in Empty Containers<br>OAC 3745-51-07(A) &(B)<br><br>[Identification and Listing of Hazardous Waste,<br>Subpart A—General, Residues of Hazardous Waste in Empty Containers<br>40 CFR §261.7] | Any hazardous waste remaining in either an empty container or an inner liner removed from an empty container is not subject to regulation under 40 CFR Parts 261 through 265 (RCRA requirements). A container is empty if:<br><br>1) All wastes have been removed that can be removed using the practices commonly employed to remove materials from that type of container (e.g., pouring, pumping, and aspirating); and<br><br>2) No more than 2.5 cm (1 inch) of residue remains on bottom of the container or inner liner; or<br><br>3) No more than 3 percent by weight of the total capacity of the container remains in the container or inner liner if the container is less than or equal to 110 gal. in size, or no more than 0.3 percent by weight of the total capacity of the container remains in the container or inner liner if the container is greater than 110 gal. in size. | √ | R&A | Appl | Pertinent when containerizing: soil contaminated by RCRA waste; any treatment residues exhibiting RCRA characteristics including advanced wastewater treatment (AWWT) sludges and soil decontamination residues. | Section 3.3 and Appendix F of this Sitewide Excavation Plan |



000413

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# TABLE A-2
# (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| **MANAGEMENT OF HAZARDOUS REMEDIATION WASTE**, continued | | | | | | |
| Closure and Post-Closure Under Interim Standards,<br><br>Condition of Containers<br>OAC 3745-66-71<br><br>Compatibility of Containers<br>OAC 3745-66-72<br><br>Management of Containers<br>OAC 3745-66-73<br><br>Inspections<br>OAC 3745-66-74<br><br>Special Requirements for Ignitable or Reactive Waste<br>OAC 3745-66-76<br><br>Special Requirements for Incompatible Wastes<br>OAC 3745-66-77<br><br>[Interim Status Standards,<br>Subpart I—Use & Management of Containers,<br>40 CFR §§265.171 through .174, .176 and .177] | If a container holding hazardous waste is not in good condition (e.g., severe rusting, apparent structural defects) or begins to leak, the owner or operator must transfer the hazardous waste from this container to a container that is in good condition or manage the waste in some other way that complies with this requirement. | ✓ | R&A | Appl | Pertinent to handling containers holding environmental media contaminated with RCRA waste. | Section 2.5 and Appendix F of this Sitewide Excavation Plan |



000414

# TABLE A-2
# (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **MANAGEMENT OF HAZARDOUS REMEDIATION WASTE**, continued | | | | | |
| [New Facilities] Corrective Action, Closure and Post-Closure Requirements<br><br>Containment<br>OAC 3745-55-75<br><br>[Interim Status Hazardous Waste Facility Standards, Subpart I—Use & Management of Containers<br>40 CFR §§265.175(a) through (c)] | A containment system for RCRA containment storage areas must be designed and operated to provide:<br><br>1) A sufficiently impervious base, which is sloped to collect any leaking liquids.<br>2) Sufficient capacity to contain liquids.<br>3) Prevention of run-on into the containment system.<br>4) A sump to prevent overflow of the collection system.<br><br>Storage areas for containers holding only wastes that do not contain free liquids need not have a containment system, provided that:<br><br>1) The storage area is sloped or is otherwise designed and operated to drain and remove liquid resulting from precipitation, or<br>2) The containers are elevated or are otherwise protected from contact with accumulated liquid. | ✓ | R&A | Appl | Pertinent to handling soil contaminated with RCRA listed or characteristic hazardous waste. A Part B Permit Application for RCRA storage has been submitted to the OEPA. | Section 3.3 and Appendix F of this Sitewide Excavation Plan |
| [New Facilities] Surface Impoundments, Waste Piles, and Tanks<br><br>[Waste Piles] Design and Operating Requirements<br>OAC 3745-56-51(A) through (F) | A waste pile used to store or treat hazardous waste must have:<br><br>1) A liner that is designed, constructed, and installed to prevent any migration of waste out of the pile into the adjacent subsurface soil or groundwater or surface water at any time during the active life (including the closure period) of the waste pile, and<br>2) A leachate collection and removal system immediately above the liner that is designed, constructed, maintained, and operated to collect and remove leachate from the pile. | ✓ | R&A | ✓ | Pertinent to on-site hazardous waste piles used for longer than 90 days unless the CAMU Rule is applied. | Addressed through remedial design documents (IRDPs). |
| | The owner/operator must design, construct, operate, and maintain a run-on control system capable of preventing flow onto the active portion of the pile during peak discharge from at least a 25-yr storm and manage a runoff management system to collect and control at least the water volume resulting from a 24-hr, 25-yr storm. | ✓ | R&A | ✓ | | |
| | If the pile contains any particulate matter which may be subject to wind dispersal, the owner or operator must cover or otherwise manage the pile to control wind dispersal. | ✓ | R&A | ✓ | | FEMP Fugitive Dust Control BAT Determination, and Section 5.0 and Appendix F of this Sitewide Excavation Plan |
| Monitoring and Inspection<br>OAC 3745-56-54(A) and (B) | During construction or installation, liners and cover systems must be inspected for uniformity, damage, and imperfections. | ✓ | R&A | ✓ | | |



000415

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# TABLE A-2
# (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **MANAGEMENT OF HAZARDOUS REMEDIATION WASTE**, continued | | | | | |
| | Collection and holding facilities associated with run-on and runoff control system must be inspected weekly and be emptied or otherwise managed expeditiously after storms to maintain design capacity of the system. | ✓ | R&A | ✓ | | FEMP Stormwater Pollution Prevention Plan, and Appendix F of this Sitewide Excavation Plan |
| Special Requirements for Ignitable or Reactive Waste<br>OAC 3745-56-56(A) and (B)<br><br>Special Requirements for Incompatible Wastes<br>OAC 3745-56-57(A), (B) and (C)<br><br>[Subpart L—Waste Piles,<br>40 CFR §§264.251 through .259] | Ignitable, reactive, or incompatible waste must not be added to a waste pile, unless specified in OAC 3745-56-56(A) and (B) or 57(A), (B) and (C). | ✓ | R&A | ✓ | The CERCLA RIs did not find evidence of ignitive or reactive material on-site. Impacted and non-impacted materials management will be segregated and managed in separate piles, based upon intended disposition (waste acceptance criteria). | |
| Temporary Units<br><br>Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities,<br>Subpart S-<br>40 CFR §264.553 (a), (b)<br>(58 FR 865829, February 16, 1993) | For temporary tanks and container storage areas used for treatment or storage of remediation wastes during remedial activities, the Regional Administrator may determine that a design, operating, or closure standard applicable to such units may be replaced by alternative requirements which are protective of human health and the environment.<br><br>Any temporary unit to which alternative requirements are applied shall be:<br><br>• located within the facility boundary; and<br>• used solely for treatment or storage of remediation wastes. | R&A | ✓ | R&A | Pertinent to short-term management/storage of impacted materials during the CERCLA soil remediation activities. | Appendix F of this Sitewide Excavation Plan |



000416

# TABLE A-2
## (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **MANAGEMENT OF HAZARDOUS REMEDIATION WASTE, continued** | | | | | |
| Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, Subpart DD—Containment Building 40 CFR §§264.1100 through .1102<br><br>57 FR 37194 (August 18, 1992) | The owner or operator is not subject to the definition of land disposal in RCRA Section 3004(k) provided that the unit:<br><br>1) Is a completely enclosed, self-supporting structure that is designed and constructed of synthetic materials of sufficient strength and thickness to support themselves, the waste contents, and any personnel and heavy equipment that operate within the unit, and to prevent failure due to pressure gradients, settlement, compression, or uplift, physical contact with the hazardous wastes to which they are exposed, climatic conditions, and the stresses of daily operation, including the movement of heavy equipment within the unit and contact of such equipment with containment walls;<br><br>2) Has a primary barrier for management of solids, in addition to a liquid collection system and secondary containment for management of liquids.<br><br>3) Has controls sufficient to prevent fugitive dust emissions to meet the no visible emission standard in Sec. 264.1101(c)(1)(iv); and<br><br>4) Is designed and operated to ensure containment and prevent the tracking of materials from the unit by personnel or equipment.<br><br>At closure, the owner or operator must remove or decontaminate all waste residues, contaminated containment system components, contaminated subsoil, and structures and equipment contaminated with waste and leachate, and handle them as a hazardous waste. | ✓ | R&A | R&A | Pertinent to excavated RCRA hazardous soil and sediment that may require short-term management/ storage during the CERCLA soil remediation activities.<br><br>NO CONTAINMENT BUILDINGS ARE ANTICIPATED. | Appendix F of this Sitewide Excavation Plan |



000427

# TABLE A-2
# (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **MANAGEMENT OF HAZARDOUS REMEDIATION WASTE**, continued | | | | | |
| Procedures for Planning and Implementing Offsite Response Actions ("The CERCLA Offsite Rule")<br>40 CFR §300.400 | Materials from remediation of a CERCLA site ("CERCLA waste") may only be transferred to offsite facilities that are in compliance with Resource Conservation and Recovery Act (RCRA), Toxic Substances Control Act (TSCA), or other applicable federal and state requirements. Only U.S. EPA has the authority to determine whether the facility in question meets the acceptability criteria and is acceptable for receiving CERCLA waste from offsite. A determination of acceptability for a potential receiving facility is to be made in advance (prior to initiating transportation offsite, and optimally prior to making offsite treatment/ storage/disposal contract arrangements).<br><br>Materials covered under this rule ("CERCLA waste") are any hazardous substance, pollutant, or contaminant as defined under CERCLA sections 101(14) and 101(33). Samples of waste sent to a laboratory for characterization are exempt from the rule, as are certain treatability study waste.<br><br>The receiving facility must meet compliance and release criteria presented therein. Facility is defined as the receiving unit(s) that directly stores, treats, or disposes of the CERCLA waste. Non-receiving units at the facility need not be in compliance in order for the U.S. EPA to determine that the receiving unit meets acceptance criteria. U.S. EPA may deem a facility acceptable even if certain minor violations have occurred at the facility.<br><br>If a facility does not meet the criteria for receiving CERCLA wastes, the rule presents notification, determination, appeal/review and reinstatement procedures. | ✓ | ✓ | Appl | Pertinent to preparation of materials for off-site disposition. | Appendix F of this Sitewide Excavation Plan and the Operable Unit 1 Design Criteria Package |
| [Hazardous Waste] Generator Standards<br>OAC 3745-52-20 through -23, and -30 through -33<br><br>[40 CFR §§262.20 through .23, and .30 through .33] | Before transporting hazardous waste or offering hazardous waste for transportation off-site ("pre-transport"), for either treatment or disposal, general requirements for the generator, require a manifest [OAC 3745-52-20 through -23], in accordance with the requirements specified therein. Pre-transport requirements also include appropriate packaging [OAC 3745-52-30], labeling [OAC 3745-52-31], marking [OAC 3745-52-32], and placarding [OAC 3745-52-33], in accordance with the requirements specified therein. | ✓ | Appl | Appl | Pertinent to preparation of RCRA hazardous waste for off-site treatment and/or disposal. | See preceding |



000448

## TABLE A-2
## (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| **MANAGEMENT OF HAZARDOUS REMEDIATION WASTE**, continued | | | | | | |
| Implementation of the United Nations Recommendations, International Maritime Dangerous Goods Code, and the International Civil Aviation Organization's Technical Instructions<br><br>59 FR 67390 (December 29, 1994)<br><br>as amended by<br><br>60 FR 26796 (May 18, 1995) | These rules (final rule was effective October 1, 1995) comprehensively revise the Hazardous Materials Regulations (HMR), 49 CFR Parts 171-173, 177, and 178, with respect to hazard communication, classification, and packaging requirements based on United Nations recommendations. | ✓ | ✓ | Appl | These Hazardous Materials Regulations are requirements embedded in both the state (OAC) and federal (CFR) regulations in both the generator standards (preceding entry) and the transporter standards (subsequent entry). | See preceding generator standards entry and subsequent transporter standards entry. |
| [Hazardous Waste] Land Disposal Restrictions<br>OAC 3745-59<br><br>[Land Disposal Restrictions, Subpart D—Treatment Standards<br>40 CFR §§268.40 through .44] | A restricted hazardous waste may be land disposed only if:<br><br>1) An extract of the waste or of the treatment residue of the waste does not exceed the value shown in 40 CFR §268.41.<br>2) It is treated using a technology specified in 40 CFR §268.42(a) or an equivalent treatment method.<br>3) The constituent concentrations in the waste or treatment residue of the waste do not exceed the value shown in 40 CFR §268.43. | ✓ | Appl | Appl | Not applicable to on-property disposal within a CAMU under the CAMU Rule as invoked under the OU5 ROD.<br><br>Applicable to those RCRA hazardous wastes that will be disposed of off-site. | For waste that is dispositioned for off-site disposal, see the Operable Unit 1 Design Criteria Package. |
| Land Disposal Restrictions, Subpart D—Treatment Standards, Treatment Standards Expressed as Concentrations in Waste Extract<br>40 CFR §268.41 | The maximum concentration of lead (5.0 mg/L) may not be exceeded whether it is the extract of a waste or waste treatment residual. | R&A | Appl | | Not applicable to on-property disposal within a CAMU under the CAMU Rule as invoked under the OU5 ROD.<br><br>Applicable to those RCRA hazardous wastes that will be disposed of off-site. | For waste that is dispositioned for off-site disposal, see the Operable Unit 1 Design Criteria Package. |



000419

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# TABLE A-2
## (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **MANAGEMENT OF HAZARDOUS REMEDIATION WASTE, continued** | | | | | |
| Land Disposal Restrictions, Subpart D—Treatment Standards, Contaminated Debris 40 CFR §268.45 | Hazardous debris must be treated before land disposal unless the EPA determines that the debris is no longer contaminated with hazardous waste or the debris is treated to the waste-specific treatment standard for the waste contaminating the debris.<br><br>Provided the debris does not exhibit a RCRA characteristic it is not subject to regulation under 40 CFR 260, 261 to 266, 268, or 270 if:<br><br>1) The hazardous debris has been treated using one of the required extraction or destruction technologies specified in 40 CFR §268.45; or<br>2) The debris, considering the extent of contamination, is determined to no longer be contaminated with hazardous waste. | √ | Appl | Appl | Not applicable to on-property disposal within a CAMU under the CAMU Rule as invoked under the OU5 ROD.<br><br>Applicable to those RCRA hazardous wastes that will be disposed of off-site. | For waste that is dispositioned for off-site disposal, see the Operable Unit 1 Design Criteria Package. |
| [Hazardous Waste] Transporter Standards OAC 3745-53-20 through -22, -30 and -31<br><br>[40 CFR §§263.20 through .22, .30 and .31] | General requirements for the transporter during transportation of hazardous waste for off-site treatment and/or disposal require acceptance and handling of hazardous waste and use of the manifest system [OAC 3745-53-20], compliance with the manifest [OAC 3745-53-21], and recordkeeping [OAC 3745-53-22], in accordance with the requirements specified therein. Appropriate response actions must be taken for any hazardous waste discharge during transportation [OAC 3745-53-30 and -31], in accordance with the requirements specified therein. | √ | Appl | Appl | Pertinent to transportation of RCRA hazardous wastes for off-site treatment and/or disposal. | Section 2.5 and Appendix F of this Sitewide Excavation Plan. |
| | **MANAGEMENT OF PCB-TAINTED MATERIAL** | | | | | |
| Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution In Commerce, And Use Prohibitions,<br><br>Subpart D—Storage and Disposal, Disposal Requirements 40 CFR §761.60(a)(4) | Any nonliquid PCBs at concentrations 50 ppm or greater in the form of contaminated soil, rags, or other debris shall be disposed of in an incinerator which complies with 40 CFR §761.70, or in a chemical waste landfill which complies with 40 CFR §761.75. | | Appl | Appl | Pertinent if soil or other material containing PCBs above 50 ppm is excavated. PCBs were detected in soil beneath the Fire Training Facility. | Section 2.5 and Appendix F of this Sitewide Excavation Plan |



000420

## TABLE A-2
## (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **MANAGEMENT OF PCB-TAINTED MATERIAL**, continued | | | | | |
| Subpart D—[PCB] Storage and Disposal, Disposal Requirements 40 CFR §761.60(e) | Any person who is required to incinerate PCBs or PCB items under this subpart and who can demonstrate that an alternate method of destroying PCBs or PCB items can achieve a level of performance equivalent to the requirements under 40 CFR §761.70 may submit a written request to either the Regional Administrator or the Director, Exposure Evaluation Division, for an exemption from the incineration requirements of 40 CFR §§ 761.70 or 761.60. The applicant must show that the alternate method of destroying PCBs will not present an unreasonable risk of injury to health or the environment. | | Appl | Appl | Pertinent only if PCB contaminated soil is greater than 50 ppm and is treated on-property using a method besides incineration. | Section 2.5 and Appendix F of this Sitewide Excavation Plan. |
| Subpart D—[PCB] Storage and Disposal, Storage for Disposal 40 CFR §761.65 | This section applies to the design of storage areas to be used for later disposal of PCBs at concentrations of 50 ppm or greater. | | Appl | Appl | Pertinent to storage of PCB-contaminated material at 50 ppm or greater. | |



000421

925

# TABLE A-2
## (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| **POST-CLOSURE** | | | | | | |
| | **DESCRIPTION OF POST-CLOSURE CARE** | | | | | |
| [New Facilities Hazardous Waste] Surface Impoundments, Waste Piles, and Tanks,<br><br>[Waste Piles] Post-Closure<br>OAC 3745-56-58(B)<br><br>[Subpart L—Waste Piles,<br>40 CFR §§264.251 through .259] | If, after removing or decontaminating all residues and making all reasonable effort to effect removal or decontamination of contaminated components, subsoil, structures and equipment, the owner/operator finds that not all contaminated subsoil can be practically removed or decontaminated, he must close the unit/facility and perform post-closure care in accordance with OAC 3745-57-10. | ✓ | R&A | | Only pertinent to those units where risk-based FRLs are not met. | Currently addressed in the OSDF Post-closure Care and Inspection Plan, which notes in its Prologue that it can be revised at a later date to expand the scope of coverage to encompass the entire FEMP site as needed.<br><br>Will also be addressed in the Remedial Action Report. |
| [New Facilities Hazardous Waste] Incinerators [and Miscellaneous Units],<br><br>[Miscellaneous Units] Environmental Performance Standards<br>OAC 3745-57-93<br><br>[Subpart X—Miscellaneous Units,<br>40 CFR §§264.601 through .603] | If a treatment or storage miscellaneous unit has contaminated soil or groundwater that cannot be completely removed or decontaminated during closure, the unit must also meet the requirements of OAC 3745-57-91 during the post-closure care period. The post-closure plan under OAC 3745-55-18 must specify the procedures that will be used to satisfy this requirement.<br><br>A miscellaneous unit that is a disposal unit must be maintained in a manner that complies with OAC 3745-57-91 during the post-closure care period. | ✓ | R&A | | Pertinent to those units where risk-based FRLs are not met. | See preceding |
| Closure and Post-Closure Under Interim Standards,<br><br>Post-closure Care and Use of Property<br>OAC 3745-66-17(A)<br><br>[40 CFR §265.117(a)(2)] | Post-closure care of hazardous waste management units must begin after completion of closure of the unit and continue for 30 years after that date unless shortened by the Director [of the OEPA, a.k.a. the Ohio Director of Environmental Protection] in accordance with OAC 3745-66-18(G) (40 CFR §117(a)(2)). | ✓ | Appl | | **NOTE:** Identified in the OU5 ROD as applicable only to existing hazardous waste management units (HWMUs); also cited in RCRA/CERCLA Integrated Closure DF&O @ V.1.<br><br>Pertinent to those units where risk-based FRLs are not met. | |



000822

# TABLE A-2
## (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **DESCRIPTION OF POST-CLOSURE CARE**, continued | | | | | |
| Closure and Post-Closure Under Interim Standards,<br><br>Post-closure Care and Use of Property<br>OAC 3745-66-17(A)(1)<br><br>[40 CFR §265.117(a)(1)] | Post-closure care...must consist of at least the following:<br><br>• monitoring and reporting; and<br><br>• maintenance and monitoring of waste containment systems. | ✓ | ✓ | ✓ | Cited in the RCRA/CERCLA Integrated Closure DF&O @ V.1.<br><br>Pertinent to those units where risk-based FRLs are not met. | See preceding. |
| Closure and Post-Closure Under Interim Standards,<br><br>Post-closure Plan; Amendment of Plan<br>OAC 3745-66-18(A)&(C) | The owner of a hazardous waste disposal unit shall have a written post-closure plan, which shall identify the activities that will be carried on after closure of each unit and the frequency of those activities, and include at least:<br><br>• a description of the planned monitoring activities and frequencies at which they will be performed;<br>• a description of the planned maintenance activities and frequencies at which they will be performed, to ensure (a) the integrity of the cap and final cover or other containment systems, and (b) the functioning of the monitoring equipment; and<br>• the name, address and telephone number of the person or office to contact about the hazardous waste disposal unit or facility during the post-closure period. | ✓ | ✓ | ✓ | Cited in the RCRA/CERCLA Integrated Closure DF&O @ V.1.<br><br>Pertinent to those units where risk-based FRLs are not met. | See preceding. |
| | **MODIFICATIONS TO POST-CLOSURE CARE PLAN OR PERIOD** | | | | | |
| Closure and Post-Closure Under Interim Standards,<br><br>Post-closure Plan; Amendment of Plan<br>OAC 3745-66-18(D) | The owner may amend the post-closure plan any time during the active life of the facility or during the post-closure period. | ✓ | ✓ | ✓ | Cited in the RCRA/CERCLA Integrated Closure DF&O @ V.1.<br><br>Pertinent to those units where risk-based FRLs are not met. | Currently addressed in the OSDF Post-closure Care and Inspection Plan, which notes in its Prologue that it can be revised at a later date to expand the scope of coverage to encompass the entire FEMP site as needed. |
| Closure and Post-Closure Under Interim Standards,<br><br>Post-closure Plan; Amendment of Plan<br>OAC 3745-66-18(G) | The post-closure plan and length of the post-closure period may be modified any time prior to the end of the post-closure care period. A modification of the post-closure plan may include, where appropriate, the temporary suspension rather than permanent deletion of one or more post-closure care requirements. At the end of the specified period of suspension, the Director [of the OEPA, a.k.a. the Ohio Director of Environmental Protection] would then determine whether the requirements should be permanently discontinued or reinstated to prevent threats to human health and the environment. | ✓ | ✓ | ✓ | Cited in the RCRA/CERCLA Integrated Closure DF&O @ V.1.<br><br>Pertinent to those units where risk-based FRLs are not met. | See preceding. |



000423

925

# TABLE A-2
## (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **PROPERTY USE RESTRICTIONS** | | | | | |
| Closure and Post-Closure Under Interim Standards,<br><br>Post-closure Care and Use of Property<br>OAC 3745-66-17°<br><br>[40 CFR §265.117(c)] | Post-closure use of property on or in which hazardous waste remain after partial or final closure must never be allowed to disturb the integrity of the final cover, liner(s), or any other component of the containment system, or the function of the facility's monitoring systems, unless the Director [of the OEPA, a.k.a. the Ohio Director of Environmental Protection] approves otherwise.<br><br>**NOTE:** If clean (or risk-based) closure is performed, then post-closure care is not required. | ✓ | Appl | ✓ | **NOTE:** Identified in the OU5 ROD as applicable only to existing hazardous waste management units (HWMUs); also cited in RCRA/CERCLA Integrated Closure DF&O @ V.1. | Currently addressed in the OSDF Post-closure Care and Inspection Plan, which notes in its Prologue that it can be revised at a later date to expand the scope of coverage to encompass the entire FEMP site as needed. |
| Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings<br>Subpart A—<br>40 CFR §192.02(a) | Controls of residual radioactive materials from inactive uranium processing sites shall be designed to be effective for up to 1,000 years, to the extent reasonably achievable, and in any case, for at least 200 years, and provide protection of groundwater. | R&A | R&A | | Most pertinent to the design and closure of the On-Site Disposal Facility. | Addressed by selected remedies of OU2 and OU5 RODs in establishment of FRLs. |
| Long-Term Management of Residual Radioactive Material<br><br>DOE Order 5400.5<br>Chapter IV (6)(d)<br><br>10 CFR Part 834<br>(PROPOSED) | Controls of residual radioactive materials from inactive uranium processing sites shall be designed to be effective for up to 1,000 years, to the extent reasonably achievable, and in any case, for at least 200 years, and provide protection of groundwater. | | TBC | | | Addressed by selected remedies of OU2 and OU5 RODs in establishment of FRLs. |
| | For long-term management of uranium, thorium, and their decay products, access to a property and use of on-site materials contaminated by residual radioactive material should be controlled through appropriate administrative and physical controls such as those described in 40 CFR 192. These controls should be designed to be effective to the extent reasonable for at least 200 years. | TBC | TBC | | | |
| Control of Residual Radioactive Material Above the Guidelines<br><br>DOE Order 5400.5<br>Chapter IV (6) | Residual radioactive material with concentrations above the generic guidelines (see chemical-specific requirements) shall be managed in accordance with Chapter II, Requirements for Radiation Protection of the Public and the Environment, and operational and control requirements. | TBC | ✓ | | | See preceding |



000324

## TABLE A-2
## (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| **PROPERTY USE RESTRICTIONS**, continued | | | | | | |
| Supplemental Limits and Exceptions for Residual Radioactive Material<br><br>DOE Order 5400.5 Chapter IV (7) | If special specific property circumstances indicate that the concentration guidelines or authorized limits are not appropriate, supplemental limits or an exception may be requested to those guidelines or limits. | TBC | ✓ | | | See preceding |
| Release of Property<br><br>DOE Order 5400.5 Chapter II (5) | Real property (land and structures), personal property, materials, and equipment shall be released if the concentration of radioactivity is within the limits of residual radioactive contamination. | TBC | ✓ | | | See preceding |
| **POST-CLOSURE NOTICE/SURVEY PLAT** | | | | | | |
| Closure and Post-Closure Under Interim Standards,<br><br>Survey Plat<br>OAC 3745-66-16 | The owner shall submit -- to the local zoning authority, or the authority with jurisdiction over local land use, and to the Director [of the OEPA, a.k.a. the Ohio Director of Environmental Protection] -- a survey plat, prepared and certified by a professional land surveyor, indicating the location and dimensions of landfill cells or other hazardous waste disposal units with respect to permanently surveyed benchmarks. The plat must contain a note, prominently displayed, which states the owner's obligation to restrict disturbance of the hazardous waste disposal unit in accordance with OAC 3745-66-17(C). | ✓ | ✓ | ✓ | Cited in the RCRA/CERCLA Integrated Closure DF&O @ V.1. | Currently addressed in the OSDF Post-closure Care and Inspection Plan, which notes in its Prologue that it can be revised at a later date to expand the scope of coverage to encompass the entire FEMP site as needed. |
| Closure and Post-Closure Under Interim Standards,<br><br>Post-closure Notices<br>OAC 3745-66-19(A) | The owner shall submit -- to the local zoning authority, or the authority with jurisdiction over local land use, and to the Director [of the OEPA, a.k.a. the Ohio Director of Environmental Protection] -- a record of the type, location, and quantity of hazardous waste disposed of within each cell or disposal unit of the facility. | ✓ | ✓ | ✓ | Cited in the RCRA/CERCLA Integrated Closure DF&O @ V.1. | See preceding. |
| **DEED NOTATION** | | | | | | |
| Closure and Post-Closure Under Interim Standards,<br><br>Post-closure Notices<br>OAC 3745-66-19(B) | The owner shall record, in accordance with state law, a notation on the deed of the facility property, or on some other instrument which is normally examined during title search, that will notify in perpetuity the potential purchasers of the property that:<br><br>• the land has been used to manage hazardous wastes;<br>• its use is restricted under the Ohio Administrative Code closure and post-closure rules; and<br>• a survey plat and record of the type, location, and quantity of hazardous wastes disposed of within each cell or hazardous waste unit of the facility as required by OAC 3745-66-16 and OAC 3745-66-19(A) have been filed with the local zoning authority or the authority with jurisdiction over local land use and the Director [of the OEPA, a.k.a. the Ohio Director of Environmental Protection]. | ✓ | ✓ | ✓ | Cited in the RCRA/CERCLA Integrated Closure DF&O @ V.1. | Currently addressed in the OSDF Post-closure Care and Inspection Plan, which notes in its Prologue that it can be revised at a later date to expand the scope of coverage to encompass the entire FEMP site as needed.<br><br>Will also be addressed in the NRRP. |



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# TABLE A-2
# (Continued)

| Citation | Requirement | OU2 ROD | OU5 ROD | OU3 ROD | Remarks | Cross-Reference |
|---|---|---|---|---|---|---|
| | **DEED NOTATION** | | | | | |
| Closure and Post-Closure Under Interim Standards,<br><br>Post-closure Notices<br>OAC 3745-66-19° | If the owner or any subsequent owner of the land upon which a hazardous waste disposal unit was located wishes to remove hazardous wastes and hazardous waste residues in satisfaction of the criteria in OAC 3745-66-17(C), the owner may request that the Director [of the OEPA, a.k.a. the Ohio Director of Environmental Protection] approve either:<br>• the removal of the notation on the deed to the facility property or other instrument normally examined during title search; or<br>• the addition of a notation to the deed or instrument indicating the removal of the hazardous waste. | ✓ | ✓ | ✓ | Cited in the RCRA/CERCLA Integrated Closure DF&O @ V.1. | See preceding. |



000426

# APPENDIX B

# SITEWIDE SEQUENCING PLAN

## LIST OF ACRONYMS

| | |
|---|---|
| AWWT | Advanced Wastewater Treatment Facility |
| D&D | Decontamination and Dismantlement |
| FEMP | Fernald Environmental Management Project |
| FTF | Fire Training Facility |
| IRDP | Integrated Remedial Design Package |
| LSP | Lime Sludge Ponds |
| OSDF | On-Site Disposal Facility |
| RCRA | Resource Conservation and Recovery Act |
| SEP | Sitewide Excavation Plan |
| SSP | Sitewide Sequencing Plan |
| SSOD | Storm Sewer Outfall Ditch |
| STP | Sewage Treatment Plant |
| SWRB | Storm Water Retention Basin |

## INTRODUCTION

This Sitewide Sequencing Plan (SSP) represents the current concept of the order in which the at- and below grade remediation areas within the Fernald Environmental Management Project (FEMP) will be addressed. This concept will be integrated into the FEMP baseline plan as it is revised. The ultimate sequence of activities depends on complex relationships between demolition of above-ground facilities, proper material placement ratios within the On-Site Disposal Facility (OSDF), and schedules for waste pit and silo remediation activities relative to other parts of the site. Therefore, the process of integration into the baseline will inevitably result in refinements of the sequencing. This sequencing plan must be viewed as a living document that is subject to modification based on the ongoing planning, design, and construction activities at the FEMP.

### Purpose of Plan

The purpose of this SSP is to present the overall sequencing strategy and to explain the objectives and criteria that were used in sequence development. The SSP describes soil excavation sequencing between, and within, the major remediation areas on the FEMP. The major remediation areas are shown on Figure B-1. (Note: All referenced figures and tables are presented at the end of this document.)

As large areas of the FEMP are remediated, potentially contaminated corridors will be left unremediated until the sitewide effort nears completion. These corridors (Figure B-2) include haul routes as well as areas used for remedial actions that are expected to extend beyond the time required to conduct soil excavation (e.g., South Plume pipeline).

### Integration of Plan with Design

The SSP for the FEMP will be used in developing integrated remedial design packages (IRDPs) for each of the major remediation areas. During the development of IRDPs and implementation of field activities, it is likely that the need for sequence changes will be identified. When necessary, the SSP will be updated to address any significant changes in the excavation sequencing. The latest version of the SSP will serve as a reference source for IRDP development in each successive area.

Format

The SSP consists of text and conceptual drawings that illustrate the appropriate sequencing of excavation. Criteria that were used to develop the soil excavation sequencing are presented in Section B.1. The actual sequencing of areas to be remediated is described and presented in Section B.2 and on Figures B-3 through B-16.

## B.1 SEQUENCING STRATEGY

### B.1.1 Sequencing Objectives

The overall goal of soil remediation at the FEMP is to remove soil that presents an unacceptable risk to human health. The objective of the sequencing strategy is to remediate the soil in a cost effective and efficient manner that is protective of human health and the environment

#### B.1.1.1 Protect Human Health and the Environment

During remediation, procedures will be implemented to protect human health and the environment by minimizing potential exposure to contamination and avoiding cross-contamination. This will be achieved by:

- Generally excavating areas from upgradient to downgradient
- Controlling haul routes through contaminated areas to minimize cross-contamination of certified clean areas
- Using paved roads, to the extent practical, to minimize dust generation to avoid cross-contamination.

Exposure of the environment to contamination will be minimized by prioritizing the remediation of potential source areas as soon as practical. For example, the Southern Waste Units (Inactive Flyash Pile, South Field, and Active Flyash Pile) will be remediated early in the sequencing process because they are a source of contamination to the Great Miami Aquifer.

Another factor that is important for protection of human health and the environment is avoiding slope stability problems. Geotechnical analysis of soil samples will be performed during the pre-excavation investigation to provide data to determine safe-cut slopes for both temporary and long-term conditions.

#### B.1.1.2 Optimize Effectiveness and Efficiency

The steps that will be taken to make the sequencing cost-effective and efficient include the following:

- Minimize double handling of material.
- Establish large work areas to provide efficient equipment utilization.
- Minimize haul distances as much as possible.
- Minimize unneeded treatment of water.
- Minimize sheeting and shoring of excavated slopes.

B.1.1.3 Achieving Objectives

To achieve the sequencing objectives, a phased excavation approach will be used to ensure that cost-saving measures, enhanced excavation techniques, and identified problems are incorporated into successive areas undergoing excavation. The phased approach is provided in Section B.2.

B.1.2 Sequencing Assumptions

Some of the information that will affect sequencing decisions will not be known until remediation is actually under way and/or virtually completed in a given area (e.g., Area 1, Phase 1). For example, the initial excavation extent to be delineated in the IRDP for the Former Production Area may be modified during the remedial action due to the heterogeneous distribution of susbsurface contamination. The current sequencing plan is based on the following assumptions:

- Quantities and locations of contaminated soil to be excavated are estimated based on current data and modeling.
- The New Railroad (including the North Rail Yard) will be removed as part of site remediation after material from the Operable Unit 1 Waste Pits (Area 6) has been sent off site.
- The OSDF will not need the railroad for delivery of material.
- The Advanced Wastewater Treatment Facility (AWWT) will be remediated after closure of the OSDF.
- In all but the final sequence step, there will be a debris stockpile located in an unremediated area. Generally, bulk-stored surface debris from an unremediated area will be hauled to the OSDF with the soil from the active excavation area.

- Operational knowledge and existing data indicate that some areas of the FEMP will not require large excavations. These areas will be surveyed as part of a pre-certification process. Localized impacts within these areas will be excavated as required and the areas certified.

- Groundwater and corresponding construction dewatering will not affect the excavation sequence. However, dewatering may affect the protocols within a given isolated excavation.

- The FEMP property west of Paddys Run (except for the railroad corridor) will not require excavation. The area is generally upwind of the FEMP site and is not expected to be contaminated.

### B.1.3 Excavation Criteria

Excavation of contaminated soil from the FEMP will consist of excavating approximately 2 million cubic yards of soil and at- and below-grade structures. To achieve the objectives previously described, the following criteria were established to develop the sequencing plan:

- Complete excavation ahead of the OSDF construction on a north-to-south basis.

- Work in isolated drainage areas for efficient collection and handling of surface water.

- Complete continuous excavations at one time. Avoid splitting a large and continuous excavation into multiple pieces.

- Utilize existing production area drainage systems to the extent practical.

- Schedule large excavations when the entire area is available and accessible to assure capability to excavate continuously.

- Perform excavation from upgradient to downgradient as much as possible.

- Minimize double handling by planning excavated soil generation to coincide with placement capacities and schedules.

- Avoid hauling contaminated soil through certified remediation areas.

- Identify and utilize haul routes to the OSDF that are as direct as possible.

- Minimize loading to the AWWT by redirecting uncontaminated flow from certified areas as early as possible.

### B.1.4 Sequence Development Steps

The prioritized steps that were used to develop the soil sequencing plan are as follows:

- Identify areas of risk near the OSDF footprint. To eliminate slope failure risk in the vicinity of the OSDF, all soil excavation and certification in the vicinity of the OSDF must be completed well ahead of actual cell construction.

- Identify existing and proposed drainage areas. Excavation should be performed within distinct drainage areas. Generally, it should begin within an existing drainage area and end within a proposed future drainage area (a large and continuous excavation is considered one drainage area). Large areas of excavation should be completed as one unit. Working large excavation areas at one time will eliminate the need for temporary structures and diversions and will allow surface water to be collected and handled more efficiently.

- Prioritize continuing sources of contamination. Continuing sources of contamination are identified and will be selected for early removal.

- Prioritize areas from upgradient to downgradient. Excavation is planned to proceed from an upgradient to a downgradient surface water and groundwater direction to minimize the potential for certified areas to become recontaminated by run-off from contaminated areas that are upgradient. Hence, the isolated drainage areas identified above were then sequenced from upgradient to downgradient.

- Estimate and coordinate quantities. Soil excavation quantities will then be compared and coordinated with 1) estimated debris in an area, 2) estimated debris to be generated from above-grade decontamination and dismantlement (D&D) in other areas that will be addressed at the same time, and 3) OSDF construction material requirements.

## B.2 EXCAVATION SEQUENCING PLAN

The majority of the remediation areas (Figure B-1) will be subdivided into component areas to facilitate logistic and schedule considerations. These component areas are dependent on and/or related to excavation in other remediation areas, as described below.

Figures B-3 through B-16 present excavation sequencing of the component areas. Conceptual haul routes to the OSDF and proposed excavation drainage patterns are also shown on the figures. The drainage patterns will depend on the proposed restoration topography and will capture the general flow of construction water from the active remediation area. Drainage patterns are expected to be maintained only until certification is achieved for the area. Beyond that point in time, the flow would be redirected away from active remediation areas. Flow directions will be presented conceptually in later versions of the SSP as restoration concepts evolve. Each phase of the sequence is discussed below.

### B.2.1 Remediation Area 1, Phase I (Figure B-3)

Excavation in Remediation Area 1, Phase I has begun because it must be certified prior to beginning construction activity on the OSDF. During Phase I, the North Entrance Road will be relocated to the east in preparation for construction of the first cell of the OSDF. Excavated soil will be placed in a temporary stockpile within the area.

### B.2.2 Remediation Area 2, Phase I - Southern Waste Units (Figure B-4)

The Southern Waste Units (SWUs) consist of the South Field and the Active and Inactive Flyash Piles. Excavation of the SWUs will be the first large-scale remediation task to generate material for the OSDF. The completion of this activity is required prior to initiating excavation actions in Remediation Area 3. The proposed haul route to the OSDF will be a new haul road constructed through Remediation Areas 2, 7, 6, and 3. Run-off from the area will be collected in retention basins and pumped to the Storm Water Retention Basins (SWRBs).

B.2.3 Remediation Area 1, Phase II - Southeast Portion of FEMP (Figure B-5)

The remediation of this area will provide a source of borrow material to construct the OSDF. Construction of an associated sediment pond will also occur during this activity. The proposed haul route to the OSDF will be the existing North Access Road. Surface water drainage will be directed to the new sediment pond.

B.2.4 Remediation Area 1, Phase II - OSDF Footprint and Sewage Treatment Plant (Figure B-6)

This task must be completed before construction can be completed on the New North Entrance Road and the OSDF. Completion of this task is dependent on finishing the new Sewage Treatment Plant (STP), which must be on-line before demolition and excavation of the old STP can begin; closure of HWMU #4, the sludge drying beds at the old STP; and removing at- and below-grade structures associated with the old STP. The potential contamination of this area consists primarily of wind-blown radiological contaminants from the Former Production Area and the incinerator at the old STP. The proposed haul route to the OSDF will be the existing North Access Road. Surface-water drainage will be directed to the new sediment pond.

B.2.5 Remediation Area 3 - North End of Former Production Area (Figure B-7)

Excavation of soil and at- and below-grade structures will not proceed until demolition of above-grade structures in Remediation Area 3 is completed. Completion of work in Remediation Area 3, including the FTF and LSP, will allow work to begin in Remediation Area 4. Excavation activities in Remediation Area 3 will be completed ahead of the OSDF construction planned in the same area to prevent potential undermining and stability problems. Surface-water drainage will be directed to the storm drain in Remediation Area 4B. The haul routes from the LSP and Former Production Area to the OSDF will be on First and Second Streets and for the FTF it is across Remediation Area 6 and onto the new haul road in the northern section of Remediation Area 3. Perched water encountered during the excavation of the FTF may be contaminated with a listed RCRA constituent. If so, the water will be pretreated prior to final treatment at the AWWT facility.

B.2.6 Remediation Area 4A - East Central Portion of Former Production Area (Figure B-8)

Remediation in this area will begin after the demolition of above-grade structures in the area and excavation activities in Remediation Area 3 are completed.. Surface-water drainage will be directed to the storm drain within the active area. Haul routes to the OSDF will be on Second Street and across the Haul Road Corridor in Remediation Area 5.

B.2.7 Remediation Area 4B - West Central Portion of Former Production Area (Figure B-9)

Remediation of this area will proceed after demolition of above-grade structures and the completion of excavation activities in Remediation Area 4A. A corridor through the parking lot of Remediation Area 5 will not be remediated to maintain a hauling corridor for materials removed from Remediation Areas 6 and 7. Surface-water drainage will be directed to the SWRBs. The proposed haul route to the OSDF will be the Haul Road Corridor in the active area.

B.2.8 Remediation Area 5 - Administration Area (Figure B-10)

Remediation of this area will proceed after demolition of above-grade structures and the completion of excavation activities in Remediation Area 4B. Surface-water drainage will be directed to the Biodenitrification Surge Lagoon. The proposed haul route to the OSDF will be south along the east side of the AWWT to the Area 5 Haul Road Corridor.

B.2.9 Remediation Area 1, Phase III - North Area of FEMP (Figure B-11)

This area is not expected to contain significant contamination and it is anticipated that pre-certification activities will be initiated without excavation. Once work is completed in Remediation Area 1, Phase III, final excavation activity can begin in the Railroad Corridor. Surface-water drainage will be directed to the Biosurge Lagoon.

B.2.10 Remediation Area 6 - Waste Pit Area, Solid Waste Landfill, Railroad Corridor, and Original North Entrance Road (Figure B-12)

Soil excavation will proceed in this area after all material in the waste pits has been removed for off-site disposal. Material from the SWL that is below waste acceptance criteria (WAC) for the OSDF will be placed in the OSDF. Surface-water drainage will be directed to the Biodenitrification Surge Lagoon. The proposed haul route to the OSDF will be south to the Area 5 Haul Road Corridor.

B.2.11 Biodenitrification Surge Lagoon and Remediation Area 2, Phase II (Figure B-13)

Remediation Area 2, Phase II is not expected to contain significant contamination and it is anticipated that minimal excavation will take place. Surface-water drainage will be directed to the AWWT facility or the SWRB. The haul route to the OSDF will be along the Haul Road Corridor in Remediation Area 5.

B.2.12 Remediation Area 7 - Silo Area (Figure B-14)

The excavation of soil in Remediation Area 7 will begin after the silo materials and structures have been removed for off-site disposal. Surface-water drainage during will be directed to the Sediment Pond south of Remediation Area 5. The haul road to the OSDF will be along the corridor in Remediation Area 5.

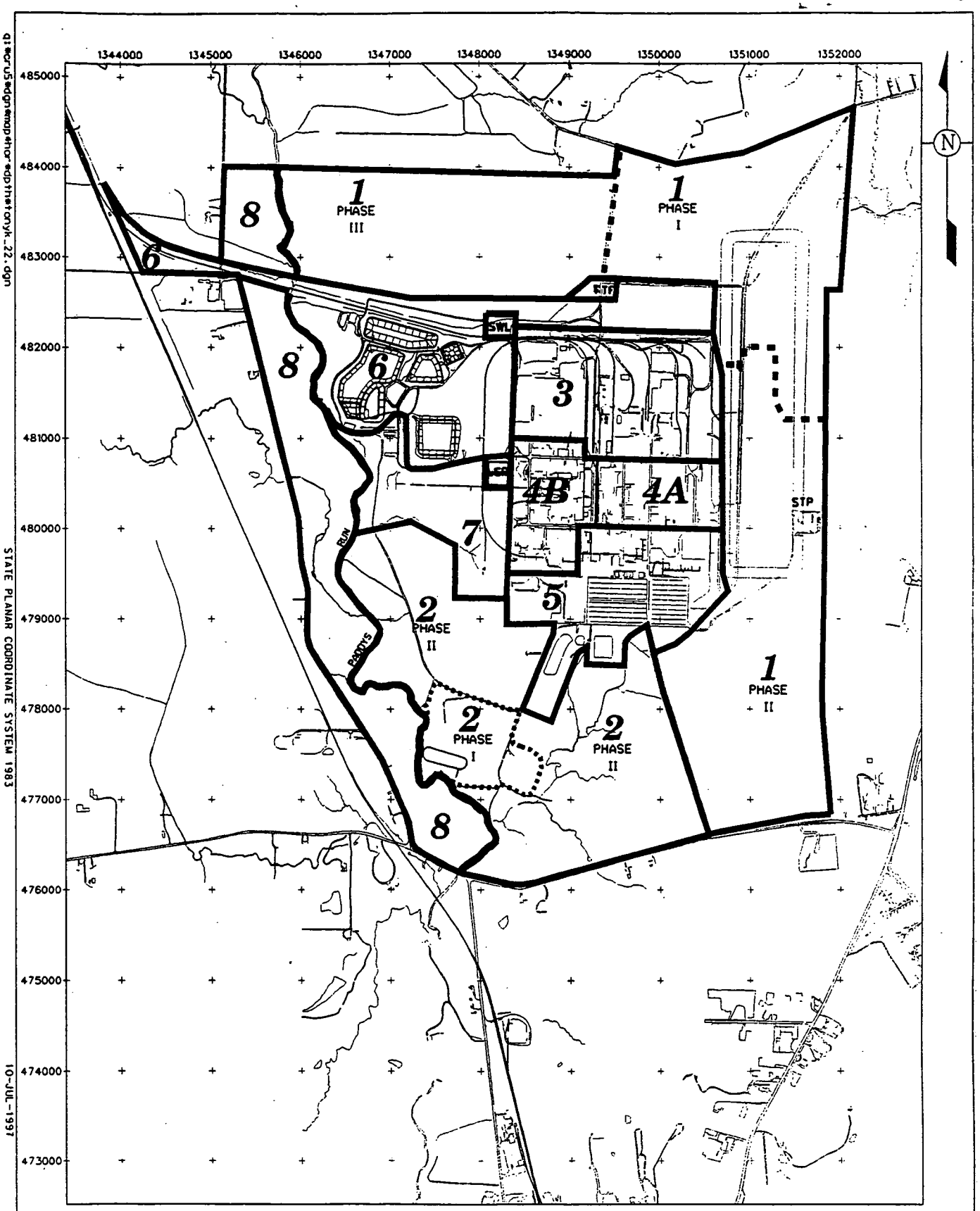
B.2.13 Remediation Area 8 - West of Paddys Run (Figure B-15)

Based on existing data, process knowledge, and wind patterns at the site, Remediation Area 8 is not expected to contain contamination at levels that would required excavation. It is anticipated that pre-certification activities will commence in this area without excavation. As shown on Figure B-1, the railroad corridor is not included as part of this area.

B.2.14 Advanced Wastewater Treatment Facility and Long-Term Corridors (Figure B-16)

The AWWT facility is sequenced in the final step because of the long-term operation of the aquifer restoration system and the use of AWWT facility in supporting other remediation activities. Parallel to

or immediately following remediation of the AWWT facility, the remaining long-term corridors at the site would be remediated. These include the South Entrance Road, the South Plume Pipeline, the South Field Pump System, and the Outfall Line.




LEGEND:

REMEDIATION AREA BOUNDARY

PHASE BOUNDARY WITHIN A REMEDIATION AREA

SCALE

1500 750 0 1500 FEET

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FIGURE B-1. SITE REMEDIATION AREAS

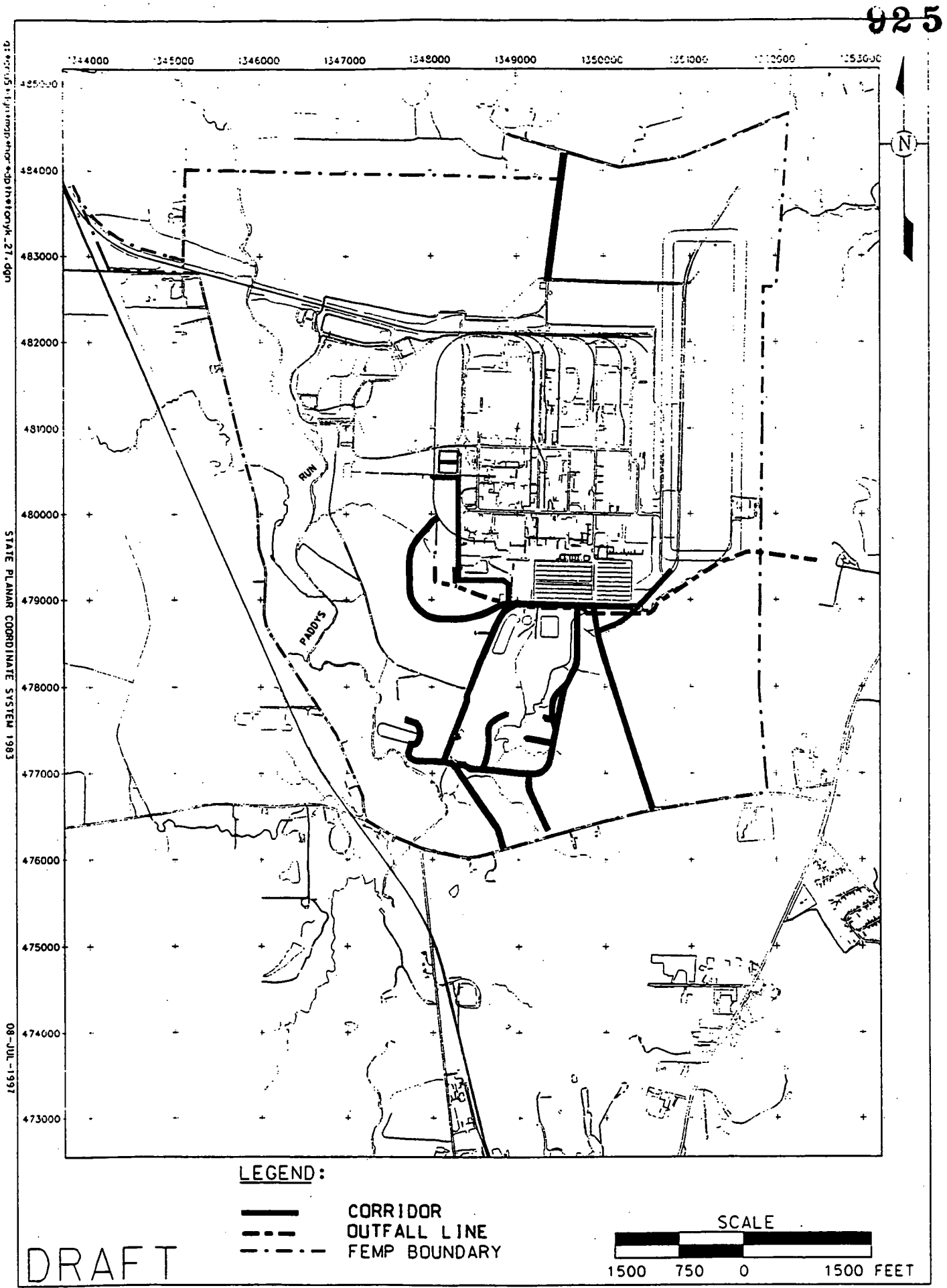



FIGURE B-2. LONG TERM CORRIDORS

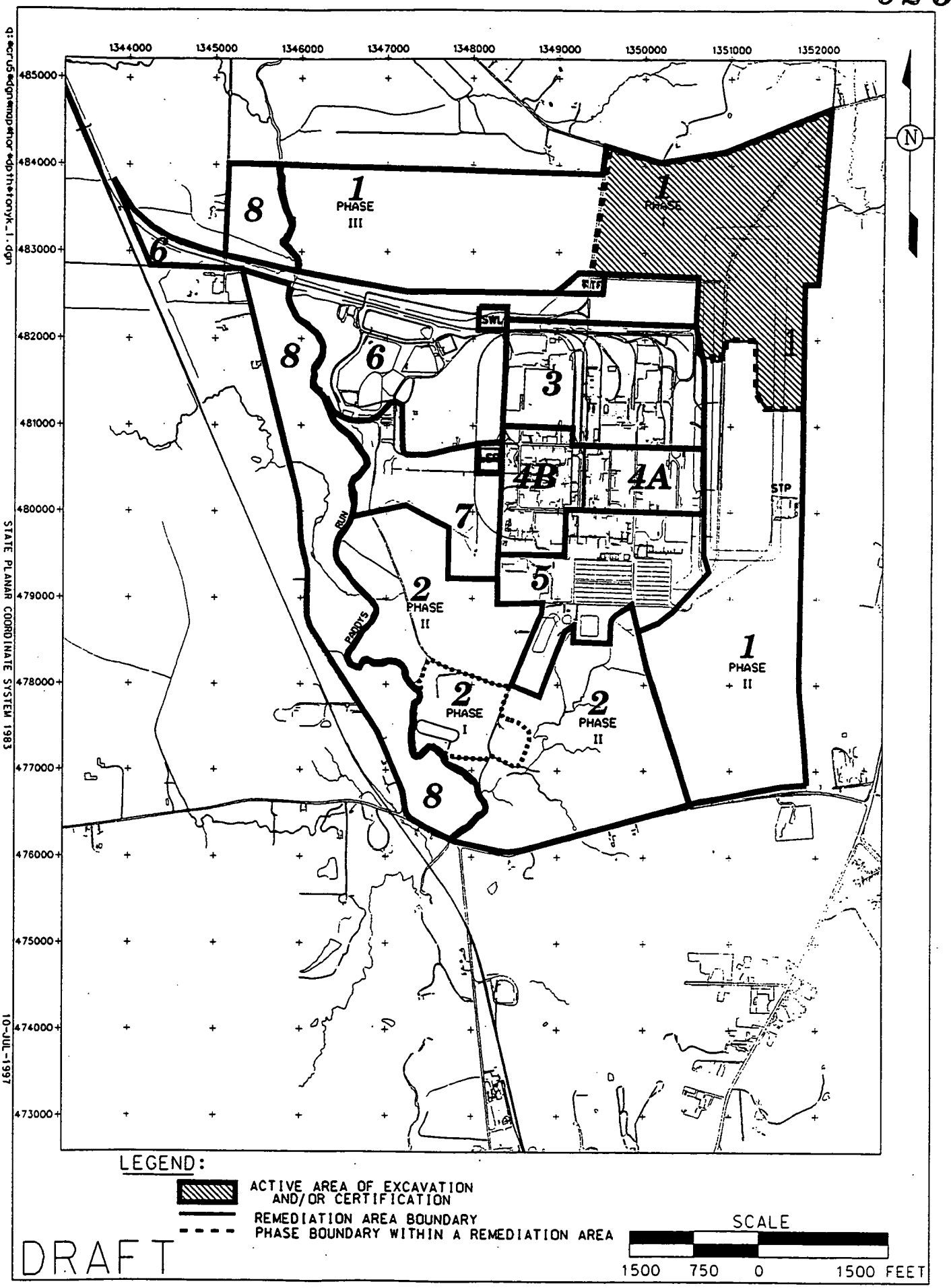



FIGURE B-3. AREA 1, PHASE I NORTH ENTRANCE ROAD AND OSDF FOOTPRINT

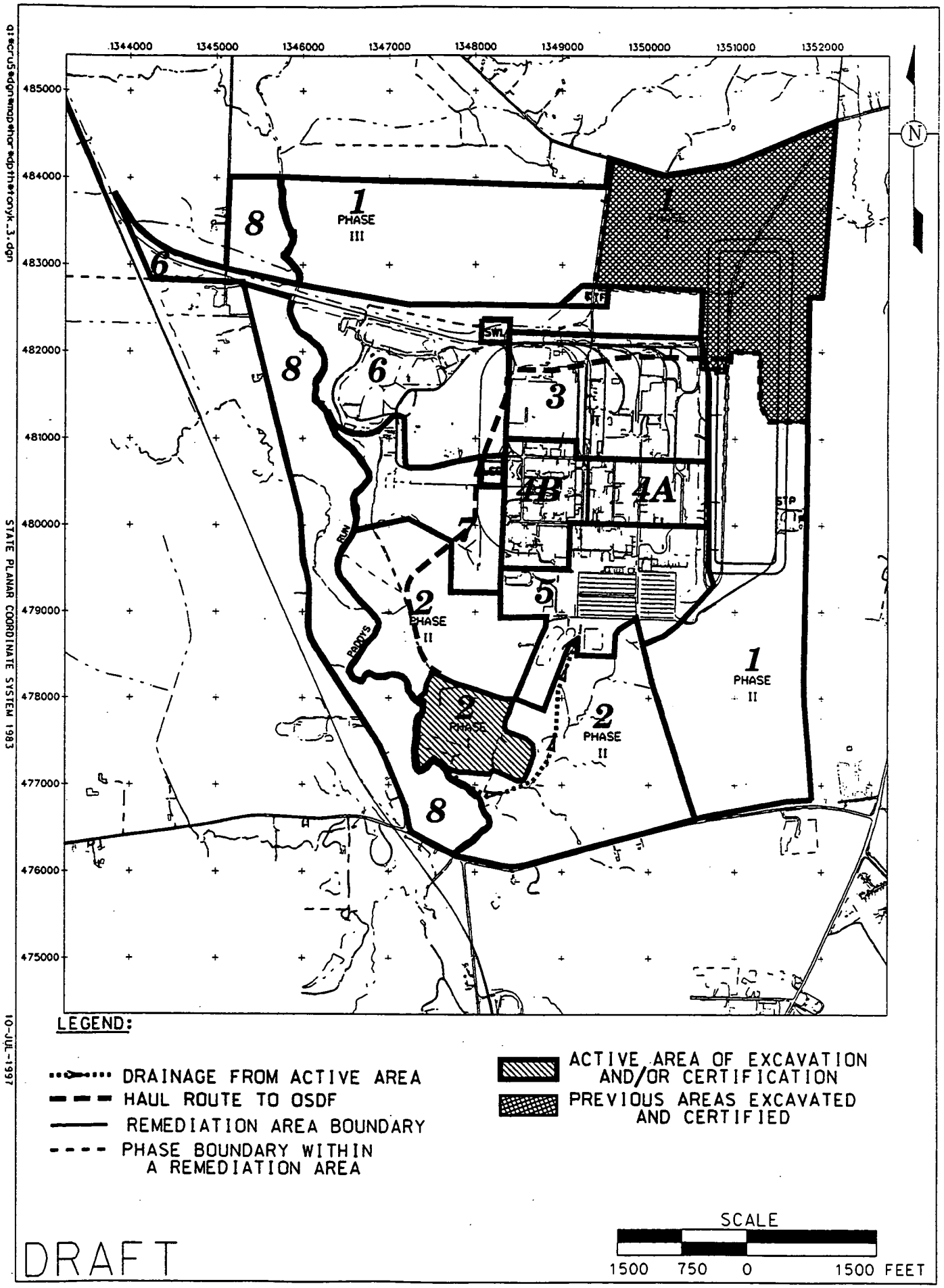
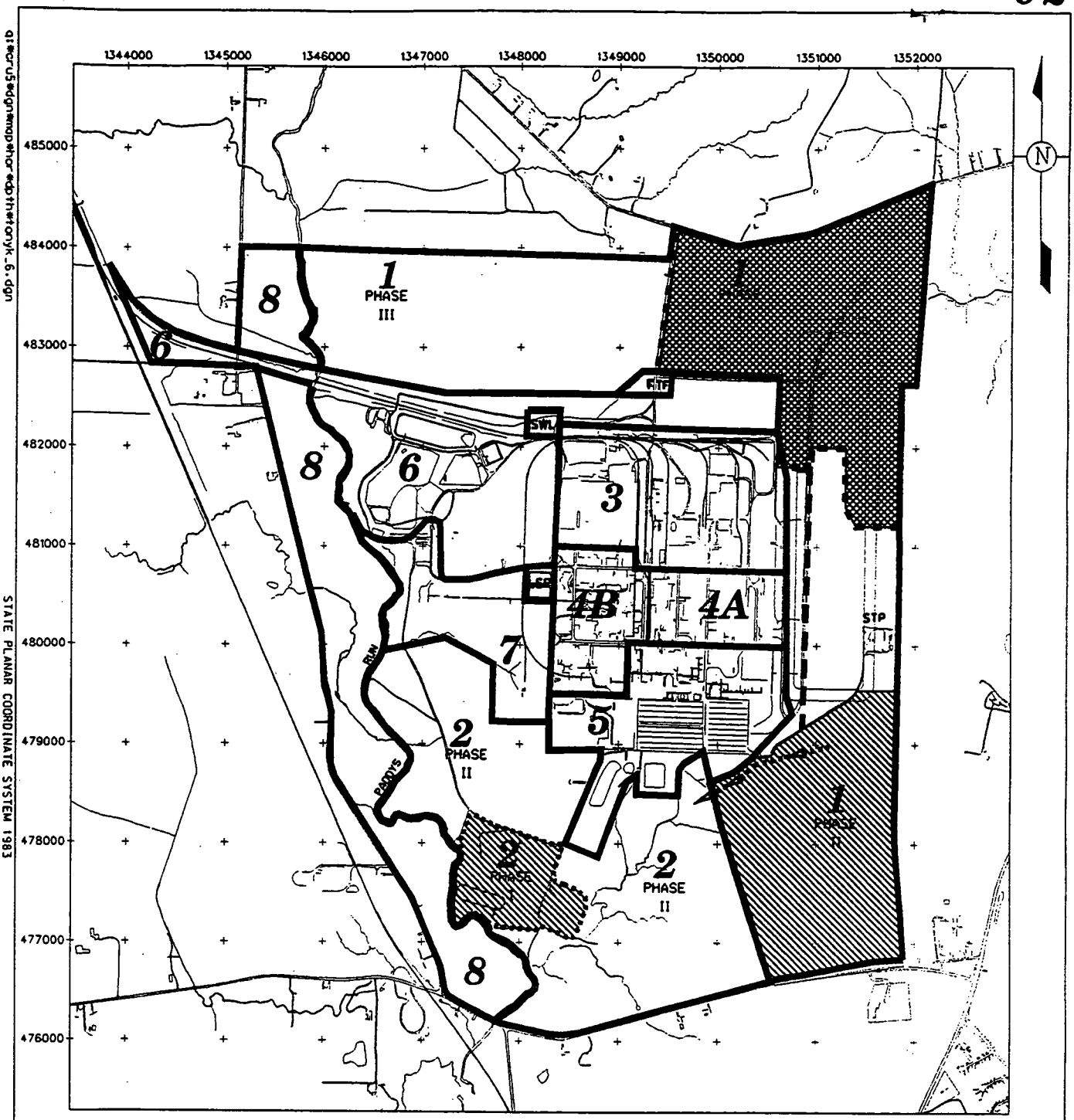



FIGURE B-4. AREA 2, PHASE I SOUTHERN WASTE UNITS




LEGEND:

- ACTIVE AREA OF EXCAVATION AND/OR CERTIFICATION
- PREVIOUS AREAS EXCAVATED AND CERTIFIED
- DRAINAGE FROM ACTIVE AREA
- REMEDIATION AREA BOUNDARY
- PHASE BOUNDARY WITHIN A REMEDIATION AREA
- HAUL ROUTE TO OSDF

SCALE

1500 750 0 1500 FEET

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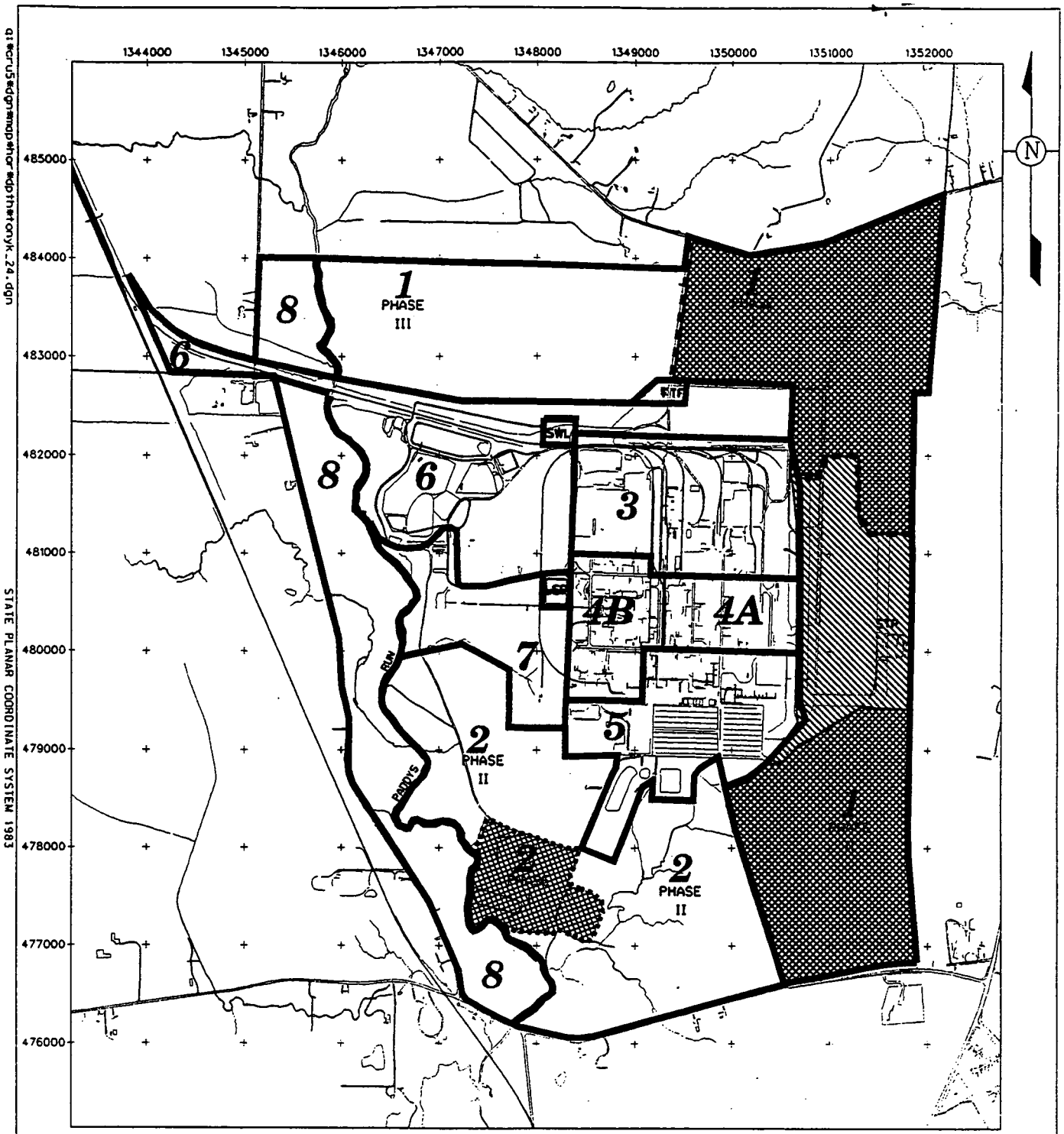
STATE PLANAR COORDINATE SYSTEM 1983

10-JUL-1997

FIGURE B-5. AREA 1, PHASE II: SOUTHEAST PORTION OF FEMP




LEGEND:

- ACTIVE AREA OF EXCAVATION AND/OR CERTIFICATION
- PREVIOUS AREAS EXCAVATED AND CERTIFIED
- REMEDIATION AREA BOUNDARY
- PHASE BOUNDARY WITHIN A REMEDIATION AREA

SCALE

1500 750 0 1500 FEET

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FIGURE B-6. AREA 1, PHASE II:
OSDF FOOTPRINT AND SEWAGE TREATMENT PLANT



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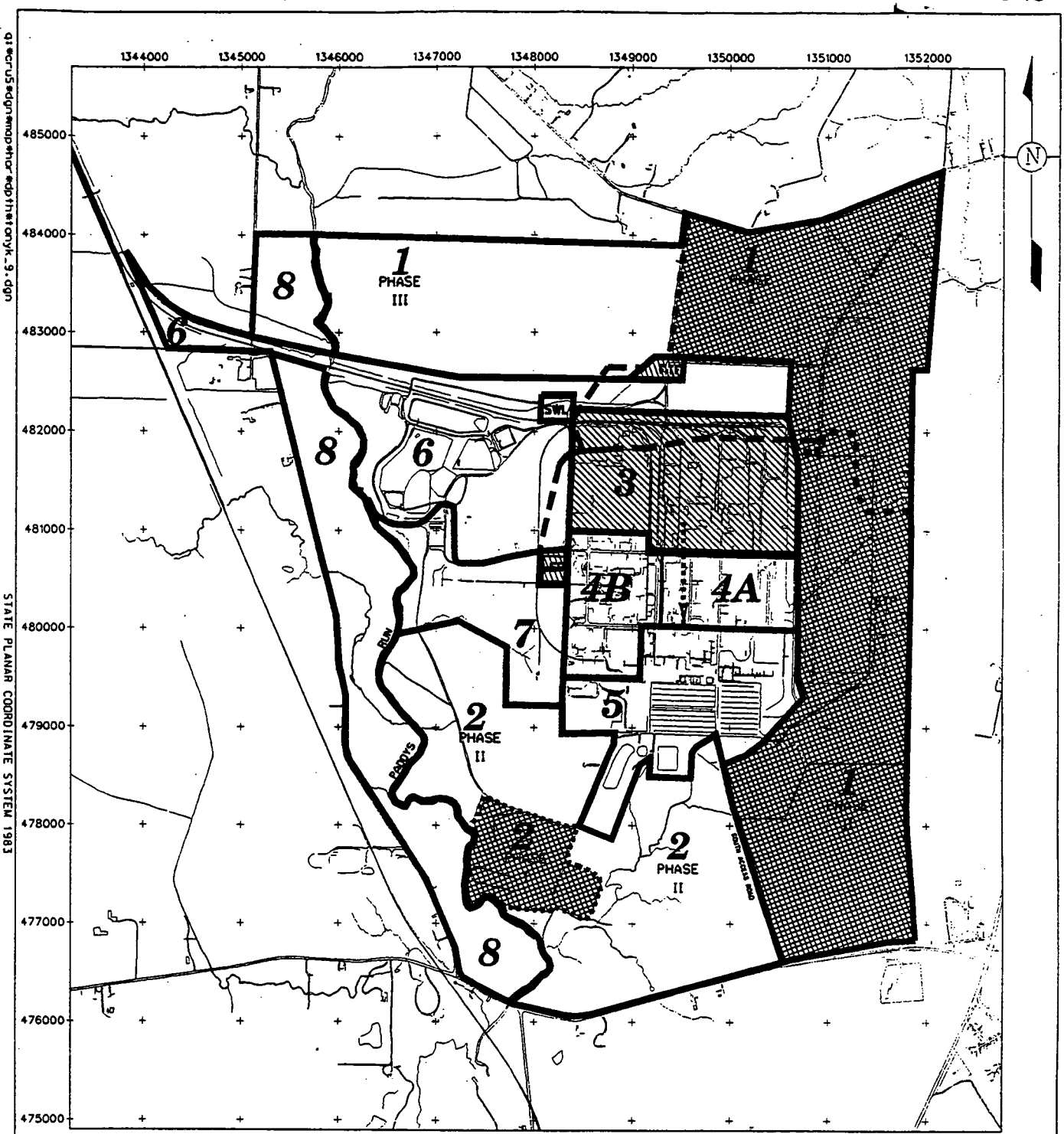
STATE PLANAR COORDINATE SYSTEM 1983
10-JUL-1997




LEGEND:

- ACTIVE AREA OF EXCAVATION AND/OR CERTIFICATION
- PREVIOUS AREAS EXCAVATED AND CERTIFIED
- DRAINAGE FROM ACTIVE AREA
- HAUL ROUTE TO OSDF
- REMEDIATION AREA BOUNDARY
- PHASE BOUNDARY WITHIN A REMEDIATION AREA

SCALE

1500 750 0 1500 FEET

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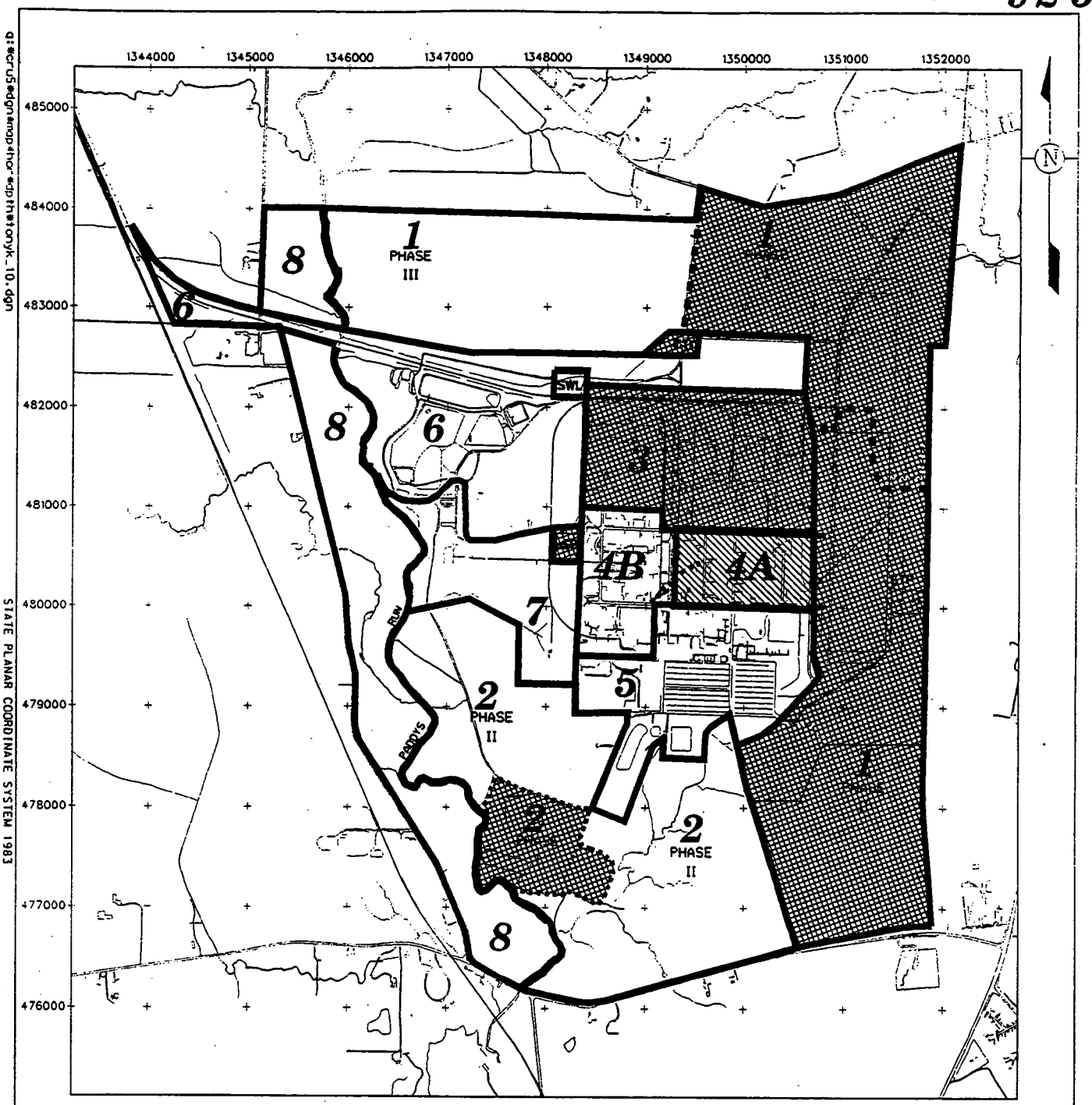
STATE PLANAR COORDINATE SYSTEM 1983

10-JUL-1997

FIGURE B-7. AREA 3, (NORTH END OF FORMER PRODUCTION AREA), LIME SLUDGE PONDS, AND FIRE TRAINING FACILITY




LEGEND:

- ACTIVE AREA OF EXCAVATION AND/OR CERTIFICATION
- PREVIOUS AREAS EXCAVATED AND CERTIFIED
- DRAINAGE FROM ACTIVE AREA
- HAUL ROUTE TO OSDF
- REMEDIATION AREA BOUNDARY
- PHASE BOUNDARY WITHIN A REMEDIATION AREA

SCALE

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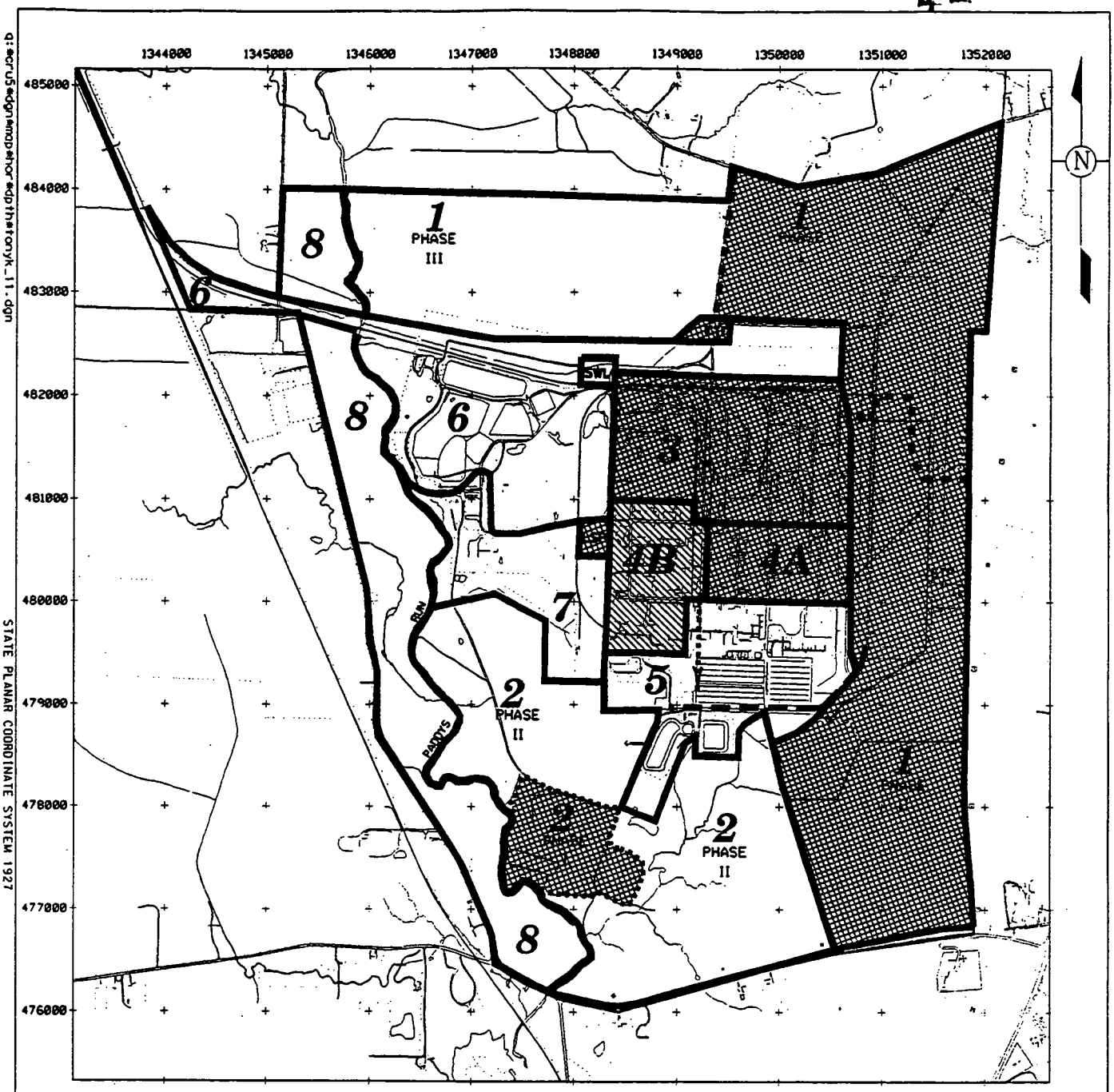
STATE PLANAR COORDINATE SYSTEM 1983

10-JUL-1997

B-8. 4 A EAST CENTRAL PORTION OF FORMER PRODUCTION AREA)




LEGEND:

- ACTIVE AREA OF EXCAVATION AND/OR CERTIFICATION
- PREVIOUS AREAS EXCAVATED AND CERTIFIED
- DRAINAGE FROM ACTIVE AREA
- HAUL ROUTE TO OSDF
- REMEDIATION AREA BOUNDARY
- PHASE BOUNDARY WITHIN A REMEDIATION AREA

SCALE

1500 750 0 1500 FEET

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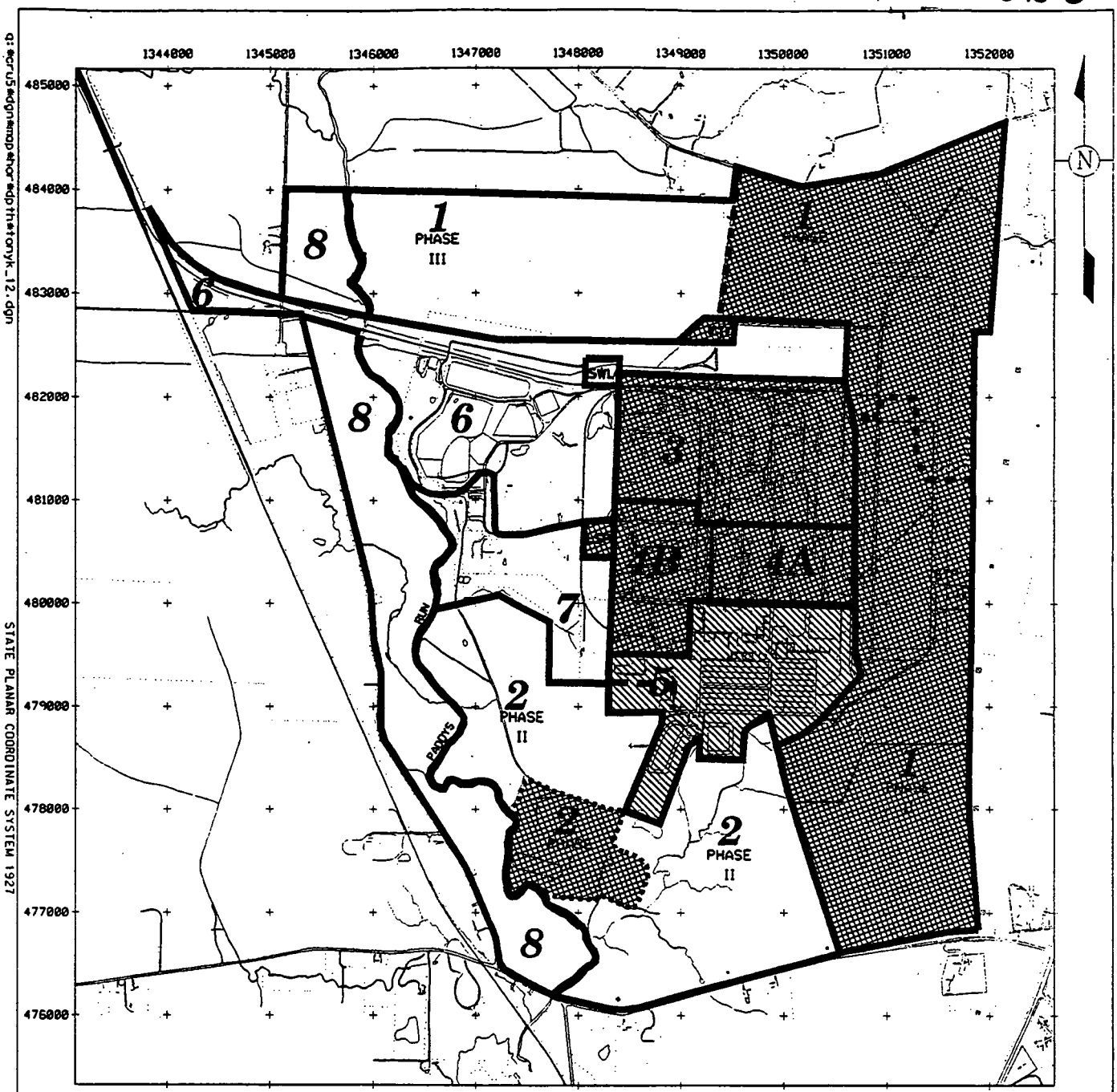
STATE PLANAR COORDINATE SYSTEM 1927

10-JUL-1997

FIGURE B-9. AREA 4B (WEST CENTRAL PORTION OF FORMER PRODUCTION AREA)




LEGEND:

- ACTIVE AREA OF EXCAVATION AND/OR CERTIFICATION
- PREVIOUS AREAS EXCAVATED AND CERTIFIED
- DRAINAGE FROM ACTIVE AREA
- HAUL ROUTE TO OSDF
- REMEDIATION AREA BOUNDARY
- PHASE BOUNDARY WITHIN A REMEDIATION AREA

SCALE

1500 750 0 1500 FEET

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FIGURE B-10. AREA 5 (ADMINISTRATION AREA)



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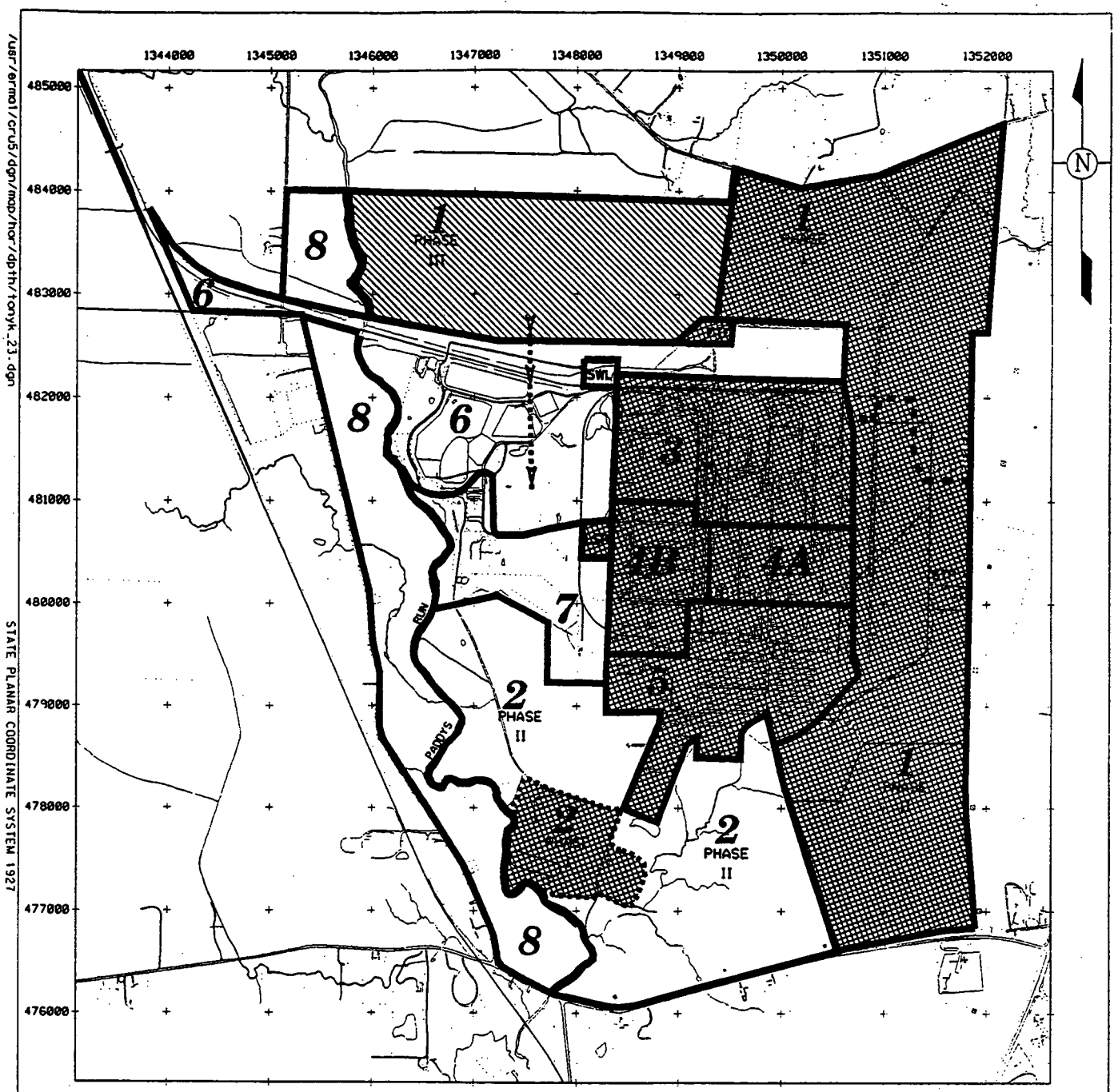
STATE PLANAR COORDINATE SYSTEM 1927
10-JUL-1997




LEGEND:

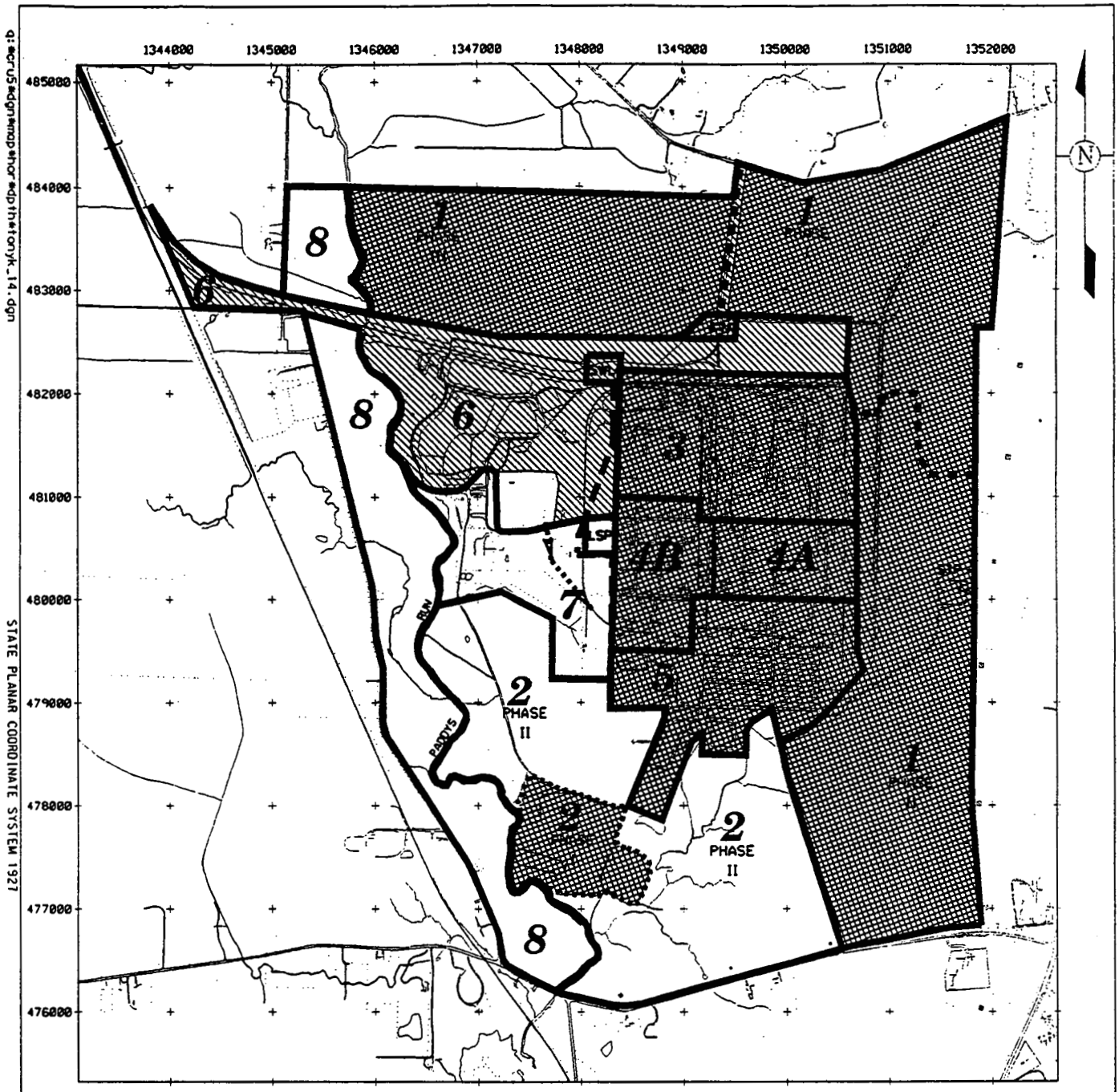
- ACTIVE AREA OF EXCAVATION AND/OR CERTIFICATION
- PREVIOUS AREAS EXCAVATED AND CERTIFIED
- DRAINAGE FROM ACTIVE AREA
- HAUL ROUTE TO OSDF
- REMEDIATION AREA BOUNDARY
- PHASE BOUNDARY WITHIN A REMEDIATION AREA

DRAFT

SCALE

1500 750 0 1500 FEET

FIGURE B-11. AREA 1, PHASE III (NORTH AREA OF FEMP)




LEGEND:

- ACTIVE AREA OF EXCAVATION AND/OR CERTIFICATION
- PREVIOUS AREAS EXCAVATED AND CERTIFIED
- DRAINAGE FROM ACTIVE AREA
- HAUL ROUTE TO OSDF
- REMEDIATION AREA BOUNDARY
- PHASE BOUNDARY WITHIN A REMEDIATION AREA

SCALE

1500 750 0 1500 FEET

DRAFT

q:\ecru5\dgn\map\hor\edp\thetonyk_14.dgn

STATE PLANAR COORDINATE SYSTEM 1927

10-JUL-1997

FIGURE B-12. WASTE PIT AREA, SOLID WASTEL ANDFILLS, RAILROAD CORRIDOR AND ORIGINAL NORTH ENTRANCE ROAD

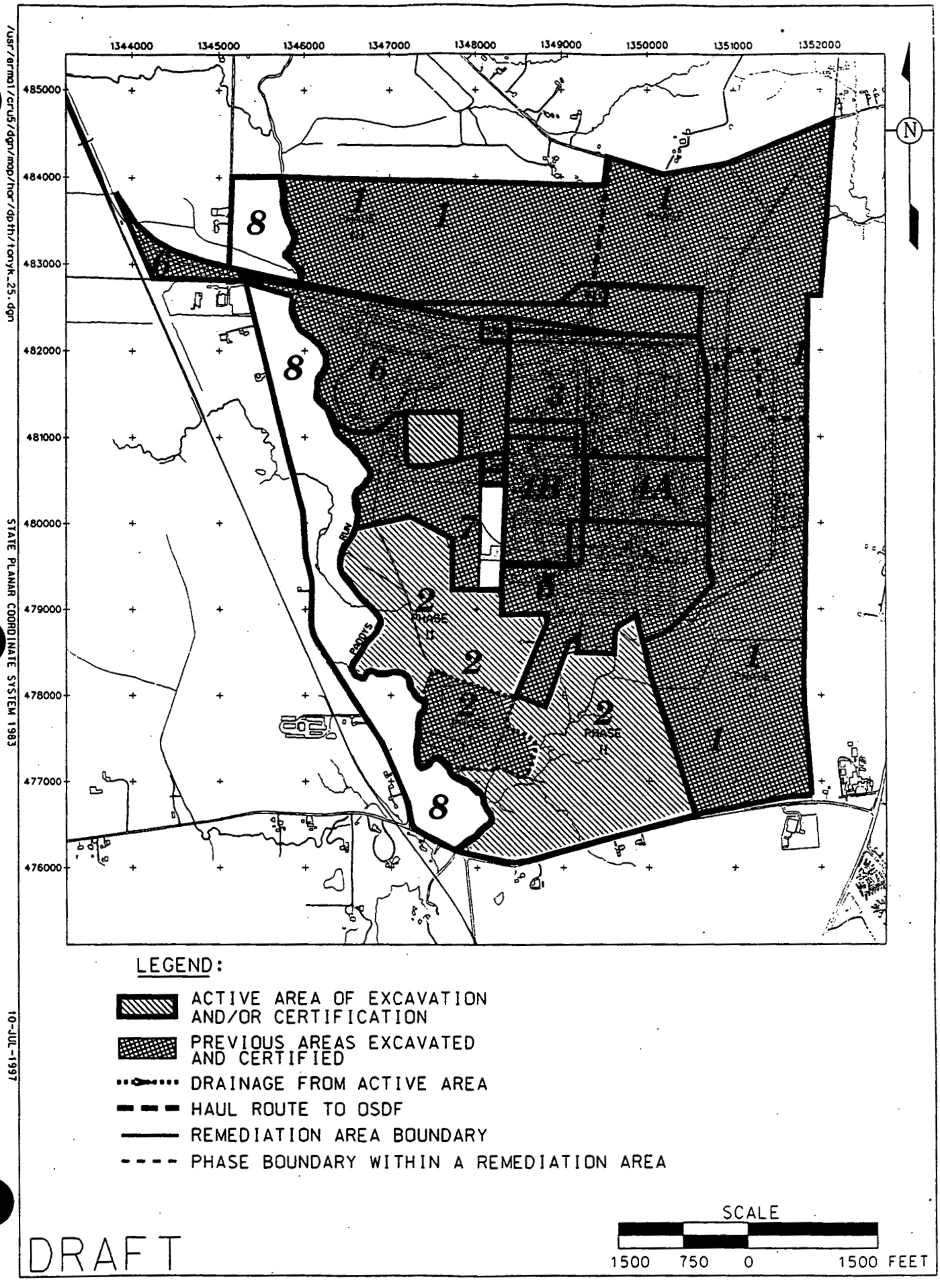



FIGURE B-13. BIO SURGE LAGOON AND AREA 2, PHASE 11

# APPENDIX C

# CONSTITUENT OF ECOLOGICAL CONCERN SELECTION

## LIST OF ACRONYMS

| | |
|---|---|
| BTV | benchmark toxicity value |
| CAWQC | chronic ambient water quality criteria |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| COEC | constituents of ecological concern |
| DOE | U.S. Department of Energy, Fernald Field Office |
| EPA | United States Environmental Protection Agency |
| FEMP | Fernald Environmental Management Project |
| FRL | final remediation level |
| FTF | Fire Training Facility |
| IEMP | Integrated Environmental Monitoring Plan |
| NRRP | Natural Resource Restoration Plan |
| NRT | Natural Resource Trustee |
| OSDF | On-site Disposal Facility |
| OU | Operable Unit |
| PAH | polynuclear aromatic hydrocarbons |
| RI | Remedial Investigation |
| RI/FS | Remedial Investigation/Feasibility Study |
| ROD | Record of Decision |
| SED | Site-wide Environmental Database |
| SERA | Site-wide Ecological Risk Assessment |
| WAC | waste acceptance criteria |

## INTRODUCTION

At the time of the Operable Unit 5 (OU5) Record of Decision (DOE 1996a), DOE recognized the need to evaluate the impact of contaminants to ecological receptors on and around the property. As part of the process of restoring the site to its final land use, DOE must ensure that ecological receptors are not adversely impacted by residual contamination that may remain after remediation is complete[1]. One early step towards this goal was taken with the publication of the Site-wide Ecological Risk Assessment (SERA), which was conducted as part of the Operable Unit 5 Remedial Investigation (RI; DOE 1995).

The SERA contains a preliminary evaluation of potential risks to all organisms that may be exposed to contaminants within OU5[2], exclusive of humans and domestic animals. Risks to these receptors were divided into radiological risks and non-radiological risks. Concentrations of constituents of ecological concern (COECs) in environmental media that may pose a risk to ecological receptors were identified by first computing their concentration and comparing it to specific screening criteria. For radioactive constituents, the COEC concentrations were used to calculate the radiological dose rates accrued by individuals of various representative species. These doses were then compared to the target level dose (36.5 rad/year) as established by the International Atomic Energy Agency (1992). For potential non-radiological risks, COECs were identified for all perimeter areas at the FEMP by comparing existing data from the RI with literature-derived benchmark toxicity values (BTVs). If locations were found to have media with COEC concentrations exceeding these BTVs, they would have been identified for further study.

Consideration of the information developed in the SERA was to have been deferred until after all human health driven remediation had been completed (DOE 1995b). However, as negotiations with the

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[1] The Operable Unit 5 (OU5) Record of Decision (DOE 1996) established final remediation levels (FRLs) for the remediation of soil and other environmental media at the Fernald Environmental Management Project (FEMP). The FRLs in the OU5 ROD were determined based on computed health impacts to human receptors. Ecological impacts were not directly considered.

[2] The SERA was limited to contaminants present in various media outside of the source OUs at the FEMP. The Production Area (OU3), Waste Pit Area (OU1), K-65 Silos (OU4) and the Southern Waste Units (OU2) were not included in the SERA evaluation.

FEMP Natural Resource Trustees progressed, it became clear that in order to resolve all trustee concerns, ecological impacts must be considered before remedial activities have been completed. To accommodate this requirement, final land use planning is being accelerated in the form of the Natural Resource Restoration Plan (NRRP).

The NRRP will guide the growth of an undeveloped park at the FEMP. This proposed park will feature wildlife habitat as one of its central land uses. Anticipated post-excavation ecological risks could directly affect some of the organisms in these habitats. This would influence the development of the final land use plan. In order to better define these risks a second ecological risk screening has been conducted.

Appendix C examines existing data characterizing the nature and extent of chemical and radiological contaminants at the FEMP. The evaluation uses existing data for all potential COECs in media at the site as it is today (preexcavation data), as well as modeled remnant (post-excavation) data. Also, the findings of the SERA have been revisited and qualitatively evaluated to determine what will remain a concern based on post-remedial site conditions. All analyses are presented in this appendix. All soil data pulled for the sitewide and remnant data review are available upon request.

## C.1 SYNOPSIS OF THE SITEWIDE ECOLOGICAL RISK ASSESSMENT

The methods and results of the Sitewide Ecological Risk Assessment (SERA) form the basis for the sitewide re-evaluation of COECs presented in this appendix. The SERA was used to evaluate risks from two types of COECs present at the site: Radioactive COECs and non-radioactive COECs.

### C.1.1 Nonradioactive COECs in soil

To determine relative risks to ecological receptors from the non-radiological characteristics of COECs in soil, soil concentrations of contaminants were compared to screening concentrations. These screening concentrations, known as benchmark toxicity values are COC and media specific values. They are derived from available literature and are considered to be protective of ecological receptors. Constituents exceeding these BTVs were regarded as COECs for the FEMP

For soil, the SERA divided the FEMP into seven separate study areas (Areas A-G, Figure C-1). These study areas were based on habitat type and, to a lesser extent, the home range of potential ecological receptors and land-use history (DOE 1995). Existing RI/FS surface soil (0-6 inches deep) data were obtained for each all constituents within each study area, excluding all source areas (Southern Waste Units, Sewage Treatment Plant, etc.).

The representative concentrations for each constituent were determined using statistical methods outlined in the FEMP Baseline (human health) Risk Assessment Addendum and subsequent U.S. Environmental Protection Agency (EPA) guidance. This procedure calls for the calculation of the upper 95 percent confidence limit on the arithmetic mean for normally or lognormally distributed data. When a COEC was not detected in a sample, the concentration for that sample was set at one half the detection limit. Data sets that were not normally or lognormally distributed, contained few detects (less than 7 detects), or contained a large portion of nondetects (greater than 50 percent) were declared to have an undefined distribution. For data with an undefined distribution, the 95th percentile value or the maximum detected value was used as the representative concentration. For most parameters, this was the maximum concentration found within each study area. The areas evaluated in the SERA

(Figure C-1) often had undefined data distributions since the COEC was either not detected or was detected at very low concentrations.

The BTVs used to develop the SERA COEC list were obtained from a variety of sources. When possible, BTVs were selected in the SERA that considered impacts to ecological receptors. However, limited information was available with respect to protection standards for ecological receptors. In many instances, surface soil benchmarks developed to be protective of human health had to be employed. To the extent possible, these values were compared to ecological toxicity data published in the literature to help ensure that they were protective of ecological receptors (DOE 1995).

### C.1.2 Nonradioactive COECs in Surface Water and Sediment

For surface water, chronic ambient water quality criteria (CAWQC) were used as BTVs, when available. Hardness-dependent CAWQC were adjusted with site-specific water hardness values. When CAWQC were not available, a surrogate BTV was calculated from published acute toxicity data. LC50 concentrations (concentrations lethal to 50 percent of a test population) were divided by 100 to determine a conservative chronic value that was used as a BTV. In other instances, "lowest observed effect levels" were divided by 10 to calculate a BTV. For sediment, BTVs for inorganic constituents were determined from published values or sediment quality criteria. Nonpolar organics were modeled to determine interstitial water concentrations, while polar organics were assumed to be completely dissolved in the interstitial water. These values were compared to the appropriate surface water BTV.

The SERA also evaluated drinking water exposure to terrestrial receptors from several sources on-property and off-property. For drinking water BTVs, (referred to as "drinking water benchmarks" in the SERA), human health drinking water criteria were used. if these values were not available, human health risk-based criteria were used. Finally, if risk-based criteria were not available, the surface water aquatic BTV was used as a screen.

### C.1.3 Assessment of Radioactive COECs in Surface Media

Dose rates from exposure to radioactive COECs in surface soil, surface water, and sediment were calculated for representative ecological receptors at the FEMP. The results of this radiation dose assessment indicated that doses derived from on- and off-property media concentrations of radioactive COECs did not exceed a target level dose (36.5 rad/year) established by the International Atomic Energy Agency (1992). Therefore, radiological impacts on ecological receptors at the site were not recommended for further consideration during development of the land use plan.

### C.1.4 Conclusions

Table C-1 presents the resulting list of potential COECs identified in soils for each discrete study area assessed by the SERA The determination of the BTVs used in the SERA to construct this list was appropriate for that stage of the process, but it produced very conservative results. A more detailed analysis is required before the SERA COECs can be finalized to address restoration concerns. The SERA can therefore be viewed as a useful screening-level document which does not provide the level of site-specific detail necessary to determine realistic estimates of residual impacts to FEMP ecological receptors.

## C.2 APPROACH FOR ADDRESSING COECS

The development of the NRRP requires that COECs be considered prior to the completion of excavation. Excavation will reduce the levels of COECs in soil and surface water at the site, but ecological impacts may still result from COEC's that remain in soil. The evaluation of soil COECs is divided into two phases, based on the soil's location on the site: Source areas and Perimeter areas. The remainder of this section presents the approaches used to identify potential COEC's in surface water and sediment.

### C.2.1 Source Area Soil COECs

COECs in Source Area Soils were evaluated by comparing their soil concentrations to an appropriate screening value. If a COEC's soil concentrations exceeded its corresponding screening value, the COEC in question was retained for further evaluation. Figure C-2 depicts the this approach. To follow this approach, three tasks must be completed. First, a list of COECs must be created, then an appropriate screening value must be determined, and then the concentrations of these that are likely to remain after excavation must be determined. Each of these steps is discussed below.

#### C.2.1.1 Selection of COECs

First, a preliminary list of COECs was formed by combining all the constituents investigated in the SERA with the list of constituents in the OU5 ROD that had an FRL assigned to them (DOE 1995, DOE 1996). Then, all constituents on the preliminary list that had a SERA soil BTV with a higher concentration than its corresponding FRL were removed to reflect the assumption that FRL-driven excavation will automatically reduce the concentrations of these constituents to ecologically benign levels. Table C-2 lists the COECs that were removed by this process. The COECs retained for further consideration are found in Table C-3.

#### C.2.1.2 Derivation of BTV Screening Value

Once a list of COEC's was developed, the COEC concentrations that might harm an ecological receptor were established. For COECs with a SERA BTV, the established BTV was used as the screening value. If no SERA BTV was derived, then a search of several databases for media-specific

BTVs was conducted. Ecological databases searched included the U.S. EPA Region III Ecological Screening Database (1994) and the Oak Ridge National Laboratory Screening Benchmarks for Ecological Risk Assessment Database (DOE 1996b). The lowest available concentration listed in these three sources is the BTV. If no screening value was available from the databases searched, then soil concentrations were screened against FRLs. For the limited number of cases where no SERA BTV, FRL, or Database screening value was available, professional judgment was used in the screening process to determine whether the constituent should be carried through for further evaluation. Table C-3 lists the BTV used in bold, along with available information on the soil FRL established in the OU5 ROD, the SERA soil BTV, the OU5 FS detection limits, and the OU5 FS background values.

C.2.1.3 Determination of Soil Concentrations

A compendium of information was assembled about the preliminary COECs identified in this evaluation. This compendium generated by querying the most complete database available on the nature and extent of site-wide contaminants, the site-wide environment database (SED). Information retrieved included each sample's identification number, the sampling location, the analyte's name, the sample analytical result, and the result's validation qualifier. Because this section considers post excavation conditions, soil concentrations at all depths were included in the data queries. The resulting catalogue of data is available upon request.

A review of data queried from the SED reveled that both soil characterization data and treatability study data were included. Treatability data is not considered to be representative of current soil concentrations. This had no impact on final results because none of these parameters were retained as a post-excavation concern, and routine quality assurance checks discovered the problem before this report was published.

C.2.1.4 Soil Screening Process

The screening process involved comparing maximum soil concentrations detected at any depth across the FEMP to the appropriate BTV. If maximum concentrations exceeded a corresponding BTV, the COEC in question was retained for further evaluation. Since BTVs were compared against sitewide

concentrations detected at any depth, a COEC was not retained for further evaluation if there were less than five detections less than an order or magnitude greater than the BTV.

All COECs that were retained following the review of sitewide concentrations were evaluated based on remnant soil concentrations. Remnant soil is the soil that is expected to remain after the remedial excavation work is complete. A preliminary estimate of the extent of the excavation was developed using the spatial distribution of total uranium in soils on the site. It was assumed that any excavation would remove soil containing uranium concentrations in excess of the applicable total uranium FRL. To reflect this, results from samples with a uranium concentration that exceeded the uranium were excluded from the remnant data set.[3] This provided a conservative estimate of samples from soils that would remain after the FRL-driven excavation was complete. Concentration data from the samples in this remnant data set were compared to the applicable BTVs. Any sample with a constituent concentration exceeding its BTV was passed to the next phase of the evaluation.

Samples in the remnant data set that exceeded a BTV were examined to see if they were located within an area that would be excavated because they contain constituents other than uranium in concentrations exceeding their respective FRLs. If the sample was from such a location it was eliminated from further consideration. Any remaining exceedances were singled out for additional consideration. The existence of these samples will be presented to decision makers for consideration in the appropriate IRDPs.

### C.2.2 Perimeter Area Soil COECs

The Perimeter Area Soils evaluation builds on the preliminary work presented in the SERA. Evaluation of the 16 preliminary COECs outlined in the SERA are necessary because current excavation plans do not include several areas of the site where SERA COECs were identified. Also,

[3] For a few COECs, remnant data were not specifically pulled, but rather investigated from the sitewide detections data set. The limited number of BTV exceedances were investigated individually to ensure enclosure within the Sitewide Footprint of Excavation.

site conditions have changed since the completion of the SERA. For instance, the determination of a COEC within a SERA study area may have been based on surface soil concentrations that have since been remediated as part of a removal action; therefore, the risk from that preliminary COEC no longer exists within the particular study area. In addition, the determination of a preliminary COEC in the SERA may have been based on the exceedance of a BTV that is a lower value than background concentrations of that constituent at the FEMP site. Figure C-3 presents the steps followed in this process. The following sections outline the factors that were considered in establishing final COECs in the perimeter areas.

C.2.2.1 Updated Representative Concentrations

In the process of investigating the establishment of soil COECs at the FEMP, it was determined that representative concentrations for parameters in each SERA study area must be reevaluated in order to reflect current site conditions. There are two reasons for this: Representative concentrations must take into account the most recent data set; and the original calculations of representative concentrations were calculated in a very conservative manner.

The SERA used the 1987-1993 Remedial Investigation data set for analysis of ecological risks. Since then, the data set for the FEMP has been expanded and refined. Several removal actions have eliminated contaminated soil, which in some instances was the only driver for the inclusion of a potential contaminant as an COEC. Zinc is a good example. Representative soil concentrations of zinc were found to be above the BTV in SERA Study Area A (Figure C-1). However, the only elevated levels of zinc (soil concentrations greater than the BTV of 500 mg/kg) were found at the Fire Training Facility (FTF). In 1994, Removal Action No. 28 removed contaminated structures and soil from the FTF. Verification sampling has confirmed that zinc soil concentrations have been greatly reduced to a level below the BTV. Therefore, zinc is no longer considered an COEC within Study Area A.

The second reason for re-evaluating the representative concentrations was the conservative nature of the statistical methods used in the original calculations. The representative concentrations for each COEC in the SERA evaluation were determined using statistical methods outlined in the FEMP Baseline Risk Assessment Addendum and subsequent U.S. EPA. guidance. These methods were

developed for use in the operable unit human health assessments performed previously at the FEMP. This procedure calls for the calculation of the upper 95 percent confidence limit on the arithmetic mean for normally or lognormally distributed data. Data that was not normally or lognormally distributed, contained few detects (<7 detects), or contained a large portion of nondetects (>50 percent) had an undefined distribution. The representative concentration for a data set with an undefined distribution was defined as the 95th percentile of the data set[4] or the maximum detected value, which ever was lower. In the SERA evaluation, this was often the maximum concentration found for most parameters.

For COEC selection, the method used in human health assessments does not adequately represent data sets with undefined distributions and a large number of nondetects or low concentrations. This is especially true when ecological risks are being attributed to an entire study area. Therefore, an alternative method that considered the full range of values found within a particular area was used to calculate a revised representative concentration. Under the alternative method used, a revised representative concentration was calculated for each study area using the 95 percent upper confidence limit on the arithmetic mean of all data points for normally or lognormally distributed data. For data with an undefined distribution, the 95 percentile upper confidence limit on the median concentration was used. Undetectable concentrations were included in this calculation at their full detection limit.

This alternative method is not necessarily less conservative than the methodology used in the previous human health assessments. Using the reported detection limit to represent the value of each nondetected datum will arbitrarily change the statistical description of the data set. Generally, this approach will increase the data set's calculated mean and 95 percentile values while it lowers its variability. This approach is consistent with U.S. EPA guidance for environmental evaluations under the Comprehensive Environmental Response, Compensation, and Liability Act (EPA 1989).

For each SERA study area (Figure C-1), a revised representative concentration was calculated using the alternative method described above. Addendum A provides a complete comparison between the soil

[4] In this approach, nondetected values were included in the distribution at one-half their reported detection limits.

concentrations used in determining SERA representative concentrations and the soil concentrations used in determining updated representative concentrations.

By using the most recent data available and by calculating representative concentrations in a manner that considers all data points across a study area, the updated COEC list more accurately reflects current site conditions. The resulting representative concentrations indicate the relative significance that may be assigned to the different exposures an ecological receptor may receive on the FEMP site.

C.2.2.2 Background Values

Background concentrations of the potential COECs are intended to represent contaminant levels in regional soils that have not been contaminated by operations at the FEMP. The samples that form the basis of the study that determined the FEMP background concentrations were collected from a reference site several miles northwest of the FEMP. Because of the variable nature of the glacial deposits found in southwestern Ohio, the soils at the background reference site might not adequately represent the glacial till soils found at the FEMP. In fact. it appears that background concentrations for COECs at the FEMP exhibit a higher degree of variability than those in soils from the reference site. This presents a problem when a BTV is lower than the value used to represent background in the screening process. It is possible for a COEC to be present in concentrations that are below the normal site background, but still exceed the BTV. It would be impossible to alleviate any BTV exceedance for a BTV that is at or below background values. Therefore, COECs with a BTVs at or below its background concentration are singled out for special consideration as part of the COEC selection process.

C.2.2.3 Bioavailability

Bioavailability of contaminants was not considered when determining BTVs in the SERA. This is because relatively little is known concerning the bioavailability and subsequent intake of soil contaminants to terrestrial receptors (EPA 1996b). However, qualitative statements can be made about the influence of soil chemistry (e.g. pH) on the bioavailability of some COECs. This information will be used to expand upon the toxicological discussions provided for each COEC in the SERA.

C.2.2.4 Receptor Values

Some ecological receptors are perceived to be more valuable than others. Special consideration will be given to endangered or threatened species that may be present. Their unique habitat requirements and known vulnerabilities to specific contaminants will provide supplemental information that will be used to select COECs within each area defined in the SERA study.

In addition, potential interactions between desirable species and anticipated land uses within the site will be considered during COEC selection. For example, construction of the OSDF will eliminate a large portion of SERA Study Areas B and C for use as a restored habitat (Figure C-1). This implies that COECs will be not be a major consideration within these areas.

C.2.2.5 Localization

This evaluation examines the geographic distribution of COECs across each SERA study area to determine if contamination that exceeds BTVs is localized. If a localized pattern of contamination is detected it could be addressed through selective excavation rather than excavation of a larger area.

C.2.2.6 Extent of Excavation

COECs identified by the SERA have been reevaluated based on the likelihood that FRL based soil excavation will concurrently reduce their concentrations to benign levels. In other words, the SERA COEC designation for that area would be discounted if the original determination was based on samples that are within a area likely to be excavated for meeting FRLs.

C.2.3 Surface Water and Sediment

It is anticipated that COECs for surface water and sediment will be addressed through the site-wide remediation of soil and other source materials. The integrated environmental monitoring plan will be used to verify protection of aquatic receptors through its site-wide environmental monitoring and reporting protocol.

To evaluate the potential for BTV exceedances in restored surface water habitats at the FEMP, such as wetland or open water habitat, cross-media modeling was conducted to predict the contaminant concentrations in surface water and sediment at the outlet of each drainage area after the sitewide remediation of soil and other source material to remnant soil concentrations.

C.2.3.1 Conceptual Model

As rain falls on the land of a drainage area, a portion of it becomes runoff depending on the land surface conditions. Runoff then can erode the surface soil and transport contaminants from the surface soil in both the dissolved form and solid form sorbed to soil particles moving with the runoff. The contaminant of dissolved form in the runoff is defined as the contaminant in the surface water and the contaminant in the solid from sorbed to soil particles is defined as the contaminant in the sediment. The contaminant in both surface water and sediment from the contaminated area will be diluted by the surface water and sediment from the uncontaminated area when it migrates toward the outlet of the drainage area.

C.2.3.2 Technical Approach

The model used to calculate the contaminant concentration in surface water and sediment is the Surface Water Flow and Infiltration Model (SWF&IM) (DOE 1993a) developed for the FEMP and Operable Unit 5 RI/FS. The SWF&IM is a combination of the FEMP-specific hydrological input parameters and several hydraulic and transport models used to simulate the various physical and chemical processes involved in the transport of contaminants from surface soil into surface water. In SWF&IM, the FEMP was divided into several drainage areas. The runoff calculation from each drainage area was performed by using HEC-1 Model with a 1-year, 24-hour storm event. Each drainage area was further divided into several sub-areas with different contaminant conditions. Figure C-4 shows all the drainage areas and sub-areas.

C.2.3.3 Input Parameters

The present configuration of the SWF&IM model is based on existing watershed information and not anticipated post-excavation runoff and drainage patterns. However, this configuration is considered adequate to evaluate the potential for BTV exceedances in post-excavation surface water and sediment for three reasons:

1. Most runoff from the restored site will drain to the same outfall locations as the current drainage configuration.

2. The existing model assumes steady-state conditions. This implies it is relatively insensitive to variations in flow rates through the system if the total water balance is maintained, and

3. The existing model used maximum concentrations which provide a measure of conservatism to the evaluation.

The soil/water partitioning coefficient is used to estimate each chemical's mobility in the model. The $K_d$ value is the chemical's ratio of its concentration in soil to its concentration in water when the two concentrations are in equilibrium. A high $K_d$ value would be representative of a chemical which has a tendency to bind to soil and is therefore less mobile in water. Depending on the chemical form of a certain contaminant (specifically for inorganics), the $K_d$ value can vary substantially. The $K_d$ values listed in the RI Report were used in this modeling. Table C-17 presents the $K_d$ values used in the modeling task.

Remnant soil concentrations located within each sub-area were assigned as the soil concentration for each sub-area. As a conservative measure, maximum concentrations were used rather than calculated representative concentrations. If remnant soil concentration was not presented in a sub-area, a background soil concentration was assigned to this sub-area. If the background concentration was not available, a zero concentration was assumed for this sub-area. The soil concentrations for all sub-areas of drainage areas in the modeling is shown in Table C-16. In Table C-16, the soil concentration was indicated as NA in a sub-area if remnant soil concentrations were not presented and no background concentration was available in this sub-area.

## C.3 COECS EVALUATION RESULTS AND DISCUSSION

The results of the COEC evaluation outlined in the previous section are presented and discussed below. Separate discussions are presented for each phase of this evaluation, so a particular COEC may be discussed more than once in the following sections. Most evaluation efforts were directed toward soil, since it is the primary medium of ecological concern. The general results show that for both source areas and perimeter areas, FRL-driven excavation will address the vast majority of ecological concerns. The specifics for each of the evaluations are presented below.

### C.3.1 Source Area Soil Review Using Current Sitewide Data

The results of the source area evaluation are summarized in Table C-4 and Table C-5. Table C-4 lists the potential COECs in soils that can be removed from further consideration by the screening process described in Section 3. As stated before, complete data sets for each of these potential COECs (all sitewide detections) are available upon request. Based on the toxicity and statistical information presented in Table C-4, none of the analytes listed in Table C-4 are judged to pose a current or future risk to ecological receptors and the FEMP.

Table C-5 lists the results of screening the analytes listed in the remnant data set. These potential COECs were shown to have sufficient concentrations within the sitewide evaluation, so remnant data were pulled and evaluated. The results of this evaluation indicate that only three soil COECs are likely to be present in post-excavation soils: antimony, cadmium, and silver. The remnant concentrations for these COECs are found in a few limited areas of the FEMP. Figures B-2 to B-4 show the locations for the remnant soil BTV exceedances of these three COECs.

Since the remnant data was generated using the uranium footprint of excavation, many of the BTV exceedances shown will not actually be present after excavation has been completed. For instance, almost all exceedances shown for antimony, cadmium, and silver in the Waste Storage Area are surface samples, which either have already been or will be removed during remedial activities. Other potential COECs listed in Table C-5 had some remnant detections that were outside of the uranium footprint but were anticipated to be excavated as well. In the comment column for Table C-5, the term "All Remnant Data

Accounted For" means that all remnant detections greater than the BTV for that COEC were evaluated and the results showed that all detections would fall within the sitewide footprint of excavation. Generally, this case was assured when surface samples (0-6") appeared as remnant detections in the production area. Remnant detections were also discounted when the sample point was too deep in the soil to present an exposure risk to ecological receptors. For a limited number of COECs, the term also refers to the accounting of detections that were discussed as part of the SERA perimeter COEC discussion. As with the existing sitewide soil data, remnant data sets are available for each COEC upon request. A map depicting the locations of remnant detections with respect to the preliminary uranium excavation footprint is present for all COECs in Table C-5 with the comment "All Remnant Data Accounted For."

### C.3.2 Perimeter Area Soils

This section reviews the results of the SERA and presents the results of the qualitative review of the soil COECs determined from the SERA. This review was conducted independently from the sitewide data review. Where appropriate, the two processes have been linked in the following discussion. Table C-1 presents the SERA representative COEC concentrations and the updated representative concentrations calculated as part of this study. Table C-7 through Table C-12 present an area by area summary of the data sets and the statistics that form the basis of the updated representative concentrations.

#### C.3.2.1 Aluminum

The SERA used a BTV for aluminum in soil of 10,103 mg/kg (dry weight) (DOE 1995). This value was derived from a planning guide for the agricultural use of wastewater sludge, and thus likely represents a maximum soil concentration of aluminum that does not adversely impact crop plant production (Missouri DNR, 1988). Aluminum was identified as potentially toxic to ecological receptors in Study Areas B, C, and E (Figure C-1). The representative soil concentrations in each of these study areas exceeded the BTV of 10,103 mg/kg (Table C-1). For Study Area B, the representative aluminum concentration represented the upper 95 percent confidence limit of the arithmetic mean of soil sample concentrations taken within the study area. For Study Areas C and E, the representative concentrations appear to be the 95th percentile detect within each study area . Since publication of the SERA, Study Area C has been regraded in preparation for construction of the On-site Disposal Facility (OSDF).

C.3.2.1.1 Updated Representative Concentrations

Updated representative concentrations for aluminum in Study Areas B, C, and E have been calculated. The data used in this updated evaluation is presented in Addendum A and summarized in Table C-6 along with the original concentrations used in the SERA. The new results vary when compared to the SERA representative concentrations. For Study Area B, the updated concentration is slightly higher than the SERA concentration, while the new concentration for Study Area E is slightly lower. The new result for Study Area C is much less than the corresponding SERA concentration.

All data points and the associated range of concentrations for aluminum in these three areas in are found in Table C-8, Table C-9, and Table C-11. All of the updated representative concentrations are above the BTV for aluminum. However, the updated concentration for Study Area C (11,812 mg/kg) is much closer to the BTV than the SERA concentration (25,700 mg/kg). As Table C-9 illustrates, the highest aluminum concentration within Study Area C is 15,600 mg/kg. These results, as well as a review of the OU5 RI data which show the highest aluminum concentration at 15,400 mg/kg, suggest that the 25,700 mg/kg SERA value is incorrect. A similar finding may be true for Study Area E, where the maximum value for aluminum is 15,800 mg/kg (Table C-11), and the SERA representative concentration is 16,300 mg/kg (Table C-1).

C.3.2.1.2 Background Values

Background soil sampling in uncontaminated reference areas north of the FEMP reveals a background concentration of 11,900 mg/kg in the upper 6 inches of soil (generally corresponding to the upper organic matter-rich part of the B-horizon, commonly referred to as the topsoil in areas of native soil and the plow layer in areas formerly subject to cultivation) and a background concentration of 16,100 mg/kg in a subsurface zone ranging from 6 to 42 inches below the surface (generally corresponding to the B-horizon, commonly referred to as the subsoil) (DOE 1993b).

Both background levels exceed the BTV of 10,103 reported for soil in the SERA. Slight BTV exceedances in surface soil samples ranging between 10,103 mg/kg and 11,900 mg/kg cannot be attributable to contamination from FEMP operations and instead may be assumed to be prevalent throughout the region. These levels are likely reflective of the mineralogy of the aluminosilicate clays

naturally present in the soils, although they could also be reflective of a combination of other anthropogenic aluminum sources throughout the area. Also, it should be noted that the mean aluminum concentration reported for surface soils over the eastern United States is 33,000 mg/kg, well over the SERA BTV of 10,103 mg/kg (Shacklette and Boerngen, 1984).

C.3.2.1.3 Bioavailability

The general toxicological properties of aluminum are discussed in the SERA, which notes that aluminum is generally considered to be nontoxic to most terrestrial organisms except in cases of high experimental doses or prolonged inhalation (DOE 1995). An additional consideration is that, especially in alkaline or slightly acid soils, aluminum tends to become bound to soil colloids and thus not bioavailable. Surface soils mapped on the FEMP are generally neutral to somewhat acid (pH ranging between roughly 5 and 7), becoming increasingly acidic in the B-horizon (falling below a pH of 5 in places) and increasingly alkaline in the C-horizon (exceeding a pH of 8 in places) (SCS 1980 and 1982). Because of this, a substantial portion of the aluminum in surface soils is not expected to be bioavailable to ecological receptors, although a higher percentage is likely to be available in the subsoil. Therefore, the use of total aluminum concentrations in soils for purposes of screening against BTVs developed for generic soil settings may be a conservative approach, considering the fact that surface soils at the FEMP are not highly acidic, and thus much of the measured aluminum may be bound to soil colloids and not bioavailable.

C.3.2.1.4 Receptor Values

Most of Study Area B currently supports planted pine monocultures that provide suitable, though not good, habitat for most species of terrestrial wildlife common to the surrounding area. The natural stand of deciduous hardwood saplings on the slope in the northern part of Study Area B provides better habitat. Although bounded along much of its perimeter by low fences, these fences do not preclude use of the habitat by most wildlife species common to the surrounding area. Because of the dense pine canopy cover, high levels of noise from the Former Production Area immediately south of Study Area B do not appear to preclude use of the habitat by most wildlife species. The NRRP calls for habitat in Study Area B to be improved, which would even increase use of the habitat by terrestrial receptors.

In contrast, Study Areas C and E do not provide suitable habitat for most species of terrestrial wildlife. Most of Study Area C is presently in an excavated condition and will ultimately support the OSDF. Once completed, the disposal facility will be grassed and fenced, excluding many terrestrial ecological receptors. Study Area E presently supports mowed grass of little value to terrestrial wildlife, although individuals may occasionally travel rapidly across it. If Study Area E is used to restore natural habitat, as presently under consideration within the NRRP, use by terrestrial wildlife (and thus exposure of that wildlife) will increase.

C.3.2.1.5 Localization

No localized pattern of aluminum contamination exists within Study Areas B and E. This is probably due to the wide range of background concentrations that are found in FEMP soil. BTVs are exceeded across the site, since the BTV is below the background concentration for aluminum. There may be some localization of elevated concentrations in the vicinity of the Sewage Treatment Plant, but as discussed below, this area will be fully remediated and kept from extensive use by wildlife because of the OSDF.

C.3.2.1.6 Extent of Excavation

Since preparations are underway within Study Areas B and C for the OSDF, much of the former surface soil has been remediated and no longer poses any risk to ecological receptors. The OSDF will be fenced and ultimately grassed over, and thus will not present any future risk to ecological receptors. Because of the fact that the BTV for aluminum is below background levels, remnant data were not investigated (Table C-4).

C.3.2.1.7 Summary and Recommendations

Based on the information presented above, further ecological investigation of aluminum as a soil COEC is not recommended. Even where the reported BTV of 10,103 mg/kg in surface soil is exceeded, the exceedances are either below or close to site-specific background levels and well below the range of natural background concentrations reported for uncontaminated soils in the eastern United States. Furthermore, even high concentrations of aluminum are not generally considered to be toxic to wildlife, and much of the total aluminum present in the relatively alkaline surface soils on the FEMP may be bound to soil colloids and not bioavailable.

C.3.2.2 Antimony

The SERA used a BTV for antimony in soil of 10 mg/kg (dry weight) (DOE 1995). This value was obtained from a table of proposed maximum acceptable concentrations of trace elements in agricultural soils and is based on phytotoxicity data for agricultural plants (Kabata-Pendias 1992). A BTV developed based on phytotoxicity to agricultural plants is likely a good basis for assessing risk to other terrestrial plants but introduces uncertainty with respect to assessing risk to terrestrial wildlife.

Antimony was identified as potentially toxic to ecological receptors in Study Areas C, D, E, and G (Table C-1 and Figure C-5). The representative soil concentrations in each of these study areas exceeded the BTV of 10 mg/kg. For each study area, the representative antimony concentration represented the upper 95th percentile or the maximum detect of soil sample concentrations taken within the study area. Study Areas D and E are described as mowed grasslands south of the Former Production Area. Study Area G is described as a pine plantation located southwest of the Former Production Area. Study Area C is described as a mowed grassland east of the Former Production Area. As stated above, the majority of Study Area C has been regraded in preparation for construction of the OSDF.

C.3.2.2.1 Updated Representative Concentrations

Updated representative concentrations for antimony in Study Areas C, D, E, and G have been calculated and presented in Table C-6. All data points and the associated range of concentrations for antimony are found in Table C-9 through Table C-12. The new results are all lower than the SERA representative concentrations, as shown on Table C-6.

For Study Area C, the representative concentration of 15.2 mg/kg is above the BTV of 10 mg/kg. The updated concentration is a result of three elevated values (out of 13 total), one of which is estimated and the other two are nondetects (Table C-9). Apparently, difficulties were encountered during the analysis of antimony. The representative concentration for antimony in Study Area D (7.4 mg/kg) is below the BTV of 10 mg/kg. One estimated value from 13 samples was determined to be above the BTV (Table C-10). All updated concentrations fall well below the BTV in Study Areas E and G, with maximum nondetected

values of 3.5 mg/kg and 3.6 mg/kg respectively ( Table C-11 and Table C-12). It should be pointed out that no remnant detections for antimony are present in Study Areas C, D, and E.

C.3.2.2.2 Background Values

Background soil concentrations for antimony based on uncontaminated reference sites near the FEMP have not been developed. Neither is background data for antimony in the soils in the eastern United States as a whole available from the usual source (Shacklette and Boerngen 1984). Thus it is not possible to eliminate antimony as an ecological risk for any of the study areas based on comparison with background data.

C.3.2.2.3 Bioavailability

The general toxicological properties of antimony are discussed in the SERA. This discussion indicates that plants readily accumulate antimony without toxicity and may thus expose herbivores to elevated antimony levels in their diet (DOE 1995). It appears as if faunal receptors are more sensitive than vegetation. Information on bioavailability appears to be very limited.

C.3.2.2.4 Receptor Values

No parts of Study Areas C, D, or E provide suitable habitat for most species of terrestrial wildlife. Again, most of Study Area C is presently in an excavated condition and will ultimately support the OSDF. Once filled, the OSDF will be grassed and fenced, excluding terrestrial ecological receptors. Study Areas D and E support mowed grass of little value to terrestrial wildlife, although individuals may on occasion travel rapidly across it. If Study Areas D and E are used to restore natural habitat, as presently under consideration within the NRRP, use by terrestrial wildlife (and thus exposure of that wildlife) will increase.

Most of Study Area G presently supports planted pine monocultures that provide suitable though not good habitat for most species of terrestrial wildlife common to the surrounding area. Because of the dense pine canopy cover, high levels of noise from the Former Production Area do not appear to preclude use of the habitat by most wildlife species. It is noted that site restoration plans presently call for habitat in Study Area G to be improved, which would even increase use of the habitat by terrestrial receptors.

C.3.2.2.5 Localization and Extent of Excavation

As previously stated, remnant concentrations of antimony are not present in Study Areas C, D, and E. Therefore, the extent of excavation will capture antimony exceedances within these areas.

For Study Area G, soil samples exceeding the antimony BTV of 10 mg/kg were obtained only from the Southern Waste Units, which will be removed as part of remedial activities. Remnant concentrations above the BTV for antimony do appear within the Active Flyash Pile, although the depth of the samples may greatly reduce the potential for exposure to ecological receptors.

C.3.2.2.6 Summary and Recommendations

The only perimeter area of concern that will remain after remedial activities have been completed is the vicinity of the Active Flyash Pile. Sampling should be conducted in post-excavation soils to determine a representative antimony concentration. If the BTV is exceeded, the FEMP Natural Resource Restoration Plan may address design changes to reduce the potential for exposure to ecological receptors.

C.3.2.3 Cadmium

The SERA used a BTV for cadmium in soil of 5 mg/kg (dry weight) (DOE 1995). This value was derived from soil threshold levels developed by the Quebec Ministry of the Environment (Direction Des Substances Dangereuses, 1988). Cadmium was identified as potentially toxic to ecological receptors in Study Areas A and G (Table C-6 and Figure C-6). For each study area, the representative cadmium concentration was designated to be the lesser of the 95th percentile of the concentration distribution or the maximum detected soil sample concentration taken within the study area. Study Area A is a matrix of deciduous forest and old field habitats northwest of the Former Production Area that has been open to livestock grazing. Study Area G is a pine plantation located southwest of the Former Production Area (Figure C-1).

C.3.2.3.1 Updated Representative Concentrations

Updated representative concentrations for cadmium in Study Areas A and G have been calculated and presented in Table C-6. All data points and the associated range of concentrations for cadmium are found

in Table C-7 and Table C-12. For both study areas, the updated representative concentrations (1.40 mg/kg and 1.30 mg/kg respectively) are lower than the SERA representative concentrations, and in fact, lower than the BTV of 5 mg/kg (Table C-6).

For Study Area A, the reduced concentration is a product of Removal Action No. 28, which removed contaminated surface soil in the vicinity of the Fire Training Facility. All exceedances of cadmium within Study Area A were associated with concentrations in and around the Fire Training Facility. Since those soils have been removed from the database, the highest concentration of cadmium is 1.90 mg/kg (Addendum A).

Updated concentrations within Study Area G reveal one data point that exceeds the BTV (Table C-12). However, the updated representative concentration of cadmium for Study Area G is well below the BTV (1.30 mg/kg, Table C-6). It should be noted that the remnant BTV exceedance shown in Study Area G just north of the Southern Waste Units is a non-validated sample that is 10 feet deep.

C.3.2.3.2 Background Values

Background soil sampling in uncontaminated reference areas north of the FEMP reveals a background concentration of 0.87 mg/kg in the upper 6 inches of soil and a background concentration of 0.91 mg/kg in a subsurface zone ranging from 6 to 42 inches below the surface (DOE 1993b). Background concentrations are substantially less than the BTVs developed in the SERA.

It is noted that representative cadmium concentrations fall within a reported range of common soil cadmium concentration (0.1 - 7 mg/kg; Brady 1974). Thus while cadmium levels in surface soil throughout parts of the FEMP may exceed local background levels and even approach levels that impose minor stress upon certain receptors, it suggests that affected populations of ecological receptors are capable of adapting to them.

C.3.2.3.3 Bioavailability

The general toxicological properties of cadmium are discussed in the SERA. Although terrestrial biota are generally considered to be less sensitive to cadmium exposure than aquatic biota, which are exceptionally sensitive, cadmium is generally considered to be highly toxic to most biota.

An additional consideration is that cadmium ions are positively charged, and thus are readily adsorbed to soil colloids and not bioavailable, except in highly acidic soils. Surface soils throughout the FEMP, including Study Area G, are generally neutral to only slightly acidic (SCS 1980 and 1982). Therefore, comparison of total cadmium concentrations from FEMP soil samples against BTVs developed for generalized soils may be an excessively conservative approach.

C.3.2.3.4 Receptor Values

Most of Study Area A provides excellent habitat for a diversity of terrestrial receptors, except for the FTF, which is located at the edge of the Former Production Area. Removal Action No. 28 has eliminated the contaminated surface soil at the FTF and thus the potential for exposure of wildlife visiting that location in the future.

Although the southern pine plantation is a monoculture inferior in habitat quality to native forest vegetation, it still offers cover for many species of terrestrial wildlife and a buffer that protects wildlife against noise from nearby human activity. The quality of this habitat would increase, and thus wildlife exposure would increase, if the pine plantations are converted to native forest cover, as presently anticipated in the NRRP.

C.3.2.3.5 Localization

For Study Area A, soil samples exceeding the BTV of 5 mg/kg were obtained only from the FTF immediately north of the Former Production Area; concentrations of cadmium in all soil samples taken from other parts of Study Area A did not exceed the BTV. The density of sampling around the FTF was sufficiently high to suggest that the cadmium exceedances are limited to within the well defined boundaries of that facility (Addendum A).

For Study Area G, the only soil sample with a cadmium exceedance appearing in the remnant data set was taken from an isolated location within the pine plantation and north of the inactive flyash disposal area. As previously stated, this is a non-validated sample located 10 feet below the surface in an area not anticipated to be excavated.

C.3.2.3.6 Extent of Excavation

The cadmium exceedances within Study Area A have already been addressed through Removal Action No. 28. Some elevated levels of cadmium within Study Area G will be addressed through the excavation of the Pilot Plant Drainage Ditch, which runs along the northern boundary of Study Area G. Post-excavation concentrations of cadmium may appear in the vicinity of the Active Flyash Pile (Figure C-3). However, concentrations present are only slightly greater than the BTV (maximum concentration = 5.1 mg/kg).

C.3.2.3.7 Summary and Recommendations

As with antimony, the only concern after remedial activities have been completed is in the vicinity of the Active Flyash Pile. The concern is minimal, however, since the maximum remnant concentration is only slightly above the BTV. Nevertheless, sampling will be conducted in conjunction with antimony and the appropriate course of action will be implemented under the NRRP.

C.3.2.4 Lead

The SERA used a BTV for lead in soil of 200 mg/kg (dry weight) (DOE 1995). This value was derived from soil threshold levels developed by the Quebec Ministry of the Environment (Direction Des Substances Dangereuses 1988). Lead was identified as potentially toxic to ecological receptors in Study Areas C and D (Table C-1). The lead concentration represented the upper 95 percent confidence limit of the arithmetic mean of soil sample concentrations taken within the study area. Study Area D is an open field of regularly mowed grassland. Study Area C was similar at the time of the SERA, but since then it has been regraded in preparation for construction of the OSDF.

C.3.2.4.1 Updated Representative Concentrations

Updated representative concentrations for lead in Study Areas C and D have been calculated and presented in Table C-6. All data points and the associated range of concentrations for lead are found in Table C-9 and Table C-10. The new results are lower than the SERA representative concentrations, as shown in Table C-6. For Study Area C, the updated representative concentration (52.3 mg/kg) falls below the BTV of 200 mg/kg. In addition, the maximum detected value within Study Area C is below the BTV (Table C-9). It appears that the SERA representative concentration was driven by a sample point located within the Sewage Treatment Plant Area (Addendum A). The updated concentration for Study Area D is 998 mg/kg, which is above the lead BTV. This exceedance is driven by several high concentrations associated with a trap shooting range southeast of the Former Production Area (Table C-10, Addendum A).

C.3.2.4.2 Background Values

Background soil sampling in uncontaminated reference areas north of the FEMP reveals a background concentration of 26.4 mg/kg in the upper 6 inches of soil and a background concentration of 15.6 mg/kg in a subsurface zone ranging from 6 to 42 inches below the surface (DOE 1993). Background concentrations are substantially less than the BTVs developed in the SERA.

C.3.2.4.3 Bioavailability

The general toxicological properties of lead are discussed in the SERA. The discussion noted that younger organisms tend to be more sensitive to lead exposure than mature ones. It further noted that food chain biomagnification is generally negligible in aquatic systems. It does not indicate, however, whether these generalizations extend to terrestrial species and ecosystems (DOE 1995).

An additional consideration is that lead ions are positively charged. They are readily adsorbed to soil colloids and not bioavailable, except in highly acidic soils. Surface soils throughout the FEMP, including Study Areas C and D, are generally neutral to only slightly acidic (SCS 1980 and 1982).

C.3.2.4.4 Receptor Values

No parts of Study Areas C or D provide suitable habitat for most species of terrestrial wildlife. Most of Study Area C is presently in an excavated condition and will ultimately support the OSDF. Once filled, the disposal facility will be grassed and fenced, excluding terrestrial ecological receptors. Study Area D supports mowed grass of little value to terrestrial wildlife, although individuals may on occasion travel rapidly across it. If Study Area D is used to restore natural habitat, as is presently under consideration in the NRRP, use by terrestrial wildlife (and thus exposure of that wildlife) will increase.

C.3.2.4.5 Localization

The representative concentration of lead reported in the SERA for surface soils in Study Area D is 2,180 mg/kg, substantially exceeding the BTV of 200 mg/kg. However, soil lead concentrations exceeding the BTV are clearly localized within the site of a former trap range, where surface soils were regularly exposed to falling lead shot. Lead concentrations in surface soils taken within this area range from 22.5 mg/kg to 2,180 mg/kg, more than an order of magnitude greater than the BTV and clearly representing a potential risk to ecological receptors. The apparent risk may not be as great as immediately suggested by these figures due to the poor habitat quality of the former trap range. But with soil lead concentrations this high in an area that is openly accessible to terrestrial wildlife, potentially serious ecological risk cannot be ruled out.

The highest lead concentration in surface soils taken elsewhere in Study Area D is 22.2 mg/kg, nearly an order of magnitude lower than the BTV. Soil lead concentrations elsewhere in Study Area D do not represent a significant ecological risk.

Examination of the spatial extent of lead exceedances in Study Area C is not necessary since the entire site has been or will be excavated to begin construction of the OSDF.

C.3.2.4.6 Extent of Excavation

It is presently anticipated that most of the northern part of Study Area D, including the entire trap range site, will be used as a borrow area for soil to cover the OSDF under construction in Study Area C. Soils at the trap range site would first be remediated to meet FRLs, based on human health risk. The FRL for

lead is 400 mg/kg. Because the FRL for lead is not as restrictive as the BTV of 200 mg/kg, soil used to cap the disposal facility could still exceed the BTV. But this soil would still not represent a significant ecological risk, since the OSDF would be grassed and fenced, thereby effectively preventing wildlife exposure.

The remnant data set shows lead concentrations above the BTVs and FRLs still occurring within Study Area D. This is an artifact of the uranium footprint driving the definition of the remnant data set. The lead FRL exceedances will be excavated during remedial activities. Because of the location of the BTV exceedances, for all practical purposes soil lead concentrations will not exceed the BTV after remedial activities have been completed.

C.3.2.4.7 Summary and Recommendations

At this time, the high lead concentrations in surface soils at the former trap range in the northern part of Study Area D clearly represent a potentially serious ecological risk. Although further ecological investigation, such as site-specific toxicity tests, could more definitively characterize the risk to specific categories of ecological receptors, it is unlikely that the results of those tests would suggest that there is no serious risk. The trap range will be remediated to meet the FRL of 400 mg/kg, and then additional soils will be removed as borrow material for the OSDF. Other areas within Study Area D do not contribute to ecological risk. Lead exceedances within Study Area C are included in the footprint for FRL-driven excavation, and construction of the OSDF will prevent the establishment of restored habitats and thus will reduce further exposure to ecological receptors. Therefore, the only action recommended is to compare Area 1, Phase II certification sampling to the lead BTV and determine if soil remediation to meet the FRL reduced the 95 percent UCL to below the BTV. No BTV exceedances are anticipated, and the NRRP will address any unanticipated exceedances accordingly.

C.3.2.5 Manganese

The SERA used a BTV for manganese in soil of 1,500 mg/kg (dry weight) (DOE 1995). This value was obtained from a table of proposed maximum acceptable concentrations of trace elements in agricultural soils and is based on phytotoxicity data for agricultural plants (Kabata-Pendias 1992). A BTV developed

based on phytotoxicity to agricultural plants is likely a good basis for assessing risk to other terrestrial plants but introduces uncertainty with respect to assessing risk to terrestrial wildlife.

Manganese was identified as potentially toxic to ecological receptors in Study Areas B and C. The representative soil concentrations in each of these study areas exceeded the BTV of 1,500 mg/kg (Table C-1). For each study area, the representative manganese concentration was designated as the lesser of the 95 percentile of the concentration distribution or the maximum detected soil sample concentration taken within the study area. Study Area B is a pine plantation located north of the Former Production Area. Study Area C was an open field of regularly mowed grassland at the time of the SERA, but since then it has been regraded in preparation for construction of the OSDF.

C.3.2.5.1 Updated Representative Concentrations

Updated representative concentrations were calculated for manganese in Study Areas B and C. The updated concentration for Study Area B is 1,248 mg/kg while the updated concentration for Study Area C is 1,284 mg/kg (Table C-6). These concentrations are lower than the SERA representative concentrations (1,530 mg/kg and 2,100 mg/kg respectively, Table C-6) as well as the BTV of 1500 mg/kg. Study Area B had no concentrations that exceeded the BTV, with the maximum detected value at 1,480 mg/kg (Table C-8). For Study Area C, two of the 17 values exceeded the BTV (Table C-9).

C.3.2.5.2 Background Values

Soil sampling in uncontaminated reference areas north of the FEMP reveals a background manganese concentration ranging between 189 and 1,750 mg/kg in the upper 6 inches of soil. Background data are not available for subsurface soil (DOE 1993b). Background concentrations are generally less than the BTV developed in the SERA, but it is noteworthy that the BTV still falls within the reported range for background values.

C.3.2.5.3 Bioavailability

The general discussion of the toxicological properties of manganese in the SERA addresses aquatic receptors only (DOE 1995). Although it is known that high levels of manganese can also be toxic to terrestrial plants and wildlife, little information exists as to exactly how manganese is toxic. Like many

other inorganic soil contaminants, manganese ions are positively charged. They are thus readily adsorbed to soil colloids, rendering them not bioavailable. Adsorption increases (and thus bioavailability decreases) as pH increases (Brady 1974). Furthermore, at soil pH over 6.5, the more soluble manganous ion is oxidized to the less soluble manganic ion, which is less bioavailable (Harris 1983). Surface soils throughout the FEMP, including Study Area B, are generally neutral to only slightly acidic, often exceeding a pH of 6.5 (SCS 1980 and 1982). Thus, much of the total manganese measured in surface soil samples taken from the site may not be bioavailable.

Comparison of total manganese concentrations from soil samples taken from these relatively alkaline soils against BTVs developed for generalized soils may be an excessively conservative approach. It may be possible to conclude that low manganese bioavailability in these soils renders this slight exceedance insignificant. It is further noted that the representative manganese concentration of 1,530 mg/kg still falls within the range of concentrations reported for background soil samples taken from uncontaminated reference sites close to the FEMP. Also, the measured concentration of 1,530 mg/kg falls well within the common range of manganese concentrations in soil (100 - 4,000 mg/kg) reported by Brady (1974).

C.3.2.5.4 Receptor Values

Most of Study Area B presently supports planted pine monocultures that provide suitable, though not good, habitat for most species of terrestrial wildlife common to the surrounding area. The natural stand of deciduous hardwood saplings on the slope in the northern part of Study Area B provides better habitat. Although bounded along much of its perimeter by low fences, these fences do not preclude use of the habitat by most wildlife species common to the surrounding area. Because of the dense pine canopy cover, high levels of noise from the Former Production Area immediately south of Study Area B do not appear to preclude use of the habitat by most wildlife species. It is noted that the NRRP presently calls for habitat in Study Area B to be improved, which would even increase use of the habitat by terrestrial receptors.

The manganese exceedance is located at the edge of the pine plantation, bordering a busy roadway. It is generally of less value as habitat for terrestrial wildlife due to the proximity of human activity. Most of

Study Area C is currently in an excavated condition and will ultimately support the OSDF. Once filled, the OSDF will be grassed and fenced, excluding terrestrial ecological receptors.

C.3.2.5.5 Localization

As stated above for Study Area B, no soil sample concentration greater than the BTV was found when calculating updated representative concentrations. Since individual samples were not provided in the SERA, it is difficult to determine how the SERA representative concentration of 1530 mg/kg was established.

Around Study Area B, soil samples exceeding the BTV of 1,500 mg/kg for manganese were obtained from only one location (2,150 mg/kg), immediately adjacent to the north access road leading to the northeast corner of the FEMP (Addendum A). It should be noted that this soil sample actually falls outside of the boundary for Study Area B, which is why the exceedance does not appear in the updated concentrations shown in Table C-8. There is no distinct land-use history for that area compared to other parts of Study Area B. Soil sampling density was relatively uniform across Study Area B, and all that can be presently determined is that the manganese exceedance extends over several acres roughly 500 feet northeast from the corner of the Former Production Area. Additional sampling would be necessary if there were a need to better delineate the exceedance.

Soil samples exceeding the BTV of 1,500 mg/kg for manganese were obtained from only one location in Study Area C, very close to the eastern perimeter fence (Addendum A). But examination of the spatial extent of manganese exceedances in Study Area C is not necessary since most of the entire area has been excavated to begin construction of the OSDF that will permanently occupy the site.

C.3.2.5.6 Extent of Excavation

As stated above, the only exceedance of the manganese BTV for Study Area B is actually south of the study area. While this sample appears in the remnant data set, the area is fully encompassed by the FRL-driven footprint of excavation (Addendum A). Also, the area in question has been significantly altered in preparation of a rail yard for use during remedial activities and for the OSDF. Again, Study Area C has already been significantly altered and will contain the OSDF.

C.3.2.5.7 Summary and Recommendations

Based on the information presented above, further ecological investigation of manganese as an COEC is not recommended. Representative manganese concentrations in Study Area B exceed the BTV developed by the SERA for soil, but only by less than 2 percent. Such a slight exceedance may not be biologically significant considering that the BTV was developed for average soils, and the soils on the FEMP are relatively alkaline. Manganese bioavailability is thus lower compared to many soils. Furthermore, the representative manganese concentration in Study Area B still falls within the range of background manganese concentrations obtained for uncontaminated reference soils near the FEMP. Although the higher manganese concentration measured for both Study Areas B and C may have formerly represented a potential ecological risk, these areas are presently undergoing construction activity, and Study Area C will remain in a permanently developed condition.

C.3.2.6 Molybdenum

The SERA used a BTV for molybdenum in soil of 10 mg/kg (dry weight) (DOE 1995). This value was derived from soil threshold levels developed by the Quebec Ministry of the Environment (Direction Des Substances Dangereuses 1988). Molybdenum was identified as potentially toxic to ecological receptors in Study Area A, B, and E (Table C-1 and Figure C-7). For each study area, the representative molybdenum concentration represented the upper 95 percent confidence limit of the arithmetic mean of soil sample concentrations taken within the study area. Study Area A is described as a mixture of wooded areas in various stages of succession that are disturbed by grazing and include jurisdictional wetlands. Study Area B is a pine plantation located north of the Former Production Area. Study Area E is a mowed grassland south of the Former Production Area.

C.3.2.6.1 Updated Representative Concentrations

Updated representative concentrations for molybdenum in Study Areas A, B and E have been calculated and presented in Table C-6. All data points and the associated range of concentrations for molybdenum are found in Table C-7, Table C-8, and Table C-11. The new results are lower than the SERA representative concentrations. All updated concentrations are below the BTV of 10 mg/kg (8.8 mg/kg, 7.2 mg/kg, and 4.3 mg/kg respectively, Table C-6).

For Study Area A, three of the 17 samples exceeded the BTV, with a maximum detect at 13.3 mg/kg (Table C-7). Two of 12 samples exceeded the BTV in Study Area B, with a maximum detect of 12.4 g/kg (Table C-8). Within Study Area E, all concentrations were below the BTV. In fact, molybdenum was not detected in Study Area E, with the exception of an estimated value of 0.6 mg/kg. The maximum nondetect value is 4.3 mg/kg (Table C-11). Again, it was difficult to determine how SERA representative concentrations were calculated when individual sample points were not provided in the SERA.

C.3.2.6.2 Background Values

Soil sampling in uncontaminated reference areas north of the FEMP reveals a background molybdenum concentration of 2.7 mg/kg in subsurface soil ranging from 6 to 42 inches below the surface. No background molybdenum data has been developed for surface soil (DOE 1993b). Background concentrations are substantially less than the BTVs developed in the SERA.

C.3.2.6.3 Bioavailability

The general toxicological properties of molybdenum are discussed in the SERA. Ruminants, such as cattle, are known to be 10 times more sensitive to molybdenum than other animals (DOE 1995). Although Study Area A is presently used for cattle grazing, the cattle will soon be removed for purposes of restoring natural habitat. Sensitivity data on other animals, including the common terrestrial wildlife and birds expected in Study Area A, is limited however (DOE 1995).

In contrast to most inorganic contaminants, molybdenum tends to exist as a negatively charged ion (anion) and thus tends to be more bioavailable in soils of pH above 5.5 (Harris 1983). As soils throughout the FEMP tend to be over pH 5.5 (SCS 1980 and 1982), BTVs developed for general soil situations, such as those used in the SERA, may not be highly conservative.

C.3.2.6.4 Receptor Values

Most of Study Area A, including the sites of samples with molybdenum exceedances, provides excellent habitat for a diversity of terrestrial receptors. However, no threatened or endangered species are known to occur there.

Most of Study Area B presently supports planted pine monocultures that provide suitable, though not good, habitat for most species of terrestrial wildlife common to the surrounding area. The natural stand of deciduous hardwood saplings on the slope in the northern part of Study Area B provides better habitat. Although bounded along much of its perimeter by low fences, these fences do not preclude use of the habitat by most wildlife species common to the surrounding area. Because of the dense pine canopy cover, high levels of noise from the Former Production Area immediately south of Study Area B do not appear to preclude use of the habitat by most wildlife species. The NRRP calls for habitat in Study Area B to be improved, which would even increase use of the habitat by terrestrial receptors.

In contrast, Study Area E does not provide suitable habitat for most species of terrestrial wildlife. As stated earlier, Study Area C is presently in an excavated condition and will ultimately support the OSDF. Once completed, the OSDF will be grassed and fenced, excluding many terrestrial ecological receptors. Study Area E presently supports mowed grass of little value to terrestrial wildlife, although individuals may occasionally travel rapidly across it. If Study Area E is used to restore natural habitat, as presently under consideration within the NRRP, use by terrestrial wildlife (and thus exposure of that wildlife) will increase.

C.3.2.6.5 Localization

The representative concentration of molybdenum reported in the SERA for surface soils is 11.7 mg/kg in Study Area A and 12.4 mg/kg in Study Area B, both exceeding the BTV of 10 mg/kg (Table C-1). Both exceedances are slight; neither exceeds the BTV by more than 20 percent, although the magnitude of the exceedance may be underestimated considering the expected high bioavailability of molybdate ion at the high soil pH prevalent at the FEMP. Yet plant communities throughout Study Areas A and B appear normal for lands with a similar grazing history. If soil molybdenum levels are adversely affecting plant growth and reproduction, they do not appear to be preventing the continuation of an apparently normal plant community.

The representative concentration of molybdenum reported in the SERA for surface soils in Study Area E is 14.5 mg/kg, exceeding the BTV of 10 mg/kg by a somewhat greater factor than concentrations reported for Study Areas A and B. However, molybdenum contamination in Study Area E is clearly localized to a

well defined area at the immediate perimeter of the active flyash pile (Addendum A). In fact, molybdenum exceedances appear to be contained entirely within the source OU area. Although soil molybdenum levels in this perimeter area may pose significant ecological risk, especially to plant receptors that may establish there after mowing is discontinued, it can be concluded that the remainder of Study Area E does not present any ecological risk.

A review of the analytical data for the perimeter areas of the FEMP indicate that the molybdenum results may have been influenced by sample and/or laboratory bias. With the exception of one detection that falls below the BTV, all detections of molybdenum in all study areas were generated by a single laboratory during a specific period of time. These results are questionable, given that adjacent samples in each study area that were collected and analyzed at different times did not detect molybdenum. These findings are supported by Area 1, Phase 1 certification sampling results. Those results show that molybdenum was rarely detected in any certification unit, and the maximum reported concentration across all certification units surveyed was 3.10 mg/kg. Therefore, when considering sample and laboratory information for all molybdenum samples within all study areas, serious doubt is raised with respect to the validity of the results.

C.3.2.6.6 Extent of Excavation

The remnant data set shows that several of the SERA molybdenum exceedances in Study Areas A and B will not be enveloped within the FRL-driven soil excavation footprint. For Study Area E, it appears that all molybdenum BTV exceedances are associated with the Southern Waste Units, and therefore will be addressed through remedial activities. The remnant data set does indicate the existence of post-excavation concentrations of molybdenum underneath the Active Flyash Pile. However, two of the three sample points are anticipated to be over five feet deeper than the post-excavation ground elevation.

C.3.2.6.7 Summary and Recommendations

Based on the information presented above, further ecological investigation of molybdenum as a soil COEC is not recommended, with the exception of post-excavation confirmatory sampling in the vicinity of the Active Flyash Pile. Although molybdenum levels in surface soils over much of Study Areas A and B could potentially pose some risk to terrestrial plants, further action in response to these exceedances is not

recommended. Plant communities throughout Study Area A appear normal. Except for the *Diplodia* tip blight affecting Austrian pines, vegetation throughout Study Area B also appears normal. Even if molybdenum levels were having minor impacts on seed germination and growth rate of certain plant species, large-scale disruption of established vegetation is not warranted considering the absence of ecological risk to other receptors.

Furthermore, the data used to determine the SERA COECs appears to be suspect. All detections except for one were sampled and analyzed from a specific laboratory during a short span of time. Even with the inclusion of the suspect data, updated representative concentrations fall below the BTV. As stated previously, molybdenum results appear to have been compromised by sample and/or lab bias.

Remnant data show that after the Active Flyash Pile has been excavated, molybdenum may be present in the remaining soil. Sampling in conjunction with the certification process will determine residual levels of molybdenum. Any ecological concerns will be addressed in the NRRP.

C.3.2.7 Silver

The SERA used a BTV for silver in soil of 10 mg/kg (dry weight) (DOE 1995). This value was derived from soil threshold levels developed by the Quebec Ministry of the Environment (Direction Des Substances Dangereuses 1988). Silver was identified as potentially toxic to ecological receptors in Study Area G (Table C-1 and Figure C-9). Study Area G is described as a pine plantation south of the Former Production Area.

C.3.2.7.1 Updated Representative Concentrations

Updated representative concentrations for silver in Study Area G have been calculated and presented in Table C-6. All data points and the associated range of concentrations for silver are found in Table C-12. The new results are lower than the SERA representative concentrations and the BTV of 10 mg/kg (2.4 mg/kg, Table C-6).

The maximum detected value was estimated at 9.7 mg/kg, as shown on Table C-12. Six of the sixteen samples analyzed within Study Area G had detectable concentrations of silver.

C.3.2.7.2 Background Values

Background soil concentrations for silver based on uncontaminated reference sites near FEMP have not been developed (DOE 1993). Neither is soil background data for silver in the eastern United States available from the usual source (Shacklette and Boerngen 1984). Thus it is not possible to eliminate silver as an ecological risk for any of the study areas based on comparison with background data.

C.3.2.7.3 Bioavailability

The general discussion of the toxicological properties of silver in the SERA addresses aquatic receptors only (DOE 1995). Although it is known that high levels of silver can also be toxic to terrestrial plants and wildlife, little information exists as to exactly how silver is toxic. Because most free silver ions are positively charged, it is expected that they are readily adsorbed to soil colloids, rendering them not bioavailable, especially at pHs over 6. However, little is known concerning silver's behavior in soil. Because surface soils throughout the FEMP are relatively alkaline (SCS 1980 and 1982), much of the total silver measured in surface soil samples taken from the site may not be bioavailable.

Comparison of total silver concentrations from soil samples taken from these relatively alkaline soils against BTVs developed for generalized soils may be an excessively conservative approach. It may be possible to conclude that low silver bioavailability in these soils renders this slight exceedance insignificant.

C.3.2.7.4 Receptor Values

Most of Study Area G presently supports planted pine monocultures that provide suitable, though not good, habitat for most species of terrestrial wildlife common to the surrounding area. Because of the dense pine canopy cover, high levels of noise from the Former Production Area do not appear to preclude use of the habitat by most wildlife species. It is noted that the NRRP presently calls for habitat in Study Area G to be improved, which would even increase use of the habitat by terrestrial receptors.

C.3.2.7.5 Localization

A review of soil data for silver reveals that the SERA BTV exceedance may have been located within the boundaries of the Southern Waste Units (Addendum A). This finding is reflected in the analysis of

updated representative concentrations, which did not consider data located within source OUs. As discussed above, no updated concentrations exceed the BTV in Study Area G.

C.3.2.7.6 Extent of Excavation

As stated above, it appears that all BTV exceedances for silver in Study Area G are found within the Southern Waste Units (Addendum A). Therefore, elevated silver concentrations will be fully enveloped within the FRL-driven excavation footprint. A review of the remnant data set shows that for Area G, the only residual concerns regarding silver are underneath the Active Flyash Pile. As with the other metals found in this location, two of the samples are over five feet deeper than the anticipated post-excavation grade level.

C.3.2.7.7 Summary and Recommendations

Based on the information presented above, further ecological investigation of silver as an COEC is not recommended, with the exception of confirmation sampling at the Active Flyash Pile. Updated concentrations indicate that silver is not a concern within Study Area G. The SERA surface soil concentrations in Study Area G only slightly exceed the BTV and may not be sufficiently bioavailable to pose risk to ecological receptors, especially terrestrial receptors. Any continuing concern over the silver levels in soils in Study Area G would likely involve potential risk to terrestrial plants. As noted above, the apparently normal vegetation throughout the study area suggests that no further action is warranted. Even if silver levels were having minor impacts on seed germination and growth rate of certain plant species, large-scale disruption of established vegetation is not warranted considering the absence of ecological risk to other receptors. After remediation is completed, residual silver concentrations will be determined in the vicinity of the Active Flyash Pile. This will occur in conjunction with certification sampling. Any residual ecological concerns may be addressed through the NRRP.

C.3.2.8 Zinc

The SERA used a BTV for zinc in soil of 500 mg/kg (dry weight) (DOE 1995). This value was derived from soil threshold levels developed by the Quebec Ministry of the Environment (Direction Des Substances Dangereuses 1988). Zinc was identified as potentially toxic to ecological receptors in Study Area A (Table C-1). The representative concentration represented the upper 95 percent confidence limit

of the arithmetic mean of soil sample concentrations taken within the study area. Study Area A is described as a mixture of wooded areas in various stages of succession that are disturbed by grazing and include jurisdictional wetlands.

C.3.2.8.1 Updated Representative Concentrations

Updated representative concentrations for zinc in Study Area A have been calculated and presented in Table C-6. All data points and the associated range of concentrations for silver are found in Table C-7. The new results are lower than the SERA representative concentrations and the BTV of 500 mg/kg (66.0 mg/kg, Table C-6).

Out of 26 samples, the maximum detected value is 137.0 mg/kg, as shown on Table C-7. These lower values are a result of eliminating data within the FTF, which is part of Study Area A but has since been remediated under Removal Action No. 28 (Addendum A).

C.3.2.8.2 Background Values

Soil sampling in uncontaminated reference areas north of the FEMP reveals a background zinc concentration of 59.6 mg/kg in the upper 6 inches of soil and a background concentration of 82 mg/kg in a subsurface zone ranging from 6 to 42 inches below the surface (DOE 1993b). Background concentrations are substantially less than the BTV used in the SERA.

C.3.2.8.3 Bioavailability

The general discussion of the toxicological properties of zinc in the SERA addresses aquatic receptors only (DOE 1995). Detailed further consideration of zinc's ecological effects is not necessary, as the only area at the FEMP where soil zinc concentrations exceed the BTV is at the former location of the FTF, where contaminated soils have already been removed.

C.3.2.8.4 Receptor Values

The representative concentration of zinc reported in the SERA for surface soils in Study Area A is 707 mg/kg, exceeding the BTV of 500 mg/kg. However, zinc concentrations in soil exceeding the BTV are clearly localized within the FTF, which has been addressed by Removal Action No. 28, subsequent to

the SERA. The highest zinc concentration found in soil samples taken from elsewhere in Study Area A is 137 mg/kg, well below the BTV (Table C-7, Addendum A).

C.3.2.8.5 Localization and Extent of Excavation

Data indicated that elevated levels of zinc within Study Area A were limited to the FTF. The FTF has been remediated under Removal Action No. 28, and it is also fully enveloped within the FRL-driven soil excavation footprint. The remaining sample reporting an elevated zinc concentration sample is from an area that has been remediated by RA No. 28. Even though the soil that the sample was taken from is now gone, the sample result remains in the data base.

C.3.2.8.6 Summary and Recommendations

Based on the information presented above, further ecological investigation of zinc as a COEC is not recommended. Surface soil concentrations in Study Area A potentially posing ecological risk were clearly localized at the time of the SERA to the FTF. These soils have since been removed. Updated representative concentrations that include soil verification data following Removal Action No. 28 reflect the elimination of zinc as a COEC.

C.3.2.9 Organics

The SERA considered a variety of organics, including several pesticides, polynuclear aromatic hydrocarbons (PAHs), and a number of other industrial solvents. Of the organic constituents considered, only the PAHs were found in soil samples, from any of the study areas, approaching the values used by the SERA as BTVs. Thus the following discussion addresses only the following group of PAHs: benzo(a)anthracene, benzo(a)fluoranthene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chorines, dibenzo(a,h)anthracene, and indeno(1,2,3-d)pyrene. The BTV used by the SERA for dibenzo(a,h)anthracene was 0.088 mg/kg, based on soil screening values that were developed based on human health and ecological risks by the EPA Region III (1994). The BTV used by the SERA for each of the other PAHs was 1 mg/kg, based on soil screening developed for general risk assessment purposes by the Quebec Ministry of the Environment (Direction Des Substances Dangereuses 1988).

One or more PAHs were identified as potentially toxic to ecological receptors in Study Areas A, C, and E. The representative soil concentrations in each of these study areas exceeded the BTV of 1 mg/kg [except for dibenzo(a,h)anthracene, which exceeded a BTV of 0.088 mg/kg in Study Areas C and E] (Table C-1). The representative concentrations of each PAH was defined as the lesser of the 95th percentile of the concentration distribution or the maximum detected soil sample concentrations taken within the study area.

C.3.2.9.1 Updated Representative Concentrations

Updated representative concentrations for PAHs in Study Areas A, C, and E have been calculated and presented in Table C-6. The new results are lower than the SERA representative concentrations. All updated concentrations are below their corresponding BTV.

All data points and the associated range of concentrations for PAHs are found in Table C-7, Table C-9, and Table C-11. For Study Area A, none of the PAHs were detected, with the exception of several very small estimated concentrations that fall two orders of magnitude below the BTV of 1 mg/kg. The highest nondetected value was 0.47 mg/kg (Table C-7). One of 13 samples exceeded the BTV in Study Area C, with a maximum detect of 1.8 mg/kg for benzo(b)fluoranthene, 1.1 mg/kg for benzo(g,h,i)perylene, 1.3 mg/kg for benzo(k)fluoranthene, and 1.5 mg/kg for indeno(1,2,3-cd)pyrene (Table C-9). No other concentrations were detected (maximum nondetect value: 0.56 mg/kg) with the exception of several very small estimated values that are well below the BTV. Within Study Area E, all concentrations are below the BTV. In fact, no PAHs were detected in Study Area E, with the maximum nondetect value at 0.42 mg/kg (Table C-11).

C.3.2.9.2 Background Values

Background soil concentrations for the subject PAHs have not been developed for the FEMP or for uncontaminated soils in the eastern United States as a whole. PAHs are not common in nature, and thus detectable concentrations would not be expected in uncontaminated soils anywhere. It is not possible to eliminate PAHs as an ecological risk for any of the study areas based on comparison with background data.

C.3.2.9.3 Bioavailability

The general toxicological properties of PAHs are discussed in the SERA. Some are known to be carcinogens and mutagens, and may thus result in similar cellular abnormalities in mammalian species of terrestrial wildlife (DOE 1995). Little is known concerning their toxicity to plants. Except for certain organic chemicals with distinctively herbicidal properties (such as the phenoxyacetic acids), plants are not generally as sensitive as fauna. Certain PAHs may form cations in the soil solution and become adsorbed to the soil colloids and rendered not bioavailable. However, this tendency is not as pronounced as it is for most inorganic contaminants.

C.3.2.10 Receptor Values

Although most of Study Area A provides excellent habitat for a diversity of terrestrial receptors, the FTF is located at the edge of the Former Production Area and does not provide quality habitat. Removal Action No. 28 has eliminated the contaminated surface soil at the FTF and thus the potential for exposure of wildlife visiting that location in the future.

No parts of Study Areas C or E provide suitable habitat for most species of terrestrial wildlife. As stated earlier, most of Study Area C is presently in an excavated condition and will ultimately support the OSDF. Once filled, the OSDF will be grassed and fenced, excluding terrestrial ecological receptors. Study Area E supports mowed grass of little value to terrestrial wildlife, although individuals may on occasion travel rapidly across it. The active flyash pile supports no vegetation and will not attract any wildlife.

C.3.2.10.1 Localization

Various figures in Addendum A illustrate the extent of PAH soil concentrations at the FEMP. In Study Area A, soil samples exceeding the respective BTV for any of the PAHs were obtained only from the FTF immediately north of the Former Production Area. Concentrations of the subject PAHs in each of the soil samples taken from other parts of Study Area A did not exceed the corresponding BTV. The closest result from soil samples taken elsewhere in Study Area A was a nondetect value of 0.47 mg/kg, well below the corresponding BTV of 1.0 mg/kg (Table C-7). The density of sampling around the FTF was

sufficiently high to clearly suggest that the PAH exceedances are limited to within the well defined boundaries of that facility (Addendum A).

PAH exceedances in Study Area C tend to be localized around the Sewage Treatment Plant (Addendum A). However, examination of the spatial extent of the exceedances is not necessary, since all of Study Area C has been or will be excavated since completion of the SERA to begin construction of the OSDF.

In Study Area E, soil samples exceeding corresponding BTVs were obtained only from the Southern Waste Units, which will be removed as part of remedial activities. Concentrations of the subject PAHs in the soil samples taken from other parts of Study Area E did not exceed the corresponding BTV. The closest result from soil samples taken elsewhere in Study Area E was a nondetect value of 0.42 mg/kg, well below the corresponding BTV of 1.0 mg/kg [0.088 mg/kg for dibenzo(a,h)anthracene] (Table C-11).

C.3.2.10.2 Extent of Excavation

All SERA PAH exceedances either have already or will be enveloped within the FRL-driven soil excavation footprint. PAHs are not found in perimeter areas. The fact that some PAHs have already been addressed through removal actions is reflected in the updated representative concentrations shown on Table C-6. The remnant data set does not show any PAH exceedances within Study Areas A, C, or E.

C.3.2.10.3 Summary and Recommendations

Based on the information provided above, it is recommended that PAHs be eliminated as soil COECs. Updated concentrations and the localization of contamination illustrate that PAHs have already or will be addressed through existing excavation plans.

C.3.3 Results and Discussion of Surface Water and Sediment Evaluation

Since soil excavation is the primary means of addressing surface water and sediment ecological concerns, this evaluation focused on modeling based on remnant soil concentrations. In general, there is much more information available with respect to BTVs for surface water and sediment than for soil. The BTVs used

in the SERA were usually chronic ambient water quality standards. These values are considered appropriate for a sitewide screen of protectiveness to ecological receptors.

Table C-13 summarizes the results of the SERA for surface water, sediment and drinking water. The SERA evaluated drinking water from several sources on and off FEMP property to terrestrial receptors. This evaluation considers both aquatic and terrestrial receptors by screening against the lower of the two BTV concentrations. As Table C-13 shows, many of the water and sediment COECs have FRLs at a lower concentration than the corresponding BTV. Also, several COECs were reported only in the Great Miami River.[5] Because of the reasons summarized above, and because of the fact that remedial activities will remove most sources of contamination at the FEMP, surface water and sediment modeling efforts were based on remnant soil data rather than existing conditions.

Surface water and sediment modeling was conducted for COECs using remnant concentrations in several source blocks across the FEMP. The surface water modeling results for each drainage basin modeled are listed in Table C-14. Sediment results are presented in Table C-15. These results illustrate that the only calculated post-excavation exceedance is manganese. This finding appears to be an artifact of the way data gaps were handled in this modeling exercise. When a representative remnant concentration was not available for a given sub-basin, the FS background concentration was used. In the case of manganese, this value was 1,400 mg/kg. (Table C-16). This background value was high enough to dominate the modeling results.

For sediments, the manganese background concentration exceeds the BTV. No single SERA BTV was established for silver, so a BTV was derived from the Oak Ridge National Laboratory screening benchmark for ecological risk assessment database (1996b). Silver exceeds this BTV slightly, but the

[5] The Great Miami River flows through several urban areas before joining the Ohio river. It receives both point and nonpoint discharges from a variety of sources like industries, municipalities, and agricultural areas. Data characterizing this river was limited, particularly in the upstream direction. The results with respect to the Great Miami River are suspect.

conservative nature of the modeling suggests that silver will not be an ecological concern in restored aquatic habitats.

## C.4 UNCERTAINTIES

Areas of uncertainty are associated with any risk assessment. In general, for a screening exercise such as this, conservative decisions are made during the evaluation process. Several key aspects of the COEC evaluation that contribute to uncertainty are described below.

One key uncertainty associated with the evaluation is the use of the BTVs for assessing potential ecological risk. The BTVs are screening values that are derived from literature based sources and are not risk based cleanup levels. It should be emphasized that the intent of these values is to identify potential ecological risks that require additional evaluation. In essence, they have been used for that purpose as demonstrated in this evaluation. Four constituents out of the potential COEC list are likely to have remnant concentrations above the BTVs. Therefore, the conservative nature of the BTVs strengthens the case for negligible ecological risk after remediation.

Another uncertainty associated with the evaluation is the use of existing data from the SED to evaluate pre-remedial and remnant soil concentrations. The only reason this is identified as an uncertainty is that it may result in areas of the site being over- or under-represented. Generally, samples were concentrated in areas where there was suspected contamination. Therefore, the number of samples taken in the production area is far greater than the number taken in the areas west of Paddys Run, for example. While this does introduce some uncertainty, it appears insignificant because the areas that were not sampled extensively should be relatively clean. Likewise, the areas of the site that are the more contaminated have significant amounts of data.

The final area of uncertainty that should be discussed is the use of the uranium footprint to identify The remnant data set. The reason that this introduces uncertainty is that it does not reflect all remediation that will take place. There will be areas that are remediated outside of the uranium footprint to meet other FRLs (e.g., lead). Although the initial remnant data set identified everything outside the uranium footprint, additional excavations for other FRLs were taken into consideration as part of the evaluation. Therefore, the screening process does accurately reflect all remediation that will occur no matter what the FRL is. Related to this, the evaluation does not consider the final grading that will occur in order to prepare the site for restoration. In other words, it identifies remnant concentrations based on the

"moonscape" that will remain after excavation. While this does introduce uncertainty, it is conservative because the evaluation does not assume that any remnant concentration will be removed or addressed as part of the final grading activities.

## C.5 CONCLUSIONS AND RECOMMENDATIONS

The results of the post-excavation COEC evaluation concluded that only three soil COECs are likely to be present in sufficient amounts in post-excavation soils (i.e., antimony, cadmium and silver). In two of the cases (cadmium and silver), the remnant sample concentrations are just slightly above the BTV. In the case of antimony, the remnant sample concentrations are all approximately twice the BTV of 10 mg/kg. Furthermore, the above-BTV remnant sample concentrations of these three soil COECs are limited to the Solid Waste Landfill, Active Flyash Pile, Sewage Treatment Plant, K-65 Silos and the Production Area within the vicinity of the Boiler Plant and Building 12. The area in the vicinity of the Active Flyash Pile also shows sample concentrations of molybdenum in the remnant data set. From the results of this evaluation it appears that soil remediation to meet FRLs will address above-BTV concentrations of COECs in all cases, except for three parameters which are located in six isolated areas, as well as molybdenum around the Active Flyash Pile. The sample locations for remnant detections of these three COECs are shown in Figures C-5, C-6, and C-8. It should be noted that not all of the locations indicated on these figures represent an actual remnant detection, since the remnant data set was conservatively estimated using the uranium footprint of excavation. Many of these sample locations, such as around the Waste Storage Area, will be excavated during remedial activities.

No post-excavation surface water or sediment concentrations are expected to be an ecological concern. Routine sampling by the IEMP will monitor surface water and sediment to verify that this is true. Any concerns will be addressed through IEMP protocols.

Based on the post-excavation evaluation, DOE-FEMP is recommending that soil remediation be planned and implemented to meet only the FRLs as established in the OU5 ROD. The results of this evaluation do not warrant that soil excavation be driven by BTVs or that new ecological cleanup levels be established at the FEMP. The results of the COEC evaluation further support that certification sampling for all excavation areas be driven by FRLs and not BTVs. However, the three COECs retained as a result of the evaluation will be added to the sampling parameters for each of the certification units in which the remnant data identified a potential exceedance. Molybdenum will also be sampled for around the Active Flyash Pile.

The certification data for all areas of the site, once collected, will be compared with the BTVs to identify any actual exceedances in the field. The existence of a post-excavation, above-BTV soil concentration could trigger further evaluation by the NRTs and be factored into the natural resource restoration planning process as appropriate. However, certification of an area as clean will not be dependent on whether all BTVs are met.

In addition, there also appears to be no reason why above-BTV concentrations should affect the implementation of the NRRP once soil remediation is complete. The restoration plans as outlined in the NRRP will not be jeopardized by isolated, above-BTV concentrations in remediated areas of the site. Steps can be taken as part of restoration (e.g., backfilling, installing liners) to minimize the exposure of ecological receptors to above-BTV concentration, if determined appropriate by the NRTs.

In summary, it is DOE's position that there is a limited potential for post-excavation exceedances of BTVs. In other words, remediation to meet FRLs at the FEMP will essentially address areas of potential ecological risk at the site. Therefore, DOE is recommending that sampling be conducted for the four COECs concurrently using certification sampling in the appropriate certification units. DOE is further recommending that the NRTs move forward with restoration planning at the FEMP in an effort to resolve DOE's liability for natural resource injury. The NRRP will contain provisions for dealing with unanticipated future and residual impacts. Therefore, upon approval of the NRRP, a mechanism will be in place to deal with above BTV concentrations should they occur post-excavation. No additional action is recommended for evaluating COECs and/or BTVs except for those outlined in this recommendation.

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## TABLE C-1

## SERA CONSTITUENTS OF ECOLOGICAL CONCERN IN SOIL BY AREA

| COEC | FRL (mg/kg) | BTV (mg/kg) | Representative Concentration (mg/kg) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Area A | Area B | Area C | Area D | Area E | Area F | Area G |
| aluminum | na | 10103 | | 10700 | 25700 | | 16300 | | |
| antimony | 96 | 10 | | | 21.5 | 10.6 | 10.2 | | 29.5 |
| cadmium | 82 | 5 | 5.90 | | | | | | 5.80 |
| lead | 400 | 200 | | | 570 | 2180 | | | |
| manganese | 4600 | 1500 | | 1530 | 2100 | | | | |
| molybdenum | 2900 | 10 | 11.7 | 12.4 | | | 14.5 | | |
| silver | 29000 | 10 | | | | | | | 10.3 |
| zinc | 120000 | 500 | 707 | | | | | | |
| benzo(a)anthracene | 20 | 1 | 2.10 | | | | | | |
| benzo(a)pyrene | 2 | 1 | 1.60 | | | | 1.15 | | |
| benzo(b)fluoranthene | 20 | 1 | 2.10 | | 1.80 | | 3.70 | | |
| benzo(g,h,i)perylene | na | 1 | | | 1.10 | | 3.10 | | |
| benzo(k)fluoranthene | 200 | 1 | | | 1.30 | | 3.30 | | |
| chrysene | 2000 | 1 | 2.10 | | | | 3.20 | | |
| dibenzo(a,h)anthracene | 2 | 0.088 | | | 0.40 | | 1.10 | | |
| indeno(1,2,3-cd)pyrene | 20 | 1 | | | 1.50 | | 3.00 | | |

## TABLE C-2

## SOIL COECS WITH FRLS LESS THAN BTVS

| COEC | FRL | BTV (mg/kg) | Failed SERA Screen? |
|---|---|---|---|
| aroclor-1254 | 0.13 mg/kg | 1 | - |
| radium-228 | 1.8 pCi/g | 340000 | - |
| thorium-232 | 1.5 pCi/g | 240000 | - |
| aroclor-1260 | 0.13 mg/kg | 1 | - |
| uranium, total | 82 mg/kg | 230 | yes |
| uranium-238 (carcinogen) | 262 pCi/g | 12000 | - |
| radium-226 | 1.7 pCi/g | 670 | - |
| thorium-228 | 1.7 pCi/g | 1400000 | - |
| technetium-99 | 30 pCi/g | 93000 | - |
| arsenic | 12 mg/kg | 30 | - |
| beryllium | 1.5 mg/kg | 56 | - |
| cesium-137 | 1.4 pCi/g | 12000 | - |
| lead-210 | 38 pCi/g | - | - |
| dieldrin | 0.015 mg/kg | 0.04 | - |
| thorium-230 | 280 pCi/g | 210000 | - |
| plutonium-238 | 78 pCi/g | 3800000 | - |
| tetrachloroethene | 3.6 mg/kg | 25 | - |
| trichloroethene | 25 mg/kg | 58 | - |
| neptunium-237 | 3.2 pCi/g | - | - |
| strontium-90 | 14 pCi/g | 2800 | - |
| octachlorodibenzo-p-dioxin | 0.0088 mg/kg | 4 | - |
| carbazole | 12 mg/kg | 32 | - |
| 4-methyl-2-pentanone | 2500 mg/kg | 3900 | - |
| bromodichloromethane | 4 mg/kg | 10 | - |
| carbon disulfide | 5000 mg/kg | 7800 | - |
| chlordane (alpha) | 0.19 mg/kg | 0.49 | - |
| chlordane (gamma) | | 0.49 | |
| chlorobenzene | 340 mg/kg | 1600 | - |
| chloroform | 45 mg/kg | 100 | - |
| di-n-octyl phthalate | 1100 mg/kg | 1600 | - |
| methylene chloride | 37 mg/kg | 85 | - |
| plutonium-239/240 | 77 pCi/g | 4100000 | - |

# TABLE C-3

## SOIL COECS EVALUATED

| COEC *all values in mg/kg* | Soil FRL | Soil BTV | FS Detection Limits | FS Background | Lowest Soil BTV (Source) |
|---|---|---|---|---|---|
| 1,1-dichloroethene | 0.41 | - | 0.001 | na | - |
| 1,1,1-trichloroethane | - | 7000 | 0.001 | na | <0.3 (1) |
| 1,1,2-trichloroethane | 4.3 | - | 0.001 | na | <0.3 (1) |
| 1,2-dichloroethane | 0.16 | - | 0.001 | na | 870 (2) |
| 2-butanone | - | 47000 | - | na | - |
| 2-methylnaphthalene | - | - | - | na | - |
| 3,3'-dichlorobenzidine | 0.55 | - | 0.2 | na | - |
| 4-methylphenol | 250 | - | 0.2 | na | 0.1 (1) |
| 4-nitroaniline | 150 | - | 0.9 | na | - |
| 4,4'-DDE | - | 0.1 | - | na | <0.1 (1) |
| 4,4'-DDT | - | 0.1 | - | na | <0.1 (1) |
| acenapthene | - | 4700 | - | na | 0.1 (1) |
| acenaphthylene | - | - | - | na | <0.1 (1) |
| acetone | 43000 | 8000 | 0.007 | na | - |
| aluminum | - | 10103 | - | 11700 | 1 (3) |
| antimony | 96 | 10 | 0.5 | nd | 0.48 (3) |
| barium | 68000 | 500 | 1.3 | 120 | 208 (4) |
| benzene | 850 | - | 0.001 | na | 0.1 (1) |
| benzoic acid | - | 310000 | - | na | - |
| benzo(a)anthracene | 20 | 1 | 0.0007 | na | 0.1 (1) |
| benzo(a)pyrene | 2 | 1 | 0.0007 | na | 0.1 (1) |
| benzo(b)fluoranthene | 20 | 1 | 0.0007 | na | 0.1 (1) |
| benzo(g,h,i)perylene | - | 1 | 0.0007 | na | 0.1 (1) |
| benzo(k)fluoranthene | 200 | 1 | 0.0007 | na | - |
| bis(2-chloroisopropyl)ether | 420 | - | 0.22 | na | - |
| bis(2-ethylhexyl)phthalate | 820 | 70 | 0.22 | na | - |
| boron | 7400 | 7000 | 4 | na | 0.0005 (2) |
| bromoform | 31 | - | 0.001 | na | - |
| bromomethane | 8200 | - | 0.001 | na | - |
| butylbenzyl phthalate | - | 1600 | - | na | - |
| cadmium | 82 | 5 | 0.1 | 0.91 | 2.5 (3) |
| carbon tetrachloride | 2.1 | - | 0.001 | na | <0.3 (1) |
| chromium (chromium vi) | 300 | 250 (0.05) | 1.3 (2.7) | 21 | 0.0075 (2) |
| chrysene | 2000 | 1 | 0.002 | na | 0.1 (1) |
| cobalt | 740 | 50 | 0.3 | 16 | 20 (5) |
| copper | 220000 | 100 | 0.5 | 20 | 50 |
| cyanide | 120000 | 50 | 0.33 | 0.27 | >0.005 |
| dibenzofuran | - | - | - | na | - |
| dibenzo(a,h)anthracene | 2 | 0.088 | 0.0005 | na | 0.1 (1) |
| diethyl phthalate | - | - | - | na | 100 (5) |
| di-n-butyl phthalate | - | 63000 | - | na | 200 (5) |
| endrine keytone | - | 23 | - | na | - |
| ethylbenzene | 5100 | - | 0.01 | na | 0.1 (1) |
| fluoranthene | - | 10 | - | na | 0.1 (1) |
| fluorene | - | 3100 | - | na | 0.1 (1) |
| fluoride | 78000 | - | 0.7 | na | 1 (3) |

## TABLE C-3 (Continued)

## SOIL COECS EVALUATED

| COEC *all values in mg/kg* | Soil FRL | Soil BTV | FS Detection Limits | FS Background | Lowest Soil BTV (Source) |
|---|---|---|---|---|---|
| heptachlorodibenzofurans | 0.00088 | - | 0.000006 | na | - |
| heptachlorodibenzo-p-dioxins | 0.00088 | - | 0.000006 | na | - |
| indeno(1,2,3-cd)pyrene | 20 | 1 | 0.004 | na | 0.1 (1) |
| lead | 400 | 200 | 0.05 | 26.4 | 0.01 (2) |
| manganese | 4600 | 1500 | 1 | 1400 | 100 (6) |
| mercury | 7.5 | 5 | 0.13 | 0.3 | 0.0185 (4) |
| molybdenum | 2900 | 10 | 13 | 2.7 | 0.59 (1) |
| naphthalene | - | 3100 | - | na | - |
| nickel | 15000 | 100 | 4 | 34.3 | 2 (3) |
| n-nitrosodiphenylamine | 51 | - | 0.2 | na | 20 (6) |
| n-nitroso-di-n-propylamine | 0.2 | - | 0.2 | na | - |
| octachlorodibenzofuran | 0.0088 | - | 0.000013 | na | - |
| pentachlorophenol | 2.3 | - | 0.9 | na | 0.1 (1) |
| phenanthrene | - | 5 | 0.001 | na | 0.1 (1) |
| phenol | - | 1 | - | na | 0.1 (1) |
| pyrene | - | 10 | - | na | 0.1 (1) |
| selenium | 5400 | 3 | 1.3 | 0.72 | 0.79 (4) |
| silver | 29000 | 10 | 1.3 | nd | 9.8E-06 (3) |
| thallium | 91 | 6.3 | 1 | 0.58 | 0.001 (3) |
| toluene | 100000 | - | 0.001 | na | 0.1 (1) |
| tributyl phosphate | 250 | - | 0.04 | na | - |
| vanadium | 5100 | 150 | 1 | 38 | 0.5 (3) |
| vinyl chloride | 0.13 | - | 0.001 | na | 0.3 (1) |
| xylenes, total | 920000 | 160000 | 0.001 | na | <0.1 (2) |
| zinc | 120000 | 500 | - | 82 | 10 (3) |

Shaded cells indicate an existing and/or lowest BTV value that is lower than background and/or detection limits.
na = not analyzed
nd = not detected

Lowest Soil BTV Sources:
1. U.S. EPA Region III Flora and Fauna
2. U.S. EPA Region III Fauna
3. U.S. EPA Region III Flora
4. Oak Ridge National Laboratory Wildlife
5. Oak Ridge National Laboratory Flora
6. Oak Ridge National Laboratory Soil and Litter

## TABLE C-4

## SUMMARY OF SITEWIDE COEC SCREENING FOR EXISTING SURFACE SOIL

| COEC *all values in mg/kg* | Soil FRL | Soil BTV | FS Detection Limits | FS Bkgd | Lowest Soil BTV (Source) | Freq of Remnant Detections | Max Conc | Comment |
|---|---|---|---|---|---|---|---|---|
| 1,1-dichloroethene | **0.41** | - | 0.001 | na | - | 35/1550 (2.2%) | 0.46 | no existing concentration > 0.46 mg/kg |
| 1,1,1-trichloroethane | - | **7000** | 0.001 | na | <0.3 (1) | 139/1419 (9.8%) | 6.6 | no existing concentration > BTV |
| 1,1,2-trichloroethane | 4.3 | - | 0.001 | na | **<0.3 (1)** | 9/1400 (0.6%) | 0.042 | no existing concentration > 0.3 mg/kg |
| 1,2-dichloroethane | 0.16 | - | 0.001 | na | **870 (2)** | 10/1550 (0.6%) | 0.079 | no existing concentration > 870 mg/kg |
| 2-butanone | - | **47000** | - | na | - | 134/1303 (10.3%) | 3.8 | no existing concentration > BTV |
| 2-methylnaphthalene | - | - | - | na | - | 72/1206 (6.0%) | 46 | no existing concentration > 46 mg/kg |
| 3,3'-dichlorobenzidine | **0.55** | - | 0.2 | na | - | 2/1190 (0.2%) | 0.19 | no existing concentration > FRL |
| 4-methylphenol | 250 | - | **0.2** | na | 0.1 (1) | 17/1362 (1.2%) | 1.7 | no existing concentration > 1.7 mg/kg |
| 4-nitroaniline | **150** | - | 0.9 | na | - | 3/1128 (0.3%) | 0.85 | no existing concentration > FRL |
| 4,4'-DDE | - | **0.1** | - | na | <0.1 (1) | 13/1110 (1.2%) | 0.12 | no existing concentration > BTV |
| 4,4'-DDT | - | **0.1** | - | na | <0.1 (1) | 18/1111 (1.6%) | 1.6 | no existing concentration > BTV |
| acenapthene | - | **4700** | - | na | 0.1 (1) | 66/1207 (5.5%) | 140 | no existing concentration > BTV |
| acetone | 43000 | **8000** | 0.007 | na | - | 263/1393 (18.9%) | 15 | no existing concentration > BTV |
| benzene | 850 | - | 0.001 | na | **0.1 (1)** | 20/1631 (1.2%) | 0.11 | no existing concentration > 0.1 mg/kg |
| benzoic acid | - | **310000** | - | na | - | 71/970 (7.3%) | 0.68 | no existing concentration > BTV |
| bis(2-chloroisopropyl)ether | **420** | - | 0.22 | na | - | 2/1127 (0.2%) | - | no existing concentration > FRL |
| bis(2-ethylhexyl)phthalate | 820 | **70** | 0.22 | na | - | 438/1202 (36.4%) | - | no existing concentration > BTV |
| boron | 7400 | **7000** | 4 | na | 0.0005 (2) | 123/164 (75%) | 1140 | no existing concentration > BTV |
| bromomethane | **8200** | - | 0.001 | na | - | 3/1339 (0.2%) | 0.72 | no existing concentration > FRL |
| butylbenzyl phthalate | - | **1600** | - | na | - | 21/1202 (1.7%) | 2.1 | no existing concentration > BTV |
| carbon tetrachloride | 2.1 | - | 0.001 | na | **<0.3 (1)** | 6/1586 (0.4%) | 0.17 | no existing concentration > 0.3 mg/kg |
| chromium (chromium vi) | 300 | **250** | 1.3 (2.7) | 21 | 0.0075 (2) | 1829/2073 (88.2%) | 560 | no existing concentration > BTV; no |
| cyanide | 120000 | **50** | 0.33 | 0.27 | >0.005 | 317/1272 (24.9%) | 540 | no existing concentration > BTV |
| dibenzofuran | - | - | - | na | - | 64/1204 (5.3%) | 120 | no existing concentration > 120 mg/kg |
| diethyl phthalate | - | - | - | na | - | 31/1208 (2.6%) | 0.68 | no existing concentration > 0.68 mg/kg |
| di-n-butyl phthalate | - | **63000** | - | na | - | 127/1213 (10.5%) | 6.1 | no existing concentration > BTV |
| endrine keytone | - | **23** | - | na | - | 6/1108 (0.5%) | 0.0071 | no existing concentration > BTV |
| fluorene | - | **3100** | - | na | 0.1 (1) | 67/1206 (5.6%) | 180 | no concentration > BTV; |
| fluoride | 78000 | - | 0.7 | na | **1 (3)** | 19/32 (59.4%) | 394 | 2 detections > 1 mg/kg: 5.69 and 7.58 mg/kg |
| heptachlorodibenzofurans | **0.00088** | - | 0.000006 | na | - | 2/68 (2.9%) | 3.2 E-7 | no existing concentration > FRL |
| heptachlorodibenzo-p-dioxins | **0.00088** | - | 0.000006 | na | - | 2/68 (2.9%) | 9 E-7 | no existing concentration > FRL |
| naphthalene | - | **3100** | - | na | - | 67/1205 (5.6%) | 96 | no existing concentration > BTV |
| n-nitrosodiphenylamine | 51 | - | 0.2 | na | **20 (6)** | 5/1203 (0.4%) | 1.3 | no existing concentration > 20 mg/kg |
| n-nitroso-di-n-propylamine | **0.2** | - | 0.2 | na | - | 11/1192 (0.9%) | 0.26 | no existing concentration > FRL |

## TABLE C-4 (Continued)

## SUMMARY OF SITEWIDE COEC SCREENING FOR EXISTING SURFACE SOIL

| COEC *all values in mg/kg* | Soil FRL | Soil BTV | FS Detection Limits | FS Bkgd | Lowest Soil BTV (Source) | Freq of Remnant Detections | Max Conc | Comment |
|---|---|---|---|---|---|---|---|---|
| octachlorodibenzofuran | **0.0088** | - | 0.000013 | na | - | 3/70 (4.3%) | 1.5 E-7 | no existing concentration > FRL |
| pentachlorophenol | 2.3 | - | 0.9 | na | **0.1 (1)** | 21/1405 (1.5%) | 0.26 | 1 detection > 0.1 mg/kg: 0.26 mg/kg |
| phenol | - | **1** | - | na | 0.1 (1) | 44/1195 (3.7%) | 0.73 | no existing concentration > BTV |
| tributyl phosphate | **250** | - | 0.04 | na | - | 28/157 (17.8%) | 94 | no existing concentration > FRL |
| vinyl chloride | 0.13 | - | 0.001 | na | **0.3 (1)** | 8/1548 (0.5%) | 0.67 | no existing concentration > 0.3 mg/kg |
| xylenes, total | 920000 | **160000** | 0.001 | na | <0.1 (2) | 61/1395 (4.4%) | 31 | no existing concentration > BTV |

Shaded cells indicate an existing and/or lowest BTV value that is lower than background and/or detection limits.
Bold cells indicate the values used for screening
na = not analyzed

Lowest Soil BTV Sources:
1. U.S. EPA Region III Flora and Fauna
2. U.S. EPA Region III Fauna
3. U.S. EPA Region III Flora
4. Oak Ridge National Laboratory Wildlife
5. Oak Ridge National Laboratory Flora
6. Oak Ridge National Laboratory Soil and Litter

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## TABLE C-5

## RESULTS OF SITEWIDE COEC SCREENING USING REMNANT SOIL DATA

| COEC (mg/kg) | Soil FRL | Soil BTV | FS Detection Limits | FS Bkgd | Lowest Soil BTV (Source) | Freq of Remnant Detections | Retain? | Comment |
|---|---|---|---|---|---|---|---|---|
| acenaphthylene | - | - | - | na | **<0.1 (1)** | 5/403 (1.2%) | no | all remnant data accounted for |
| *aluminum* | - | **10103** | - | 11700 | 1 (3) | 427/427 (100%) | no | background concentrations > BTV |
| *antimony* | 96 | **10** | 0.5 | nd | 0.48 (3) | 44/257 (17.1%) | yes | remnant concs. may be a concern at K-65 and AFP |
| barium | 68000 | **500** | 1.3 | 120 | 208 (4) | 436/437 (99.7%) | no | all remnant data accounted for |
| *benzo(a)anthracene* | 20 | **1** | 0.0007 | na | 0.1 (1) | 43/408 (10.5%) | no | all remnant data accounted for |
| *benzo(a)pyrene* | 2 | **1** | 0.0007 | na | 0.1 (1) | 30/406 (7.3%) | no | all remnant data accounted for |
| *benzo(b)fluoranthene* | 20 | **1** | 0.0007 | na | 0.1 (1) | 41/407 (10.0%) | no | all remnant data accounted for |
| *benzo(g,h,i)perylene* | - | **1** | 0.0007 | na | 0.1 (1) | 22/407 (5.4%) | no | all remnant data accounted for |
| *benzo(k)fluoranthene* | 200 | **1** | 0.0007 | na | - | 28/407 (6.8%) | no | all remnant data accounted for |
| bromoform | 31 | - | 0.001 | na | - | 0/478 (0%) | no | no remnant detections |
| *cadmium* | 82 | **5** | 0.1 | 0.91 | 2.5 (3) | 177/406 (41.5%) | yes | remnant concs. may be a concern at boiler plant/bldg 12 |
| *chrysene* | 2000 | **1** | 0.002 | na | 0.1 (1) | 44/408 (10.7%) | no | all remnant data accounted for |
| cobalt | 740 | **50** | 0.3 | 16 | 20 (5) | 405/427 (94.8%) | no | no remnant conc. > BTV; 7 remnant hits b/t 20 and 50 mg/kg |
| copper | 220000 | **100** | 0.5 | 20 | 50 | 393/426 (92.2%) | no | no remnant conc. > BTV; no remnant conc. > 50 mg/kg |
| *dibenzo(a,h)anthracene* | 2 | **0.088** | 0.0005 | na | 0.1 (1) | 11/407 (2.7%) | no | all remnant data accounted for |
| ethylbenzene | 5100 | - | 0.01 | na | **0.1 (1)** | 7/487 (1.4%) | no | all remnant data accounted for |
| fluoranthene | - | **10** | - | na | 0.1 (1) | 58/408 (14.2%) | no | all remnant data accounted for |
| *indeno(1,2,3-cd)pyrene* | 20 | **1** | 0.004 | na | 0.1 (1) | 22/407 (5.4%) | no | all remnant data accounted for |
| *lead* | 400 | **200** | 0.05 | 26.4 | 0.01 (2) | 411/412 (99.7%) | no | all remnant data accounted for |
| *manganese* | 4600 | **1500** | 1 | 1400 | 100 (6) | 417/418 (99.7%) | no | all remnant data accounted for |
| mercury | 7.5 | **5** | 0.13 | 0.3 | 0.0185 (4) | 13/434 (2.9%) | no | no remnant conc. > BTV |
| *molybdenum* | 2900 | **10** | 13 | 2.7 | 0.59 (1) | 174/409 (42.5%) | no | all remnant data accounted for |
| nickel | 15000 | **100** | 4 | 34.3 | 2 (3) | 372/421 (88.3%) | no | no remnant conc. > BTV |
| phenanthrene | - | **5** | 0.001 | na | 0.1 (1) | 42/408 (10.3%) | no | all remnant data accounted for |
| pyrene | - | **10** | - | na | 0.1 (1) | 63/408 (15.4%) | no | all remnant data accounted for |
| selenium | 5400 | **3** | 1.3 | 0.72 | 0.79 (4) | 47/360 (13.0%) | no | no remnant conc. > BTV |

## TABLE C-5 (Continued)

## RESULTS OF SITEWIDE COEC SCREEENING USING REMNANT SOIL DATA

| COEC (mg/kg) | Soil FRL | Soil BTV | FS Detection Limits | FS Bkgd | Lowest Soil BTV (Source) | Freq of Remnant Detections | Retain? | Comment |
|---|---|---|---|---|---|---|---|---|
| *silver* | 29000 | **10** | 1.3 | nd | 2 (5) | 186/419 (44.3%) | yes | remnant concs. may be a concern at SWL, bldg. 12, and AFP |
| thallium | 91 | **6.3** | 1 | 0.58 | 0.001 (3) | 84/428 (19.6%) | no | all remnant data accounted for |
| toluene | 100000 | - | 0.001 | na | **0.1 (1)** | 76/487 (15.6%) | no | all remnant data accounted for |
| vanadium | 5100 | **150** | 1 | 38 | 0.5 (3) | 421/427 (98.5%) | no | no remnant conc. > BTV |
| *zinc* | 120000 | **500** | - | 82 | 10 (3) | 414/426 (97.1%) | no | all remnant data accounted for |

Shaded cells indicate an existing and/or lowest BTV value that is lower than background and/or detection limits.
Bold cells indicate the values used for screening
Italicized COECs are the 16 soil COECs identified in the Sitewide Ecological Risk Assessment
na = not analyzed
nd = not detected

Lowest Soil BTV Sources:
1. U.S. EPA Region III Flora and Fauna
2. U.S. EPA Region III Fauna
3. U.S. EPA Region III Flora
4. Oak Ridge National Laboratory Wildlife
5. Oak Ridge National Laboratory Flora
6. Oak Ridge National Laboratory Soil and Litter

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## TABLE C-6

## COMPARISON OF UPDATED REPRESENTATIVE CONCENTRATIONS VS. SERA REPRESENTATIVE CONCENTRATIONS

| COEC | BTV (mg/kg) | Area A | | Area B | | Area C | | Area D | | Area E | | Area G | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | SERA | Updated | SERA | Updated | SERA | Update | SERA | Updated | SERA | Updated | SERA | Updated |
| aluminum | 10,103 | | | 10,700 | 12,461 | 25,700 | 11,812 | | | 16,300 | 14,296 | | |
| antimony | 10 | | | | | 21.5 | 15.2u | 10.6 | 7.4u | 10.2 | 3.5u | 29.5 | 3.5u |
| cadmium | 5 | 5.90 | 1.40 | | | | | | | | | 5.80 | 1.30 |
| lead | 200 | | | | | 570 | 52.3 | 2,180 | 998 | | | | |
| manganese | 1,500 | | | 1,530 | 1,248 | 2,100 | 1,284 | | | | | | |
| molybdenum | 10 | 11.7 | 8.80 | 12.4 | 7.2 | | | | | 14.5 | 4.3u | | |
| silver | 10 | | | | | | | | | | | 10.3 | 2.4u |
| zinc | 500 | 707 | 66.0 | | | | | | | | | | |
| benzo(a)anthracene | 1 | 2.10 | 0.45u | | | | | | | | | | |
| benzo(a)pyrene | 1 | 1.60 | 0.45u | | | | | | | 1.15 | 0.42u | | |
| benzo(b)fluoranthene | 1 | 2.10 | 0.45u | | | 1.80 | 0.44u | | | 3.70 | 0.42u | | |
| benzo(g,h,i)perylene | 1 | | | | | 1.10 | 0.46u | | | 3.10 | 0.42u | | |
| benzo(k)fluoranthene | 1 | | | | | 1.30 | 0.44u | | | 3.30 | 0.42u | | |
| chrysene | 1 | 2.10 | 0.45u | | | | | | | 3.20 | 0.42u | | |
| dibenzo(a,h)anthracene | 0 | | | | | 0.40 | 0.40 | | | 1.10 | 1.10 | | |
| indeno(1,2,3-cd)pyrene | 1 | | | | | 1.50 | 0.46u | | | 3.00 | 0.42u | | |

## TABLE C-7

## AREA A SUMMARY STATISTICS

| | Benzo(a)anthracene | Benzo(a)pyrene | Benzo(b)fluoranthene | Cadmium | Chrysene | Molybdenum | Zinc |
|---|---|---|---|---|---|---|---|
| 1 | 470 U | 470 U | 470 U | 1.90 - | 470 U | 13.3 - | 137.0 - |
| 2 | 460 U | 460 U | 460 U | 1.70 - | 460 U | 11.7 - | 80.4 - |
| 3 | 450 U | 450 U | 450 U | 1.60 - | 450 U | 10.8 - | 76.8 - |
| 4 | 450 U | 450 U | 450 U | 1.40 - | 450 U | 8.9 - | 76.2 - |
| 5 | 450 U | 450 U | 450 U | 1.40 U | 450 U | 8.8 - | 66.7 - |
| 6 | 440 U | 440 U | 440 U | 1.40 U | 440 U | 6.9 - | 65.9 - |
| 7 | 430 U | 440 U | 430 U | 1.30 U | 430 U | 4.8 U | 65.6 - |
| 8 | 430 U | 430 U | 430 U | 1.30 U | 430 U | 4.7 U | 65.4 - |
| 9 | 430 U | 430 U | 430 U | 1.30 U | 430 U | 4.7 U | 64.2 - |
| 10 | 430 U | 430 U | 430 U | 1.30 U | 430 U | 4.6 U | 62.5 - |
| 11 | 420 UJ | 430 U | 420 UJ | 0.51 - | 420 UJ | 4.5 U | 62.1 - |
| 12 | 410 U | 420 UJ | 410 U | 0.54 U | 410 U | 4.5 U | 61.8 - |
| 13 | 410 U | 410 U | 410 U | 0.54 U | 410 U | 4.3 U | 59.1 - |
| 14 | 400 U | 410 U | 400 U | 0.53 U | 400 U | 4.2 U | 54.2 - |
| 15 | 75 J | 400 U | 120 J | 0.51 U | 82 J | 4.2 U | 53.3 - |
| 16 | 48 J | 77 J | 56 J | 0.51 U | 77J | 2.6 U | 52.7 - |
| 17 | | | | 0.49 U | | 1.1 J | 51.6 - |
| 18 | | | | 0.49 U | | | 51.6 - |
| 19 | | | | 0.48 U | | | 48.6 - |
| 20 | | | | 0.48 U | | | 47.7 J |
| 21 | | | | 0.48 U | | | 47.4 - |
| 22 | | | | 0.48 U | | | 40.8 - |
| 23 | | | | 0.47 U | | | 39.8 - |
| 24 | | | | 0.46 U | | | 38.4 - |
| 25 | | | | 0.46 U | | | 37.1 - |
| 26 | | | | 0.14 U | | | 28.5 - |
| Samples | 16 | 16 | 16 | 26 | 16 | 17 | 26 |
| Hits | 2 | 1 | 2 | 5 | 2 | 7 | 26 |
| Min Hit | 48 J | 77 J | 56 J | 0.51 - | 77 J | 1.1 J | 28.5 - |
| Max Hit | 75 J | 77 J | 120 J | 1.90 - | 82 J | 13.3 - | 137.0 - |
| Min Result | 48 J | 77 J | 56 J | 0.14 U | 77 J | 1.1 J | 28.5 - |
| Max Result | 470 U | 470 U | 470 U | 1.90 - | 470 U | 13.3 - | 137.0 - |
| Distribution | Undetermined | Undetermined | Undetermined | Undetermined | Undetermined | Undetermined | Lognormal |
| UCL (N) | | | | | | | |
| UCL (L) | | | | | | | 66.0 |
| UCL (M) | 450 U | 450 U | 450 U | 1.4 * | 450 U | 8.8 - | |

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# TABLE C-8

## AREA B SUMMARY STATISTICS

| | Aluminum | Manganese | Molybdenum |
|---|---|---|---|
| 1 | 18500 - | 1480 J | 12.4 - |
| 2 | 13300 J | 1470 - | 11.3 - |
| 3 | 12700 - | 1170 - | 7.2 - |
| 4 | 12300 - | 1110 - | 6.6 NV |
| 5 | 11500 J | 838 J | 4.7 U |
| 6 | 10400 - | 648 - | 4.6 U |
| 7 | 9670 - | 641 J | 4.4 U |
| 8 | 9350 - | 621.23 NV | 4.3 U |
| 9 | 8790 - | 441 J | 4.0 U |
| 10 | 6580 - | 430 J | 3.6 U |
| 11 | 5850 NV | | 1.1 J |
| 12 | 1300 J | | 0.31 UJ |
| | | | |
| Samples | 12 | 10 | 12 |
| Hits | 12 | 10 | 5 |
| Min Hit | 1300 J | 430 J | 1.1 J |
| Max Hit | 18500 - | 1480 J | 12.4 - |
| Min Result | 1300 J | 430 J | 0.031 UJ |
| Max Result | 18500 - | 1480 J | 12.4 - |
| | | | |
| Distribution | Normal | Lognormal | Undetermined |
| UCL (N) | 12461 | | |
| UCL (L) | | 1248 | |
| UCL (M) | | | 7.2 - |

## TABLE C-9

## AREA C AREA SUMMARY STATISTICS

| | Aluminum | Antimony | Benzo(b) fluoranthene | Benzo(g,h,i) perylene | Benzo(k) fluoranthene | Indeno(1,2,3-cd) pyrene | Lead | Manganese |
|---|---|---|---|---|---|---|---|---|
| 1 | 15600 - | 21.5 J | 1800 - | 1100 - | 1300 - | 1500 - | 137.0 - | 4400 J |
| 2 | 15400 - | 19.3 UJ | 450 U | 560 U | 450 U | 560 U | 101.0 - | 2040 J |
| 3 | 15400 - | 15.2 UJ | 440 U | 460 U | 440 U | 460 U | 87.7 - | 1210 J |
| 4 | 15100 - | 7.5 UJ | 420 U | 450 U | 420 U | 450 U | 32.0 - | 1060 J |
| 5 | 11600 - | 7.4 UJ | 420 U | 440 U | 420 U | 440 U | 29.9 - | 902 J |
| 6 | 11500 - | 7.2 UJ | 420 U | 420 U | 420 U | 420 U | 27.4 - | 802 J |
| 7 | 10900 - | 3.7 J | 420 U | 420 U | 420 U | 420 U | 24.7 - | 712 J |
| 8 | 10100 - | 3.5 UJ | 410 U | 420 U | 410 U | 420 U | 23.8 - | 709 J |
| 9 | 9180 - | 2.9 J | 400 U | 420 U | 400 U | 420 U | 23.5 - | 558 J |
| 10 | 8680 - | 2.9 UJ | 390 U | 410 U | 390 U | 410 U | 23.4 - | 531 - |
| 11 | 7440 - | 2.8 J | 380 UJ | 400 U | 380 UJ | 400 U | 22.8 J | 530 J |
| 12 | 7420 - | 2.7 UJ | 140 J | 390 U | 150 U | 390 U | 22.2 J | 510 J |
| 13 | 7380 - | 2.5 UJ | 110 J | 380 UJ | 7 U | 380 UJ | 19.2 J | 506 - |
| 14 | 7370 - | | | | | | 18.3 - | 420 J |
| 15 | 7280 - | | | | | | 16.8 - | 416 J |
| 16 | 7090 - | | | | | | 15.0 - | 369 J |
| 17 | 6280 - | | | | | | 13.3 - | 369 J |
| Samples | 17 | 13 | 13 | 13 | 13 | 13 | 17 | 17 |
| Hits | 17 | 4 | 3 | 1 | 3 | 1 | 17 | 17 |
| Min Hit | 6280 - | 2.8 J | 110 J | 1100 - | 91 J | 1500 - | 13.3 - | 369 J |
| Max Hit | 15600 - | 21.5 J | 1800 - | 1100 - | 1300 - | 1500 - | 137.0 - | 4400 J |
| Min Result | 6280 - | 2.5 UJ | 110 J | 380 UJ | 91 J | 380 UJ | 13.3 - | 369 J |
| Max Result | 15600 - | 21.5 J | 1800 - | 1100 - | 1300 - | 1500 - | 137.0 - | 4400 J |
| Distribution | Normal | Undetermined | Undetermined | Undetermined | Undetermined | Undetermined | Lognormal | Lognormal |
| UCL (N) | 11812 | | | | | | | |
| UCL (L) | | | | | | | 52.3 | 1284 |
| UCL (M) | | 15.2 UJ | 440 U | 460 U | 440 U | 460 U | | |

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# TABLE C-10

## AREA D SUMMARY STATISTICS

| | Antimony | Lead |
|---|---|---|
| 1 | 10.6 J | 2180 - |
| 2 | 7.6 UJ | 2160 - |
| 3 | 7.4 U | 2020 - |
| 4 | 7.3992 NV | 1150 - |
| 5 | 4.1 J | 693 J |
| 6 | 3.8 J | 541 J |
| 7 | 2.8 J | 216 J |
| 8 | 2.6 UJ | 205 J |
| 9 | 2.5 UJ | 142 J |
| 10 | 2.4 UJ | 117 J |
| 11 | 2.4 UJ | 91.8 J |
| 12 | 2.4 UJ | 61.5 - |
| 13 | 2.3 UJ | 52.1 J |
| 14 | | 32 - |
| 15 | | 26.2 J |
| 16 | | 22.5 - |
| 17 | | 22.2 - |
| 18 | | 20.8 - |
| 19 | | 19.7 J |
| 20 | | 19.2 J |
| 21 | | 18 - |
| 22 | | 17.8 - |
| 23 | | 17.5 J |
| 24 | | 14.6 - |
| 25 | | 14.4 - |
| 26 | | 13.7 - |
| | | |
| Samples | 13 | 26 |
| Hits | 5 | 26 |
| Min Hit | 2.8 J | 13.7 |
| Max Hit | 10.6 J | 2180 |
| Min Result | 2.3 UJ | 13.7 |
| Max Result | 10.6 J | 2180 |
| | | |
| Distribution | Undetermined | Lognormal |
| UCL (N) | | |
| UCL (L) | | 998 |
| UCL (M) | 7.4 U | |

## TABLE C-11

## AREA E SUMMARY STATISTICS

| | Aluminum | Antimony | Benzo(a)pyrene | Benzo(b)fluoranthene | Benzo(g,h,i)perylene | Benzo(k)fluoranthene | Chrysene | Indeno(1,2,3-cd)pyrene | Molybdenum |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 15800 | 3.5 UJ | 420 U | 420 U | 420 U | 420 U | 420 U | 420 U | 4.3 U |
| 2 | 11600 J | 3.5 UJ | 410 U | 410 U | 410 U | 410 U | 410 U | 410 U | 4.2 U |
| 3 | 8380 | 3.4 UJ | 400 U | 400 U | 400 U | 400 U | 400 U | 400 U | 4.1 U |
| 4 | 8330 J | 3.3 UJ | 400 U | 400 U | 400 U | 400 U | 400 U | 400 U | 4 U |
| 5 | 6420 | 3.2 UJ | 380 U | 380 U | 380 U | 380 U | 380 U | 380 U | 3.9 U |
| 6 | 5610 | | | | | | | | 0.6 J |
| Samples | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| Hits | 6 | 0.000000 | 0.000 | 0.00000 | 0.00000 | 0.00000 | 0.00 | 0.000000 | 1 |
| Min Hit | 5610 - | - | - | - | - | - | - | - | 0.6 J |
| Max Hit | 15800 - | - | - | - | - | - | - | - | 0.6 J |
| Min Result | 5610 - | 3.2 UJ | 380 U | 380 U | 380 U | 380 U | 380 U | 380 U | 0.6 J |
| Max Result | 15800 - | 3.5 UJ | 420 U | 420 U | 420 U | 420 U | 420 U | 420 U | 4.3 U |
| Distribution | Lognormal | Undetermined | Undetermined | Undetermined | Undetermined | Undetermined | Undetermined | Undetermined | Undetermined |
| UCL (N) | | | | | | | | | |
| UCL (L) | 14296 | | | | | | | | |
| UCL (M) | | 3.5 UJ | 420 U | 420 U | 420 U | 420 U | 420 U | 420 U | 4.3 U |

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TABLE C-12

AREA G SUMMARY STATISTICS

| | Antimony | Cadmium | Silver |
|---|---|---|---|
| 1 | 3.6 UJ | 6.1 - | 9.7 J |
| 2 | 3.5 U | 4.7 - | 8.4 J |
| 3 | 3.5 U | 2.5 - | 3.8 J |
| 4 | 3.4 U | 1.3 - | 2.4 U |
| 5 | 3.4 U | 1.3 U | 0.51 UJ |
| 6 | 3.3 U | 1.2 U | 0.5 U |
| 7 | 3.3 U | 1.2 UJ | 0.49 U |
| 8 | 3.2 UJ | 1.2 U | 0.48 - |
| 9 | 2.7 UJ | 1.2 U | 0.48 U |
| 10 | 1.8 J | 1.2 U | 0.47 - |
| 11 | | 1.2 U | 0.47 - |
| 12 | | 1.2 U | 0.46 UJ |
| 13 | | 1.1 U | 0.25 U |
| 14 | | 0.22 U | 0.06 U |
| 15 | | 0.18 U | 0.06 U |
| 16 | | 0.14 U | 0.05 U |
| Samples | 10 | 16 | 16 |
| Hits | 1 | 3 | 6 |
| Min Hit | 1.8 J | 1.3 - | 0.47 - |
| Max Hit | 1.8 J | 6.1 - | 9.7 J |
| Min Result | 1.8 J | 0.14 U | 0.05 U |
| Max Result | 3.6 UJ | 6.1 - | 9.7 J |
| Distribution | Undetermined | Undetermined | Undetermined |
| UCL (N) | | | |
| UCL (L) | | | |
| UCL (M) | 3.5 U | 1.3 - | 2.4 U |

## TABLE C-13

## SERA SURFACE WATER, SEDIMENT, AND DRINKING WATER ECOLOGICAL COCS BY AREA

| COC | | | Representative Concentrations by Area (ug/l) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Surface Water COC | FRL (ug/L) | BTV (ug/L) | Northern DD | Southrn DDs | Pilot Plant DD | PR On-Prop. | PR Off-Prop. | GMR Upstrm | GMR Efflnt. | GMR PR |
| aluminum | na | 87 | na | na | na | 145 | -- | -- | 674 | 19,100, 856(f) |
| barium | 100,000 | 145 | na | na | na | -- | -- | -- | -- | 228 |
| cadmium | 9.8 | 3.5 | na | na | na | 5.00 | -- | -- | 5.3(f) | 18.0 |
| cyanide | 12 | 12 | na | na | na | -- | -- | -- | 16.8(f) | 21.4 |
| lead | 10 | 30 | na | na | na | 156 | 69.7 | -- | -- | 44.2 |
| manganese | 1,500 | 98 | na | na | na | 28.6(f) | -- | -- | -- | 561 |
| mercury | 0.2 | 0.2 | na | na | na | -- | -- | 0.700, 0.200(f) | -- | -- |
| silver | 5 | 1.3 | na | na | na | 4.00(f) | -- | -- | -- | -- |
| ammonia | na | 1,000 | na | na | na | -- | -- | 1,900 | -- | -- |
| bis(2-ethylhexyl)phthalate | 8.4 | 8.4 | na | na | na | 40.0 | 22.0 | -- | -- | 160 |
| di-n-octyl phthalate | 5 | 47.7 | na | na | na | 52.0 | 89.0 | -- | -- | -- |
| Sediment COC | FRL (mg/kg) | ER-L (mg/kg) | | | | | | | | |
| barium | na | 40 | na | na | na | 58.7 | -- | -- | 130 | 89 |
| cadmium | 71 | 5 | na | na | na | 5.50 | -- | -- | -- | -- |
| cyanide | na | 0.10 | na | na | na | 0.490 | -- | -- | -- | -- |
| iron | na | 17,000 | na | na | na | -- | -- | -- | 19,800 | -- |
| lead | na | 35 | na | na | na | -- | -- | -- | 39.7 | -- |
| manganese | 410 | 300 | na | na | na | 1,070 | 499 | -- | 729 | 667 |
| uranium | na | na | na | na | na | -- | 11.0(a) | -- | 2.00(a) | 3(a) |
| zinc | na | 120 | na | na | na | -- | -- | -- | -- | 171 |
| phenanthrene | 0.003 | 0.3 (b) | na | na | na | -- | -- | -- | 0.0147 | -- |
| Drinking Water COC | FRL (ug/L) | BTV (ug/L) | | | | | | | | |
| aluminum | na | 87 | 232 | -- | 14,400 | 145 | -- | -- | 674 | 19,100, 856(f) |
| beryllium | 1.2 | 4 | -- | 66.0 | -- | -- | -- | -- | -- | -- |
| cadmium | 9.8 | 5 | 6.30 | -- | -- | 5.00 | -- | -- | 5.30 | 18.0 |
| lead | 10 | 50 | -- | -- | -- | 156 | 69.7 | -- | -- | -- |
| mercury | 0.2 | 0.2 | 0.600 | -- | -- | -- | -- | 0.700, 0.200(f) | -- | -- |
| uranium | 530 | 890 | 930, 944(f) | -- | 2,890, 2,360(f) | -- | -- | -- | -- | -- |
| 1,2-dichloroethylene | na | 55 | -- | -- | 67.0 | -- | -- | -- | -- | -- |
| bis(2-ethylhexyl)phthalate | 8.4 | 18 | -- | -- | -- | 40.0 | 22.0 | -- | -- | 160 |
| di-n-octyl phthalate | 5 | 47.7 | -- | -- | -- | 52.0 | 89.0 | -- | -- | -- |
| trichloroethylene | na | 5 | -- | -- | 18.0 | -- | -- | -- | -- | -- |

[f] filtered sample
[a] retained as a COC, even though no medium-specific BTV was identified
[b] AWQC, ug/l
-- = representative concentration less than corresponding BTV(s)
na = not analyzed/not applicable

## TABLE C-14

## SURFACE WATER MODELING RESULTS

| COEC | Lowest | Area | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *all values in ug/l* | BTV(1) | 560 | 570 | 575 | 580 | 581 | 582 | PDAR | WPA | Neb |
| antimony | 6 | 0.0175 | na | na | na | na | 0.019 | na | na | na |
| cadmium | 3.5 | 0.170 | 0.13 | 0.1 | 0.03 | 0.04 | 0.038 | 0.150 | 0.137 | 0.0360 |
| manganese | 98 | 157 | 143 | 150 | 141 | 208 | 157 | 140 | 158 | 157 |
| molybdenum | 700 | 4.15 | 0.96 | 0.46 | na | na | 0.032 | 1.07 | 0.670 | 4.34 |
| silver | 1.3 | 0.319 | 0.44 | 0.28 | na | na | 0.017 | 0.809 | na | na |
| thallium | 2 | 0.0778 | 0.07 | 0.01 | 0.01 | 0.12 | 0.013 | 0.0120 | 0.0135 | 0.0134 |
| benzo(a)anthracene | 10(2) | na | na | na | na | na | na | 0.0242 | 0.108 | na |
| benzo(a)pyrene | 10(2) | na | na | na | na | na | na | 0.0455 | 0.0228 | na |
| benzo(b)fluoranthene | 15(2) | 1.28E-05 | na | na | na | na | na | 0.00309 | 0.0157 | na |
| benzo(g,h,I)perylene | 15(2) | na | na | na | na | na | na | 0.000234 | 0.000880 | na |
| benzo(k)fluoranthene | 15(2) | na | na | na | na | na | na | 0.000811 | na | na |
| chrysene | 10(2) | na | na | na | na | na | na | 0.0226 | 0.108 | na |
| dibenzo(a,h)anthracene | na | na | na | na | na | na | na | 0.00214 | 0.00272 | na |
| indeno(1,2,3-cd)pyrene | 15(2) | na | na | na | na | na | na | 8.73E-05 | 0.000272 | na |

## TABLE C-15

## SEDIMENT MODELING RESULTS

| COEC | BTV | Area | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *all values in mg/kg* | | 560 | 570 | 575 | 580 | 581 | 582 | PDAR | WPA | NEb |
| antimony | na | 0.126 | na | na | na | na | 0.134 | na | na | na |
| cadmium | 5 | 2.45 | 2.20 | 1.56 | 0.910 | 0.910 | 0.936 | 2.650 | 2.19 | 0.910 |
| manganese | 300 | 1400 | 1400 | 1400 | 1400 | 1520 | 1400 | 1400 | 1400 | 1400 |
| molybdenum | na | 11.3 | 4.30 | 3.49 | 2.70 | 2.70 | 2.76 | 4.83 | 3.340 | 11.3 |
| silver | na | 1.66 | 2.48 | 1.53 | na | na | 0.087 | 4.70 | na | na |
| thallium | na | 3.36 | 3.27 | 0.580 | 0.580 | 5.08 | 0.580 | 0.580 | 0.580 | 0.580 |
| benzo(a)anthracene | na | na | na | na | na | na | na | 1.73 | 6.85 | na |
| benzo(a)pyrene | na | na | na | na | na | na | na | 7.77 | 3.46 | na |
| benzo(b)fluoranthene | na | 7.57E-03 | na | na | na | na | na | 2.05 | 9.26 | na |
| benzo(g,h,i)perylene | na | na | na | na | na | na | na | 0.712 | 2.380000 | na |
| benzo(k)fluoranthene | na | na | na | na | na | na | na | 1.00 | na | na |
| chrysene | na | na | na | na | na | na | na | 1.62 | 6.85 | na |
| dibenzo(a,h)anthracene | na | na | na | na | na | na | na | 0.356 | 0.403 | na |
| indeno(1,2,3-cd)pyrene | na | na | na | na | na | na | na | 7.12E-01 | 1.97 | na |

000323

## TABLE C-16

## SUB-BASIN SOIL CONCENTRATIONS FOR SURFACE WATER AND SEDIMENT MODELING (MG/KG)

| Area | Antimony | Cadmium | Silver | Molybdenum | Manganese | Thallium | Benzo(b) fluoran-thene | Benzo(a) pyrene | Benzo(a) anthra-cene | Benzo (g,h,i) perylene | Benoz(k) fluoranthane | Chry-sene | Dibenzo (a,h) anthra-cene | Indeno (1,2,3-cd) pyrene |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 580A | na | 1.9 | na | 13.3 | 1400 | 0.59 | na | na | na | na | na | na | na | na |
| 580B | na | 4.9 | 8.2 | 2.7 | 1400 | 15.8 | na | na | na | na | na | na | na | na |
| SWL | na | 3.4 | 5.6 | 2.7 | 1400 | 0.58 | na | na | na | na | na | na | na | na |
| 560d | 20 | 4.9 | 13.8 | 7.1 | 1400 | 20.6 | 1.2 | na | na | na | na | na | na | na |
| 570A | na | 0.91 | 4.1 | 14.9 | 1400 | 0.58 | na | na | na | na | na | na | na | na |
| 570B | na | 1.6 | 7.8 | 8.9 | 1400 | 0.58 | na | na | na | na | na | na | na | na |
| 570C | na | 4.2 | 2.7 | 2.4 | 1400 | 0.58 | na | na | na | na | na | na | na | na |
| 570D | na | 0.91 | na | 2.7 | 1400 | 0.58 | na | na | na | na | na | na | na | na |
| 570 | na | 4.9 | na | 2.7 | 1400 | 0.58 | na | na | na | na | na | na | na | na |
| 570as | na | 0.91 | na | 2.7 | 1400 | 13 | na | na | na | na | na | na | na | na |
| 575A | na | 1.3 | na | 2.7 | 1400 | 0.58 | na | na | na | na | na | na | na | na |
| 575B | na | 0.91 | na | 2.7 | 1400 | 0.58 | na | na | na | na | na | na | na | na |
| SF | na | 3 | 9.2 | 7.6 | 1400 | 0.58 | na | na | na | na | na | na | na | na |
| 580A | na | 0.91 | na | 2.7 | 1400 | 0.58 | na | na | na | na | na | na | na | na |
| 581A | na | 0.91 | na | 2.7 | 1400 | 0.58 | na | na | na | na | na | na | na | na |
| 581B | na | 0.91 | na | 2.7 | 1985 | 21.3 | na | na | na | na | na | na | na | na |
| 581C | na | 0.91 | na | 2.7 | 1400 | 0.58 | na | na | na | na | na | na | na | na |
| 581D | na | 0.91 | na | 2.7 | 1400 | 0.58 | na | na | na | na | na | na | na | na |
| 582A | na | 0.91 | na | 2.7 | 1400 | 0.58 | na | na | na | na | na | na | na | na |
| 582B | na | 0.91 | na | 2.7 | 1400 | 0.58 | na | na | na | na | na | na | na | na |
| APP | 21.7 | 5.1 | 14.1 | 13.6 | 1900 | 0.58 | na | na | na | na | na | na | na | na |
| PAA | na | 0.91 | na | 2.7 | 1400 | 0.58 | 1.4 | na | na | 1 | na | na | na | na |
| PAB | na | 7.6 | 23.7 | 2.7 | 1400 | 0.58 | na | na | na | na | na | na | na | na |

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## TABLE C-16 (Continued)

## SUB-BASIN SOIL CONCENTRATIONS FOR SURFACE WATER AND SEDIMENT MODELING (MG/KG)

| Area | Antimony | Cadmium | Silver | Molybdenum | Manganese | Thallium | Benzo(b) fluoran-thene | Benzo(a) pyrene | Benzo(a) anthra-cene | Benzo (g,h,i) perylene | Benoz(k) fluoranthane | Chry-sene | Dibenzo (a,h) anthra-cene | Indeno (1,2,3-cd) pyrene |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PAC | na | 2 | na | 2.7 | 1400 | 0.58 | na | na | na | na | na | na | na | na |
| PAD | na | 0.91 | 2.5 | 5.7 | 1400 | 0.58 | na | na | na | na | na | na | na | na |
| PAE | na | 8.3 | 4.2 | 2.7 | 1400 | 0.58 | na | na | na | na | na | na | na | na |
| PAF | na | 1.1 | na | 2.7 | 1400 | 0.58 | na | na | na | na | na | na | na | na |
| PAG | na | 2.3 | 7 | 2.7 | 1400 | 0.58 | 6 | na | na | na | na | na | na | na |
| PAH | na | 0.91 | na | 9 | 1400 | 0.58 | NA | 24 | 6.1 | 2.2 | 3.1 | 6 | 1.1 | 2.2 |
| PAI | na | 0.91 | na | 2.7 | 1400 | 0.58 | na | na | na | na | na | na | na | na |
| LSP | na | 0.1 | na | 2.7 | 1400 | 0.58 | na | na | na | na | na | na | na | na |
| WPAA | na | 4.1 | na | 4.3 | 1400 | 0.58 | 23 | 9.6 | 17 | 5.9 | NA | 17 | 1 | 4.9 |
| WPA OU1 | na | 0.91 | na | 2.7 | 1400 | 0.58 | na | na | na | na | na | na | na | na |
| WPA OU4 | na | 0.91 | na | 2.7 | 1400 | 0.58 | na | na | na | na | na | na | na | na |
| NEb | na | 0.91 | na | 11.3 | 1400 | 0.58 | na | na | na | na | na | na | na | na |

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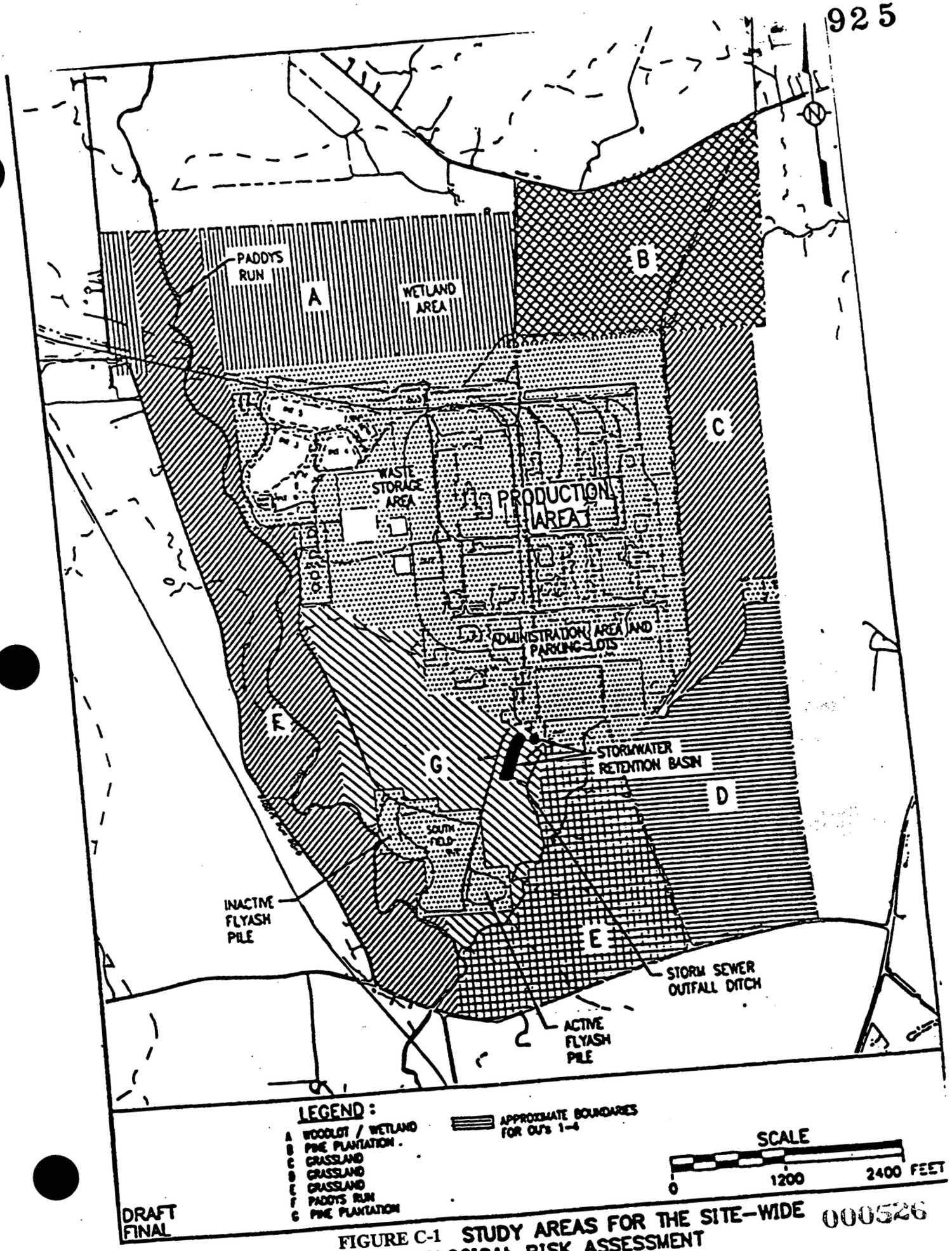



FIGURE C-1 STUDY AREAS FOR THE SITE-WIDE ECOLOGICAL RISK ASSESSMENT

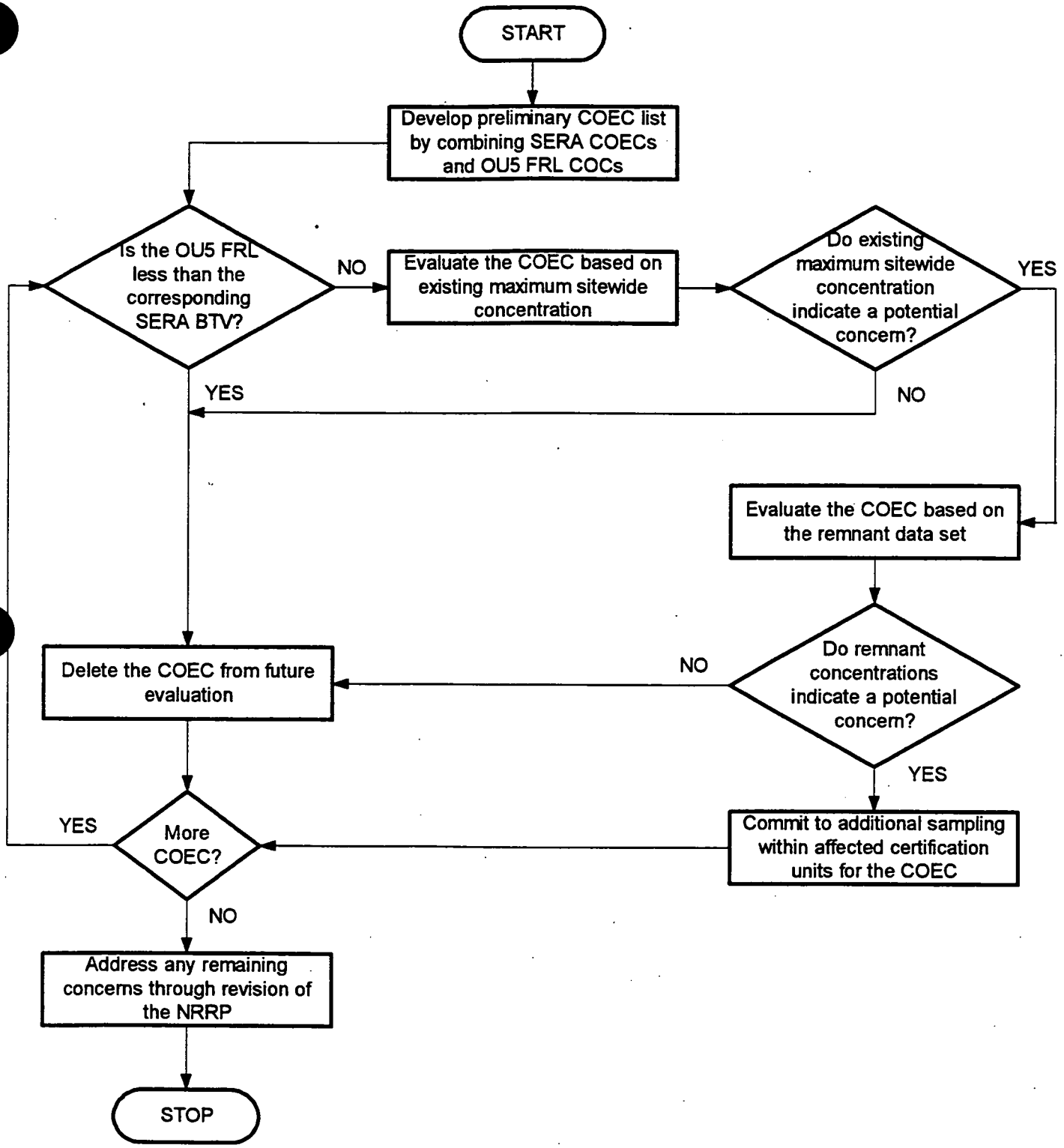



**FIGURE C-2 SOURCE AREA SOIL EVALUATION BASED ON SITEWIDE DATA REVIEW**

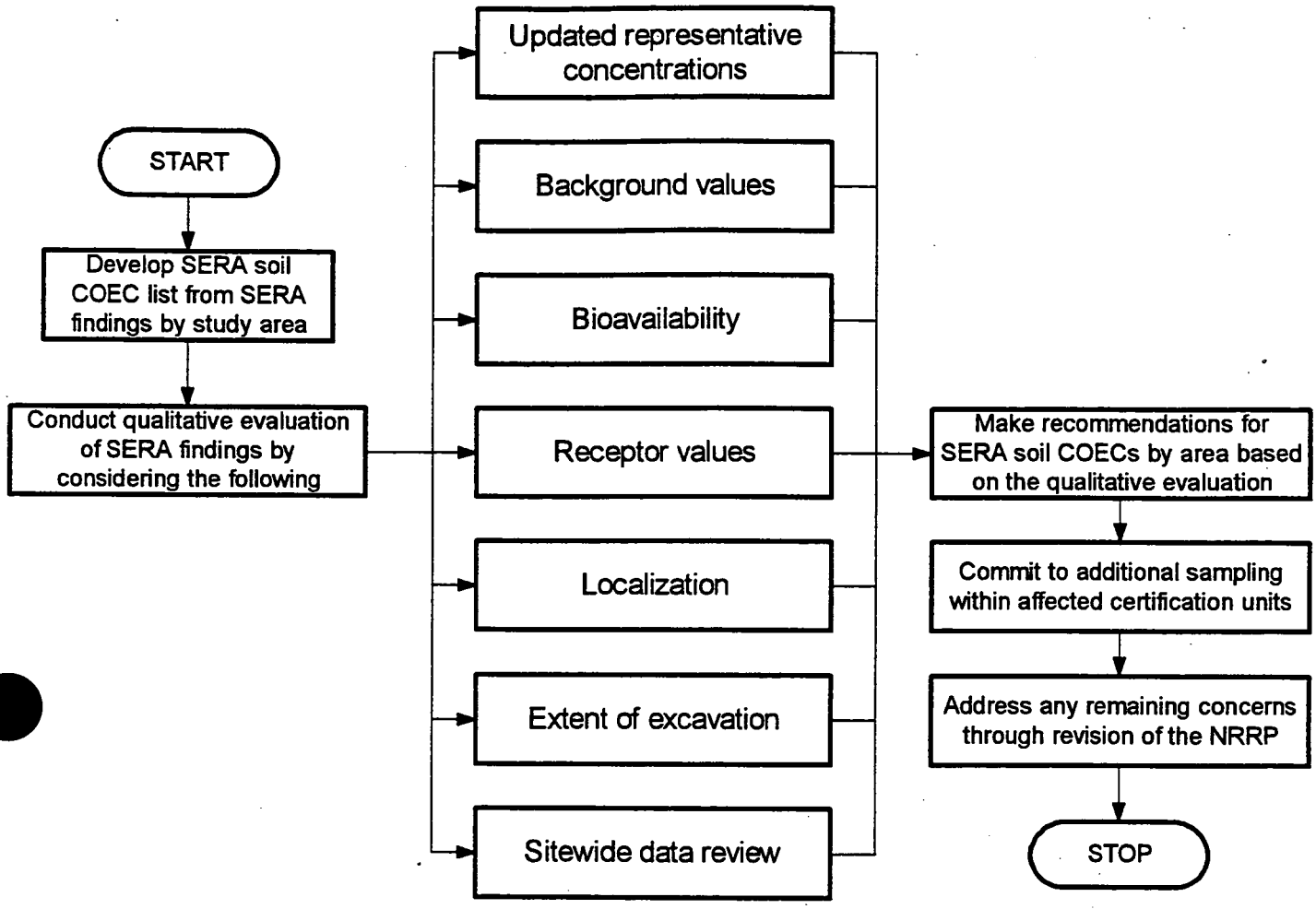



**FIGURE C-3 PERIMETER AREA SOIL EVALUATION OF SERA OU5 RI FINDINGS**

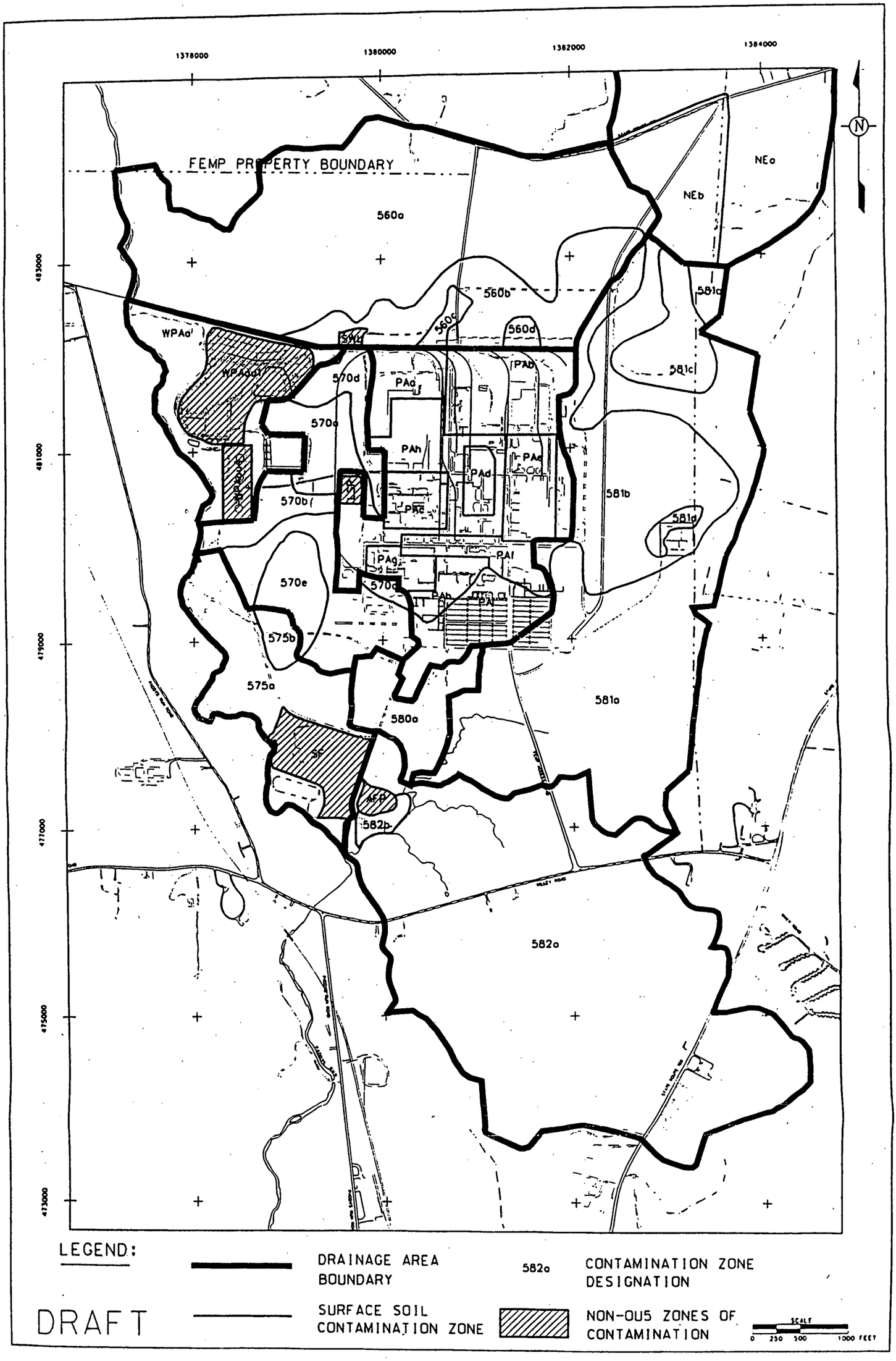



**FIGURE C-4. REMNANT SOIL CONTAMINATION ZONES FOR USE IN SURFACE WATER AND SEDIMENT MODELING**

000529

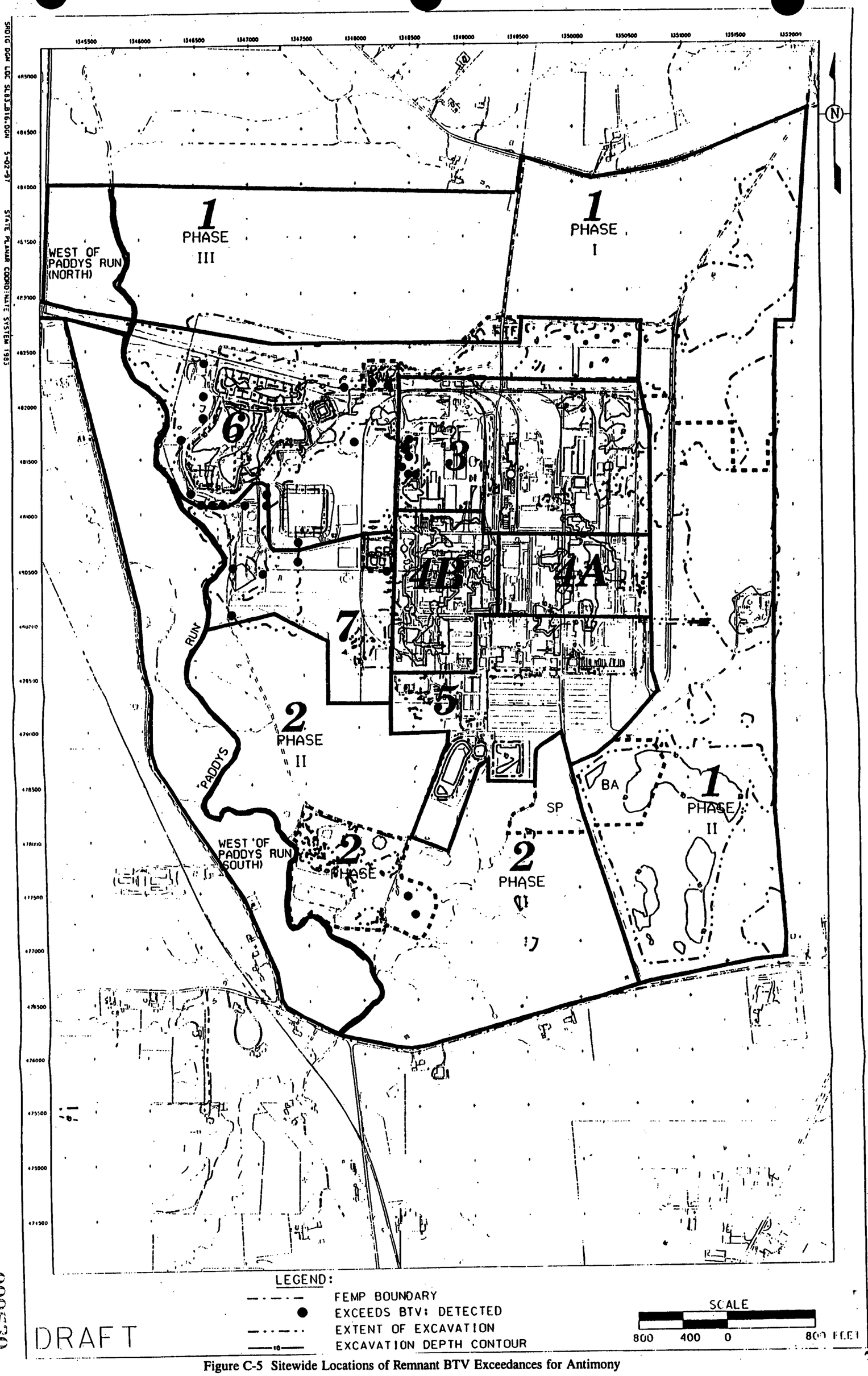



Figure C-5 Sitewide Locations of Remnant BTV Exceedances for Antimony

000530

995

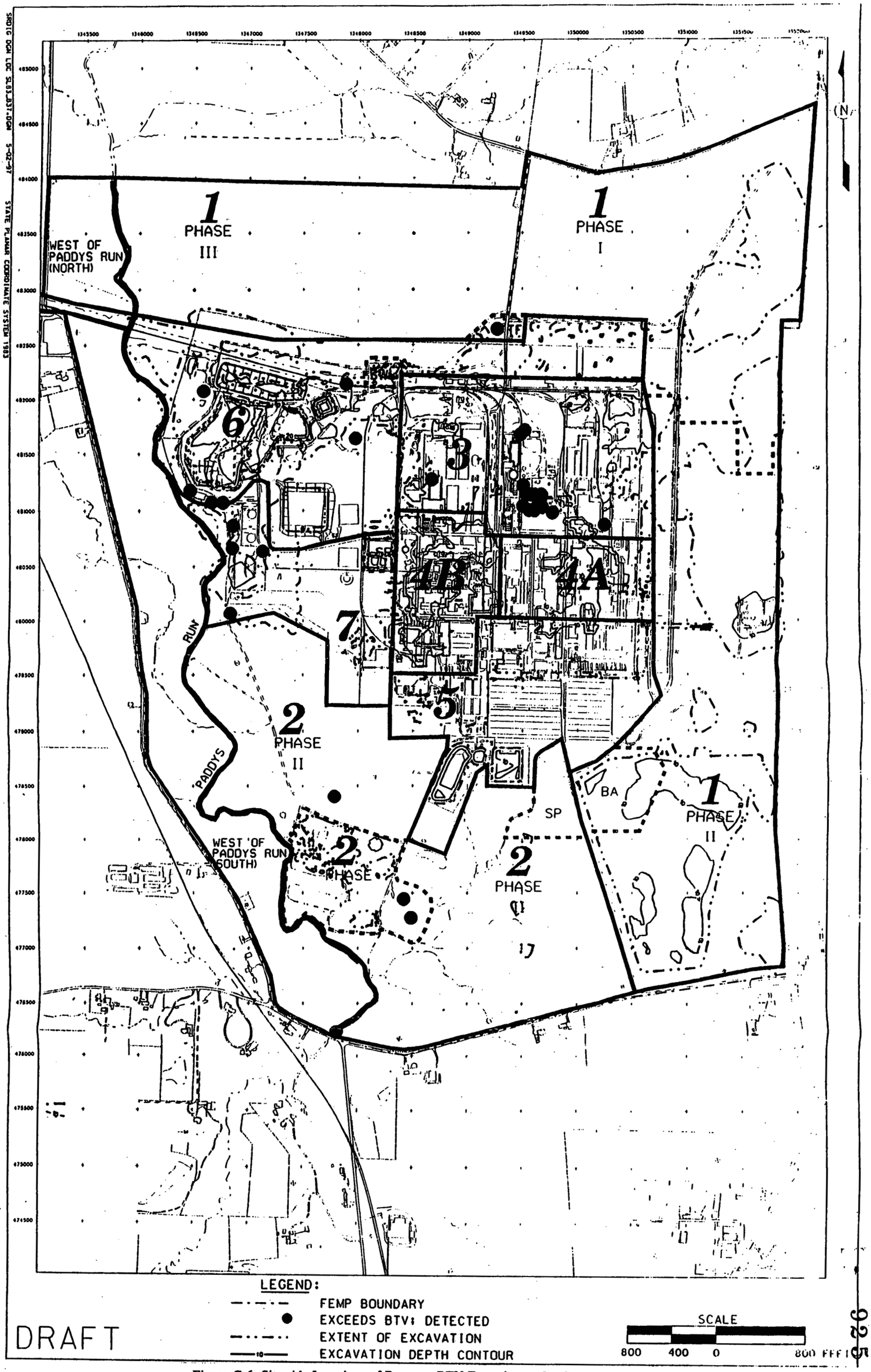



Figure C-6 Sitewide Locations of Remnant BTV Exceedances for Cadmium

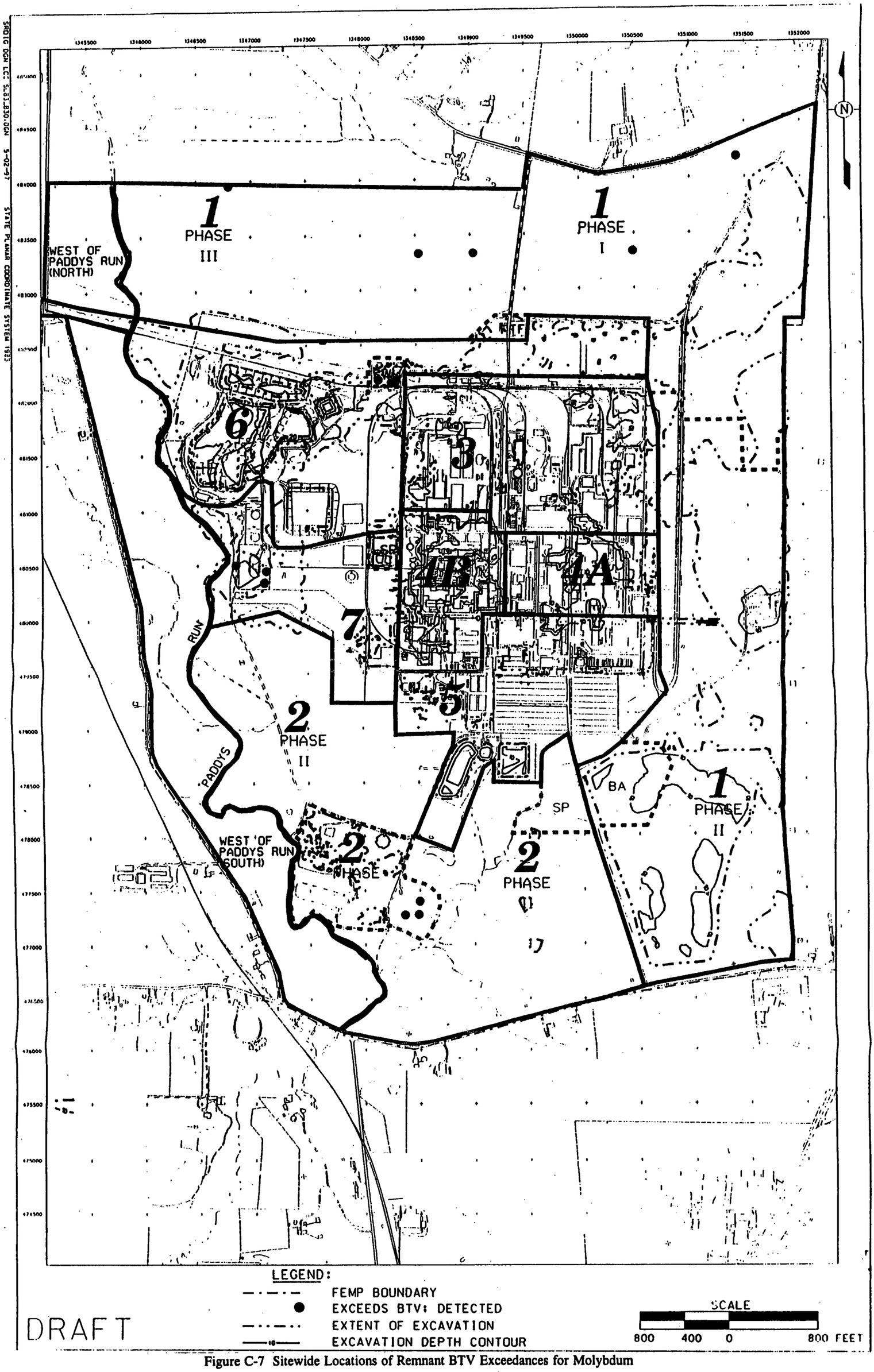



Figure C-7 Sitewide Locations of Remnant BTV Exceedances for Molybdum

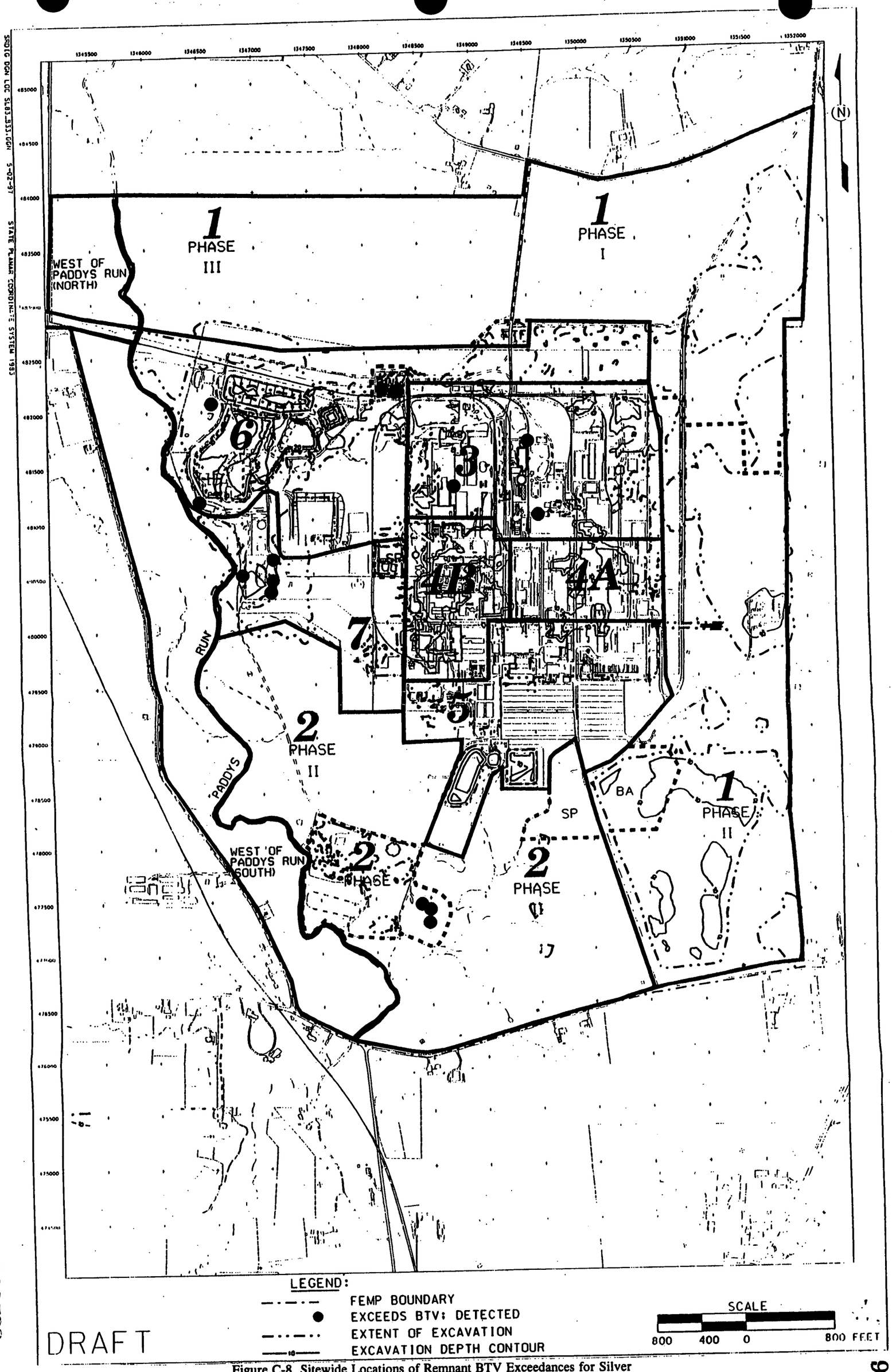



Figure C-8 Sitewide Locations of Remnant BTV Exceedances for Silver

# ADDENDUM A TO APPENDIX C

## COMPARISON OF REPRESENTATIVE CONCENTRATION DATA FROM THE SERA AND NRRP

# ADDENDUM A TO APPENDIX C

## COMPARISON OF REPRESENTATIVE CONCENTRATION DATA FROM THE SERA AND NRRP

This addendum provides a point by point comparison of the data sets used to select COECs in the SERA and in Appendix C of this document. The information is presented in Tables C.A-1 through C.A-32, And Figures C.A-1 through C.A-7 depict the locations where the surface soil samples were taken. The tables are organized alphabetically by SERA COC in each study area.

### SERA Data Set

Some assumptions had to be made to perform this analysis. The SERA report did not list all the sample locations included in its investigation. Information about the total number of samples and the percentage of detections in each SERA study area were used to deduce which samples were originally assigned to each area. For Study Areas A through D, the reconstruction appears fairly complete. However, for Study Areas E and G, sample points for the SERA representative concentrations could not be determined. Based on the total number of samples used in the SERA, it appears that data from samples taken within source areas were included in its analyses.[1]

### Revised SERA Data Set

The revised analysis presented in this report is based on an updated data set. All available surface soil (0-6 inches deep) data were obtained for each SERA COEC within each study area, excluding all source areas (Southern Waste Units, Sewage Treatment Plant, etc.). Data from locations that were previously remediated were removed from the data set and replaced with verification sample concentrations. Also, post-RI data were used if available and are noted in each table.

[1] The undocumented use of source area data in the SERA was confirmed during a review of SERA representative concentrations. It appears samples taken within the Inactive Flyash Pile and the Sewage Treatment Plant (STP) boundaries were used to develop the representative concentrations for several COECs.

**Representative Concentrations**

Once the individual data points had been compiled, representative concentrations were calculated for seven separate study areas. The statistical procedures used to for determine these representative concentrations are described in Sections C.2 and C.3. The remainder of this addendum presents the results of this data compilation and statistical analysis.

# TABLE C.A-1
## DETERMINATION OF SERA AND UPDATED REPRESENTATIVE CONCENTRATIONS FOR SURFACE SOIL IN STUDY AREA A - CADMIUM

| Sample Location | Concentration (mg/kg) | | Used in the SERA? | Used in the Update? | Comments |
|---|---|---|---|---|---|
| 1508 | 1.20 | uj | yes | no | Removed by R.A. No. 28 in 1994 |
| 1508 | 1.10 | u | yes | no | Removed by R.A. No. 28 in 1994 |
| 1668 | 4.60 | j | yes | no | Removed by R.A. No. 28 in 1994 |
| 1669 | 4.10 | j | yes | no | Removed by R.A. No. 28 in 1994 |
| 1670 | 5.20 | j | yes | no | Removed by R.A. No. 28 in 1994 |
| 1671 | 5.40 | j | yes | no | Removed by R.A. No. 28 in 1994 |
| 1672 | 7.80 | j | yes | no | Removed by R.A. No. 28 in 1994 |
| 1673 | 5.90 | j | yes | no | Removed by R.A. No. 28 in 1994 |
| 1679 | 1.70 | | yes | yes | |
| 1729 | 0.53 | u | yes | yes | |
| 1730 | 0.51 | u | yes | yes | |
| 1732 | 0.49 | u | yes | yes | |
| 1734 | 0.51 | | yes | yes | |
| 1735 | 0.54 | u | yes | yes | |
| 2728 | 0.51 | u | yes | yes | |
| 500318/SS-01 | 1.60 | | yes | yes | |
| 500318/SS-02 | 1.40 | u | yes | yes | |
| 500318/SS-16 | 1.90 | | yes | yes | |
| 500318/SS-17 | 1.40 | u | yes | yes | |
| 500318/SS-18 | 1.30 | u | yes | yes | |
| 500318/SS-19 | 1.40 | | yes | yes | |
| 500318/SS-20 | 1.30 | u | yes | yes | |
| 500318/SS-21 | 1.30 | u | yes | yes | |
| 500318/SS-22 | 1.30 | u | yes | yes | |
| 11367 | 0.14 | u | no | yes | Sample collected July, 1994 |
| 044703-034 | 0.46 | u | no | yes | R.A. No. 28 verification samples |
| 044703-035 | 0.46 | u | no | yes | R.A. No. 28 verification samples |
| 044703-036 | 0.48 | u | no | yes | R.A. No. 28 verification samples |
| 044703-038 | 0.48 | u | no | yes | R.A. No. 28 verification samples |
| 044703-039 | 0.48 | u | no | yes | R.A. No. 28 verification samples |
| 044703-040 | 0.47 | u | no | yes | R.A. No. 28 verification samples |
| 044703-042 | 0.48 | u | no | yes | R.A. No. 28 verification samples |
| 044703-044 | 0.49 | u | no | yes | R.A. No. 28 verification samples |
| 044703-045 | 0.54 | u | no | yes | R.A. No. 28 verification samples |
| Representative Conc. | | | 5.90 | 1.40 | |

j=estimated value

## TABLE C.A-2
## DETERMINATION OF SERA AND UPDATED REPRESENTATIVE CONCENTRATIONS FOR SURFACE SOIL IN STUDY AREA A - MOLYBDENUM

| Sample Location | Concentration (mg/kg) | | Used in the SERA? | Used in the Update? | Comments |
|---|---|---|---|---|---|
| 1668 | 2.50 | j | yes | no | Removed by R.A. No. 28 in 1994 |
| 1669 | 2.30 | uj | yes | no | Removed by R.A. No. 28 in 1994 |
| 1670 | 2.20 | j | yes | no | Removed by R.A. No. 28 in 1994 |
| 1671 | 2.40 | uj | yes | no | Removed by R.A. No. 28 in 1994 |
| 1672 | 3.10 | uj | yes | no | Removed by R.A. No. 28 in 1994 |
| 1673 | 2.40 | j | yes | no | Removed by R.A. No. 28 in 1994 |
| 1679 | 11.70 | | yes | yes | |
| 1729 | 6.90 | | yes | yes | |
| 1730 | 8.80 | | yes | yes | |
| 1732 | 8.90 | | yes | yes | |
| 1734 | 10.80 | | yes | yes | |
| 1735 | 13.30 | | yes | yes | |
| 2728 | 2.60 | u | yes | yes | |
| 500318/SS-01 | 4.20 | u | yes | yes | |
| 500318/SS-02 | 4.70 | u | yes | yes | |
| 500318/SS-16 | 4.70 | u | yes | yes | |
| 500318/SS-17 | 4.80 | u | yes | yes | |
| 500318/SS-18 | 4.60 | u | yes | yes | |
| 500318/SS-19 | 4.20 | u | yes | yes | |
| 500318/SS-20 | 4.50 | u | yes | yes | |
| 500318/SS-21 | 4.30 | u | yes | yes | |
| 500318/SS-22 | 4.50 | u | yes | yes | |
| 11367 | 1.1 | j | no | yes | Sample collected July, 1994 |
| 1736 | 7.20 | | yes | no | Inferred: located outside of Area A, but SERA cited 10 of 24 detections (42%) |
| Representative Conc. | | | 11.70 | 8.80 | |

# TABLE C.A-3
## DETERMINATION OF SERA AND UPDATED REPRESENTATIVE CONCENTRATIONS FOR SURFACE SOIL IN STUDY AREA A - ZINC

| Sample Location | Concentration (mg/kg) | | Used in the SERA? | Used in the Update? | Comments |
|---|---|---|---|---|---|
| 1508 | 72.7 | j | yes | no | Inferred: SERA indicated 24 detections |
| 1668 | 84.1 | | yes | no | Removed by R.A. No. 28 in 1994 |
| 1669 | 81.9 | | yes | no | Removed by R.A. No. 28 in 1994 |
| 1670 | 173.0 | | yes | no | Removed by R.A. No. 28 in 1994 |
| 1671 | 707.0 | | yes | no | Removed by R.A. No. 28 in 1994 |
| 1672 | 2150.0 | | yes | no | Removed by R.A. No. 28 in 1994 |
| 1673 | 351.0 | | yes | no | Removed by R.A. No. 28 in 1994 |
| 1679 | 47.4 | | yes | yes | |
| 1729 | 28.5 | | yes | yes | |
| 1730 | 54.2 | | yes | yes | |
| 1732 | 37.1 | | yes | yes | |
| 1734 | 40.8 | | yes | yes | |
| 1735 | 61.8 | | yes | yes | |
| 2728 | 38.4 | | yes | yes | |
| 500318/SS-01 | 62.1 | | yes | yes | |
| 500318/SS-02 | 80.4 | | yes | yes | |
| 500318/SS-16 | 137.0 | | yes | yes | |
| 500318/SS-17 | 76.8 | | yes | yes | |
| 500318/SS-18 | 66.7 | | yes | yes | |
| 500318/SS-19 | 39.8 | | yes | yes | |
| 500318/SS-20 | 51.6 | | yes | yes | |
| 500318/SS-21 | 52.7 | | yes | yes | |
| 500318/SS-22 | 62.5 | | yes | yes | |
| 1736 | 30.7 | | yes | no | Inferred: SERA indicated 24 detections |
| 11367 | 47.7 | j | no | yes | Sample collected July, 1994 |
| 044703-034 | 48.6 | | no | yes | R.A. No. 28 verification samples |
| 044703-035 | 51.6 | | no | yes | R.A. No. 28 verification samples |
| 044703-036 | 59.1 | | no | yes | R.A. No. 28 verification samples |
| 044703-038 | 64.2 | | no | yes | R.A. No. 28 verification samples |
| 044703-039 | 65.6 | | no | yes | R.A. No. 28 verification samples |
| 044703-040 | 53.3 | | no | yes | R.A. No. 28 verification samples |
| 044703-042 | 65.9 | | no | yes | R.A. No. 28 verification samples |
| 044703-044 | 65.4 | | no | yes | R.A. No. 28 verification samples |
| 044703-045 | 76.2 | | no | yes | R.A. No. 28 verification samples |
| Representative Conc. | | | 707 | 66.0 | |

## TABLE C.A-4
## DETERMINATION OF SERA AND UPDATED REPRESENTATIVE CONCENTRATIONS FOR SURFACE SOIL IN STUDY AREA A - BENZO(A)ANTHRACENE

| Sample Location | Concentration (mg/kg) | | Used in the SERA? | Used in the Update? | Comments |
|---|---|---|---|---|---|
| 1508 | 1.700 | u | yes | no | Removed by R.A. No. 28 in 1994 |
| 1668 | 0.160 | j | yes | no | Removed by R.A. No. 28 in 1994 |
| 1669 | 3.900 | u | yes | no | Removed by R.A. No. 28 in 1994 |
| 1670 | 0.370 | u | yes | no | Removed by R.A. No. 28 in 1994 |
| 1671 | 4.200 | u | yes | no | Removed by R.A. No. 28 in 1994 |
| 1672 | 2.700 | j | yes | no | Removed by R.A. No. 28 in 1994 |
| 1673 | 4.100 | u | yes | no | Removed by R.A. No. 28 in 1994 |
| 1679 | 0.430 | u | yes | yes | |
| 1729 | 0.450 | u | yes | yes | |
| 1730 | 0.430 | u | yes | yes | |
| 1732 | 0.410 | u | yes | yes | |
| 1734 | 0.430 | u | yes | yes | |
| 1735 | 0.450 | u | yes | yes | |
| 2728 | 0.430 | u | yes | yes | |
| 500318/SS-16 | 0.460 | u | yes | yes | |
| 500318/SS-17 | 0.470 | u | yes | yes | |
| 500318/SS-18 | 0.450 | u | yes | yes | |
| 500318/SS-19 | 0.410 | u | yes | yes | |
| 500318/SS-20 | 0.048 | j | yes | yes | |
| 500318/SS-21 | 0.420 | uj | yes | yes | |
| 500318/SS-22 | 0.440 | u | yes | yes | |
| 044703-040 | 0.075 | j | | yes | R.A. No. 28 verification samples |
| 044703-042 | 0.400 | u | | yes | R.A. No. 28 verification samples |
| Representative Conc. | | | 2.10 | 0.450u | |

# TABLE C.A-5
## DETERMINATION OF SERA AND UPDATED REPRESENTATIVE CONCENTRATIONS FOR SURFACE SOIL IN STUDY AREA A - BENZO(A)PYRENE

| Sample Location | Concentration (mg/kg) | | Used in the SERA? | Used in the Update? | Comments |
|---|---|---|---|---|---|
| 1508 | 1.700 | u | yes | no | Estimated use in SERA |
| 1668 | 0.370 | u | yes | no | Removed by R.A. No. 28 in 1994 |
| 1669 | 3.900 | u | yes | no | Removed by R.A. No. 28 in 1994 |
| 1670 | 0.370 | u | yes | no | Removed by R.A. No. 28 in 1994 |
| 1671 | 4.200 | u | yes | no | Removed by R.A. No. 28 in 1994 |
| 1672 | 1.600 | j | yes | no | Removed by R.A. No. 28 in 1994 |
| 1673 | 4.100 | u | yes | no | Removed by R.A. No. 28 in 1994 |
| 1679 | 0.430 | u | yes | yes | |
| 1729 | 0.450 | u | yes | yes | |
| 1730 | 0.430 | u | yes | yes | |
| 1732 | 0.410 | u | yes | yes | |
| 1734 | 0.430 | u | yes | yes | |
| 1735 | 0.450 | u | yes | yes | |
| 2728 | 0.430 | u | yes | yes | |
| 500318/SS-16 | 0.460 | u | yes | yes | |
| 500318/SS-17 | 0.470 | u | yes | yes | |
| 500318/SS-18 | 0.450 | u | yes | yes | |
| 500318/SS-19 | 0.410 | u | yes | yes | |
| 500318/SS-20 | 0.440 | u | yes | yes | |
| 500318/SS-21 | 0.420 | uj | yes | yes | |
| 500318/SS-22 | 0.440 | u | yes | yes | |
| 044703-040 | 0.077 | j | no | yes | R.A. No. 28 verification samples |
| 044703-042 | 0.400 | u | no | yes | R.A. No. 28 verification samples |
| Representative Conc. | | | 1.60 | 0.450u | |

## TABLE C.A-6
## DETERMINATION OF SERA AND UPDATED REPRESENTATIVE CONCENTRATIONS FOR SURFACE SOIL IN STUDY AREA A - BENZO(B)FLUORANTHENE

| Sample Location | Concentration (mg/kg) | | Used in the SERA? | Used in the Update? | Comments |
|---|---|---|---|---|---|
| 1508 | 1.700 | u | yes | no | estimated use in SERA |
| 1668 | 0.370 | u | yes | no | Removed by R.A. No. 28 in 1994 |
| 1669 | 3.900 | u | yes | no | Removed by R.A. No. 28 in 1994 |
| 1670 | 0.370 | u | yes | no | Removed by R.A. No. 28 in 1994 |
| 1671 | 4.200 | u | yes | no | Removed by R.A. No. 28 in 1994 |
| 1672 | 7.700 | | yes | no | Removed by R.A. No. 28 in 1994 |
| 1673 | 4.100 | u | yes | no | Removed by R.A. No. 28 in 1994 |
| 1679 | 0.430 | u | yes | yes | |
| 1729 | 0.450 | u | yes | yes | |
| 1730 | 0.430 | u | yes | yes | |
| 1732 | 0.410 | u | yes | yes | |
| 1734 | 0.430 | u | yes | yes | |
| 1735 | 0.450 | u | yes | yes | |
| 2728 | 0.430 | u | yes | yes | |
| 500318/SS-16 | 0.460 | u | yes | yes | |
| 500318/SS-17 | 0.470 | u | yes | yes | |
| 500318/SS-18 | 0.450 | u | yes | yes | |
| 500318/SS-19 | 0.410 | u | yes | yes | |
| 500318/SS-20 | 0.056 | j | yes | yes | |
| 500318/SS-21 | 0.420 | uj | yes | yes | |
| 500318/SS-22 | 0.440 | u | yes | yes | |
| 044703-040 | 0.120 | j | no | yes | R.A. No. 28 verification samples |
| 044703-042 | 0.400 | u | no | yes | R.A. No. 28 verification samples |
| Representative Conc. | | | 2.10 | 0.450u | |

# TABLE C.A-7
## DETERMINATION OF SERA AND UPDATED REPRESENTATIVE CONCENTRATIONS FOR SURFACE SOIL IN STUDY AREA A - CHRYSENE

| Sample Location | Concentration (mg/kg) | | Used in the SERA? | Used in the Update? | Comments |
|---|---|---|---|---|---|
| 1508 | | | | no | estimated use in SERA |
| 1668 | | | | no | Removed by R.A. No. 28 in 1994 |
| 1669 | | | | no | Removed by R.A. No. 28 in 1994 |
| 1670 | | | | no | Removed by R.A. No. 28 in 1994 |
| 1671 | | | | no | Removed by R.A. No. 28 in 1994 |
| 1672 | | | | no | Removed by R.A. No. 28 in 1994 |
| 1673 | | | | no | Removed by R.A. No. 28 in 1994 |
| 1679 | 0.430 | u | | yes | |
| 1729 | 0.450 | u | | yes | |
| 1730 | 0.430 | u | | yes | |
| 1732 | 0.410 | u | | yes | |
| 1734 | 0.430 | u | | yes | |
| 1735 | 0.450 | u | | yes | |
| 2728 | 0.430 | u | | yes | |
| 500318/SS-16 | 0.460 | u | | yes | |
| 500318/SS-17 | 0.470 | u | | yes | |
| 500318/SS-18 | 0.450 | u | | yes | |
| 500318/SS-19 | 0.410 | u | | yes | |
| 500318/SS-20 | 0.077 | j | | yes | |
| 500318/SS-21 | 0.420 | uj | | yes | |
| 500318/SS-22 | 0.440 | u | | yes | |
| 044703-040 | 0.082 | j | | yes | R.A. No. 28 verification samples |
| 044703-042 | 0.400 | u | | yes | R.A. No. 28 verification samples |
| Representative Conc. | | | 2.10 | 0.450u | |

## TABLE C.A-8
## DETERMINATION OF SERA AND UPDATED REPRESENTATIVE CONCENTRATIONS FOR SURFACE SOIL IN STUDY AREA B - ALUMINUM

| Sample Location | Concentration (mg/kg) | | Used in the SERA? | Used in the Update? | Comments |
|---|---|---|---|---|---|
| 1736 | 6580 | | yes | yes | |
| 1737 | 12700 | | yes | yes | |
| 1738 | 5850 | nv | yes | yes | |
| 2731 | 10400 | | yes | yes | |
| 500318/SS-03 | 11500 | J | yes | yes | |
| 500318/SS-04 | 8790 | | yes | yes | |
| 500318/SS-05 | 9670 | | yes | yes | |
| 500318/SS-06 | 1300 | J | yes | yes | |
| 500318/SS-07 | 9350 | | yes | yes | |
| 500318/SS-08 | 12300 | | yes | yes | |
| 11378 | 13300 | j | no | yes | Sample collected July, 1994 |
| 11379 | 18500 | | no | yes | Sample collected July, 1994 |
| Representative Conc. | | | 10700 | 12461 | |

## TABLE C.A-9
## DETERMINATION OF SERA AND UPDATED REPRESENTATIVE CONCENTRATIONS FOR SURFACE SOIL IN STUDY AREA B - MANGANESE

| Sample Location | Concentration (mg/kg) | | Used in the SERA? | Used in the Update? | Comments |
|---|---|---|---|---|---|
| 1736 | 648.0 | | yes | yes | |
| 1737 | 1110.0 | | yes | yes | |
| 1738 | 591.0 | | yes | yes | |
| 2731 | 1170.0 | | yes | yes | |
| 500318/SS-03 | 1140.0 | r | no | no | Rejected data |
| 500318/SS-04 | 1480.0 | j | yes | yes | |
| 500318/SS-05 | 430.0 | j | yes | yes | |
| 500318/SS-06 | 223.0 | r | no | no | Rejected data |
| 500318/SS-07 | 641.0 | j | yes | yes | |
| 500318/SS-08 | 838.0 | j | yes | yes | |
| 11378 | 1470.0 | | no | yes | Sample collected July, 1994 |
| 11379 | 441.0 | j | no | yes | Sample collected July, 1994 |
| Representative Conc. | | | 1530 | 1248 | |

## TABLE C.A-10
## DETERMINATION OF SERA AND UPDATED REPRESENTATIVE CONCENTRATIONS FOR SURFACE SOIL IN STUDY AREA B - MOLYBDENUM

| Sample Location | Concentration (mg/kg) | | Used in the SERA? | Used in the Update? | Comments |
|---|---|---|---|---|---|
| 1736 | 7.2 | | yes | yes | |
| 1737 | 12.4 | | yes | yes | |
| 1738 | 6.6 | | yes | yes | |
| 2731 | 11.3 | | yes | yes | |
| 500318/SS-03 | 4.3 | u | yes | yes | |
| 500318/SS-04 | 4.4 | u | yes | yes | |
| 500318/SS-05 | 4.7 | u | yes | yes | |
| 500318/SS-06 | 3.6 | u | yes | yes | |
| 500318/SS-07 | 4.0 | u | yes | yes | |
| 500318/SS-08 | 4.6 | u | yes | yes | |
| 11378 | 1.1 | j | no | yes | Sample collected July, 1994 |
| 11379 | 0.31 | uj | no | yes | Sample collected July, 1994 |
| Representative Conc. | | | 12.4 | 7.2 | |

## TABLE C.A-11
## DETERMINATION OF SERA AND UPDATED REPRESENTATIVE CONCENTRATIONS FOR SURFACE SOIL IN STUDY AREA C - ALUMINUM

| Sample Location | Concentration (mg/kg) | Used in the SERA? | Used in the Update? | Comments |
|---|---|---|---|---|
| 1739 | 7280 | yes | yes | |
| 1740 | 7090 | yes | yes | |
| 1741 | 7380 | yes | yes | |
| 1742 | 6280 | yes | yes | |
| 500318/SS-10 | 9180 | yes | yes | |
| 500318/SS-48 | 10100 | yes | yes | |
| 500318/SS-49 | 11600 | yes | yes | |
| 500318/SS-51 | 8680 | yes | yes | |
| 500318/SS-53 | 7440 | yes | yes | |
| 500318/SS-54 | 7370 | yes | yes | |
| 500318/SS-55 | 7420 | yes | yes | |
| ASI-08 (103683) | 15400 | yes | yes | |
| ASI-08 (103677) | 10900 | yes | yes | |
| ASI-08 (103680) | 15400 | yes | yes | |
| ASI-13 | 18100 | yes | no | Located in the STP area |
| ASI-19 | 25700 | yes | no | Located in the STP area |
| 11376 (200128) | 11500 | no | yes | Sample collected July, 1994 |
| 11377 (200142) | 15600 | no | yes | Sample collected July, 1994 |
| 11377 (200074428) | 15100 | no | yes | Sample collected July, 1994 |
| Representative Conc. | | 25700 | 11812 | |

# TABLE C.A-12
## DETERMINATION OF SERA AND UPDATED REPRESENTATIVE CONCENTRATIONS FOR SURFACE SOIL IN STUDY AREA C - ANTIMONY

| Sample Location | Concentration (mg/kg) | | Used in the SERA? | Used in the Update? | Comments |
|---|---|---|---|---|---|
| 1739 | 7.4 | uj | yes | yes | |
| 1740 | 7.2 | uj | yes | yes | |
| 1741 | 7.5 | uj | yes | yes | |
| 1742 | 7.5 | r | no | no | Rejected data |
| 500318/SS-10 | 2.8 | j | yes | yes | |
| 500318/SS-48 | 2.9 | j | yes | yes | |
| 500318/SS-49 | 2.9 | uj | yes | yes | |
| 500318/SS-51 | 2.7 | uj | yes | yes | |
| 500318/SS-53 | 3.7 | j | yes | yes | |
| 500318/SS-54 | 2.5 | uj | yes | yes | |
| 500318/SS-55 | 3.5 | uj | yes | yes | |
| ASI-08 (103683) | 15.2 | uj | yes | yes | |
| ASI-08 (103677) | 19.3 | uj | yes | yes | |
| ASI-08 (103680) | 21.5 | j | yes | yes | |
| ASI-19 | 14.2 | uj | yes | no | Located in the STP area |
| 11376 (200128) | 0.55 | r | no | no | Rejected data |
| 11377 (200142) | 0.53 | r | no | no | Rejected data |
| 11377 (200074428) | 0.53 | r | no | no | Rejected data |
| Representative Conc. | | | 21.5 | 15.2u | |

## TABLE C.A-13
## DETERMINATION OF SERA AND UPDATED REPRESENTATIVE CONCENTRATIONS FOR SURFACE SOIL IN STUDY AREA C - LEAD

| Sample Location | Concentration (mg/kg) | | Used in the SERA? | Used in the Update? | Comments |
|---|---|---|---|---|---|
| 1739 | 13.3 | | yes | yes | |
| 1740 | 15.0 | | yes | yes | |
| 1741 | 18.3 | | yes | yes | |
| 1742 | 23.5 | | yes | yes | |
| 500318/SS-10 | 24.7 | | yes | yes | |
| 500318/SS-48 | 29.9 | | yes | yes | |
| 500318/SS-49 | 32.0 | | yes | yes | |
| 500318/SS-51 | 16.8 | | yes | yes | |
| 500318/SS-53 | 27.4 | | yes | yes | |
| 500318/SS-54 | 23.8 | | yes | yes | |
| 500318/SS-55 | 19.2 | j | yes | yes | |
| ASI-08 (103683) | 137.0 | | yes | yes | |
| ASI-08 (103677) | 87.7 | | yes | yes | |
| ASI-08 (103680) | 101.0 | | yes | yes | |
| ASI-13 | 570.0 | | yes | no | Located in the STP area |
| 11376 (200128) | 22.8 | j | no | yes | Sample collected July, 1994 |
| 11377 (200142) | 22.2 | j | no | yes | Sample collected July, 1994 |
| 11377 (200074428) | 23.4 | j | no | yes | Sample collected July, 1994 |
| Representative Conc. | | | 570.0 | 52.3 | |

# TABLE C.A-14
## DETERMINATION OF SERA AND UPDATED REPRESENTATIVE CONCENTRATIONS FOR SURFACE SOIL IN STUDY AREA C - MANGANESE

| Sample Location | Concentration (mg/kg) | | Used in the SERA? | Used in the Update? | Comments |
|---|---|---|---|---|---|
| 1739 | 506 | | yes | yes | |
| 1740 | 902 | | yes | yes | |
| 1741 | 369 | j | yes | yes | |
| 1742 | 712 | j | yes | yes | |
| 500318/SS-10 | 1210 | j | yes | yes | |
| 500318/SS-48 | 2040 | j | yes | yes | |
| 500318/SS-49 | 420 | j | yes | yes | |
| 500318/SS-51 | 802 | j | yes | yes | |
| 500318/SS-53 | 709 | j | yes | yes | |
| 500318/SS-54 | 4400 | j | yes | yes | |
| 500318/SS-55 | 531 | | yes | yes | |
| ASI-08 (103683) | 1060 | j | yes | yes | |
| ASI-08 (103677) | 369 | j | yes | yes | |
| ASI-08 (103680) | 558 | j | yes | yes | |
| ASI-13 | 913 | j | yes | no | Located in the STP area |
| 11376 (200128) | 416 | j | no | yes | Sample collected July, 1994 |
| 11377 (200142) | 510 | j | no | yes | Sample collected July, 1994 |
| 11377 (200074428) | 530 | j | no | yes | Sample collected July, 1994 |
| Representative Conc. | | | 2100 | 1284 | |

## TABLE C.A-15
## DETERMINATION OF SERA AND UPDATED REPRESENTATIVE CONCENTRATIONS FOR SURFACE SOIL IN STUDY AREA C - BENZO(B)FLUORANTHENE

| Sample Location | Concentration (mg/kg) | | Used in the SERA? | Used in the Update? | Comments |
|---|---|---|---|---|---|
| 1740 | 0.410 | u | yes | yes | |
| 1741 | 0.420 | u | yes | yes | |
| 1742 | 0.420 | u | yes | yes | |
| 500318/SS-10 | 0.390 | u | yes | yes | |
| 500318/SS-48 | 0.420 | u | yes | yes | |
| 500318/SS-49 | 0.450 | u | yes | yes | |
| 500318/SS-51 | 0.400 | u | yes | yes | |
| 500318/SS-53 | 0.440 | u | yes | yes | |
| 500318/SS-54 | 0.380 | uj | yes | yes | |
| 500318/SS-55 | 0.420 | u | yes | yes | |
| ASI-08 (103683) | 1.800 | | yes | yes | Unval. samples=0.130 & 0.430 mg/kg |
| ASI-08 (103677) | 0.110 | j | yes | yes | |
| ASI-19 | 0.400 | u | yes | no | Located in the STP area |
| Representative Conc. | | | 1.80 | 0.440u | |

## TABLE C.A-16
## DETERMINATION OF SERA AND UPDATED REPRESENTATIVE CONCENTRATIONS FOR SURFACE SOIL IN STUDY AREA C - BENZO(G,H,I)PERYLENE

| Sample Location | Concentration (mg/kg) | | Used in the SERA? | Used in the Update? | Comments |
|---|---|---|---|---|---|
| 1740 | 0.410 | u | yes | yes | |
| 1741 | 0.420 | u | yes | yes | |
| 1742 | 0.420 | u | yes | yes | |
| 500318/SS-10 | 0.390 | u | yes | yes | |
| 500318/SS-48 | 0.420 | u | yes | yes | |
| 500318/SS-49 | 0.450 | u | yes | yes | |
| 500318/SS-51 | 0.400 | u | yes | yes | |
| 500318/SS-53 | 0.440 | u | yes | yes | |
| 500318/SS-54 | 0.380 | uj | yes | yes | |
| 500318/SS-55 | 0.420 | u | yes | yes | |
| ASI-08 (103683) | 1.100 | | yes | yes | Unval. samples=0.110 & 0.390 mg/kg |
| ASI-08 (103677) | 0.560 | u | yes | yes | |
| ASI-08 (103680) | 0.460 | u | yes | yes | |
| ASI-19 | 0.400 | u | yes | no | Located in the STP area |
| Representative Conc. | | | 1.10 | 0.460u | |

## TABLE C.A-17
## DETERMINATION OF SERA AND UPDATED REPRESENTATIVE CONCENTRATIONS FOR SURFACE SOIL IN STUDY AREA C - INDENO(1,2,3-CD)PYRENE

| Sample Location | Concentration (mg/kg) | | Used in the SERA? | Used in the Update? | Comments |
|---|---|---|---|---|---|
| 1740 | 0.410 | u | yes | yes | |
| 1741 | 0.420 | u | yes | yes | |
| 1742 | 0.420 | u | yes | yes | |
| 500318/SS-10 | 0.390 | u | yes | yes | |
| 500318/SS-48 | 0.420 | u | yes | yes | |
| 500318/SS-49 | 0.450 | u | yes | yes | |
| 500318/SS-51 | 0.400 | u | yes | yes | |
| 500318/SS-53 | 0.440 | u | yes | yes | |
| 500318/SS-54 | 0.380 | uj | yes | yes | |
| 500318/SS-55 | 0.420 | u | yes | yes | |
| ASI-08 (103683) | 1.500 | | yes | yes | Unval. samples=0.110 and 0.410 mg/kg |
| ASI-08 (103677) | 0.560 | u | yes | yes | |
| ASI-08 (103680) | 0.460 | u | yes | yes | |
| ASI-19 | 0.400 | u | yes | no | Located in the STP area |
| Representative Conc. | | | 1.50 | 0.460u | |

## TABLE C.A-18
## DETERMINATION OF SERA AND UPDATED REPRESENTATIVE CONCENTRATIONS FOR SURFACE SOIL IN STUDY AREA D - ANTIMONY

| Sample Location | Concentration (mg/kg) | | Used in the SERA? | Used in the Update? | Comments |
|---|---|---|---|---|---|
| 1070 | 7.6 | uj | yes | yes | |
| 1747 | 7.4 | u | yes | yes | |
| 1748 | 7.3992 | nv | no | yes | |
| 2733 | 10.6 | j | yes | yes | Unvalidated results = 7.6 mg/kg |
| trap box west (126500) | 2.6 | uj | no | yes | |
| trap box west (126503) | 2.8 | j | no | yes | |
| trap box east | 2.4 | uj | no | yes | |
| trap box north | 4.1 | j | no | yes | |
| trap box south | 3.8 | j | no | yes | |
| trap building west | 2.3 | uj | no | yes | |
| trap building south | 2.4 | uj | no | yes | |
| trap building east | 2.4 | uj | no | yes | |
| trap building north | 2.5 | uj | no | yes | |
| Representative Conc. | | | 10.6 | 7.4u | |

## TABLE C.A-19
## DETERMINATION OF SERA AND UPDATED REPRESENTATIVE CONCENTRATIONS FOR SURFACE SOIL IN STUDY AREA D - LEAD

| Sample Location | Concentration (mg/kg) | | Used in the SERA? | Used in the Update? | Comments |
|---|---|---|---|---|---|
| 1070 | 13.7 | | yes | yes | |
| 1744 | 18 | | yes | yes | |
| 1745 | 61.5 | | yes | yes | |
| 1746 | 17.8 | | yes | yes | |
| 1747 | 14.6 | | yes | yes | |
| 1748 | 14.4 | | yes | yes | |
| 2733 | 20.8 | | yes | yes | |
| trap box west (126500) | 216.0 | j | no | yes | |
| trap box west (126503) | 205.0 | j | no | yes | |
| trap box east | 142.0 | j | no | yes | |
| trap box north | 541.0 | j | no | yes | |
| trap box south | 693.0 | | yes | yes | |
| trap building west | 17.5 | j | no | yes | |
| trap building south | 117.0 | j | no | yes | |
| trap building east | 52.1 | j | no | yes | |
| trap building north | 91.8 | j | no | yes | |
| 11373 | 26.2 | j | no | yes | Sample collected July, 1994 |
| 11374 | 19.2 | j | no | yes | Sample collected July, 1994 |
| 11375 | 19.7 | j | no | yes | Sample collected July, 1994 |
| TR-7T | 32.0 | | no | yes | |
| TR-9M | 2020.0 | | yes | yes | |
| TR-11J | 1150.0 | | no | yes | |
| TR-12L | 22.5 | | yes | yes | |
| TR-12M | 2160.0 | | yes | yes | |
| TR-12N | 2180.0 | | yes | yes | |
| TR-OP | 22.2 | | yes | yes | |
| Representative Conc. | | | 2180 | 998 | |

## TABLE C.A-20
## DETERMINATION OF SERA AND UPDATED REPRESENTATIVE CONCENTRATIONS FOR SURFACE SOIL IN STUDY AREA E - ALUMINUM

| Sample Location | Concentration (mg/kg) | | Used in the SERA? | Used in the Update? | Comments |
|---|---|---|---|---|---|
| 500318/SS-43 | 8380 | | see note | yes | |
| 500318/SS-44 | 8330 | | see note | yes | |
| 500318/SS-45 | 11600 | j | see note | yes | |
| 500318/SS-46 | 6420 | | see note | yes | |
| 500318/SS-47 | 5610 | | see note | yes | |
| 11372 | 15800 | | see note | yes | Sample collected July, 1994 |
| Representative Conc. | | | 16300 | 14296 | |

## TABLE C.A-21
## DETERMINATION OF SERA AND UPDATED REPRESENTATIVE CONCENTRATIONS FOR SURFACE SOIL IN STUDY AREA E - ANTIMONY

| Sample Location | Concentration (mg/kg) | | Used in the SERA? | Used in the Update? | Comments |
|---|---|---|---|---|---|
| 500318/SS-43 | 3.3 | uj | see note | yes | |
| 500318/SS-44 | 3.2 | uj | see note | yes | |
| 500318/SS-45 | 3.4 | uj | see note | yes | |
| 500318/SS-46 | 3.5 | uj | see note | yes | |
| 500318/SS-47 | 3.5 | uj | see note | yes | |
| Representative Conc. | | | 10.2 | 3.5u | |

## TABLE C.A-22
## DETERMINATION OF SERA AND UPDATED REPRESENTATIVE CONCENTRATIONS FOR SURFACE SOIL IN STUDY AREA E - MOLYBDENUM

| Sample Location | Concentration (mg/kg) | | Used in the SERA? | Used in the Update? | Comments |
|---|---|---|---|---|---|
| 500318/SS-43 | 4.0 | u | see note | yes | |
| 500318/SS-44 | 3.9 | u | see note | yes | |
| 500318/SS-45 | 4.1 | u | see note | yes | |
| 500318/SS-46 | 4.2 | u | see note | yes | |
| 500318/SS-47 | 4.3 | u | see note | yes | |
| 11372 | 0.6 | j | see note | yes | Sample collected July, 1994 |
| Representative Conc. | | | 10.2 | 3.5u | |

## TABLE C.A-23
## DETERMINATION OF SERA AND UPDATED REPRESENTATIVE CONCENTRATIONS FOR SURFACE SOIL IN STUDY AREA E - BENZO(A)PYRENE

| Sample Location | Concentration (mg/kg) | | Used in the SERA? | Used in the Update? | Comments |
|---|---|---|---|---|---|
| 500318/SS-43 | 0.400 | u | see note | yes | |
| 500318/SS-44 | 0.380 | u | see note | yes | |
| 500318/SS-45 | 0.400 | u | see note | yes | |
| 500318/SS-46 | 0.410 | u | see note | yes | |
| 500318/SS-47 | 0.420 | u | see note | yes | |
| Representative Conc. | | | 1.15 | 0.42u | |

## TABLE C.A-24
## DETERMINATION OF SERA AND UPDATED REPRESENTATIVE CONCENTRATIONS FOR SURFACE SOIL IN STUDY AREA E - BENZO(B)FLUORANTHENE

| Sample Location | Concentration (mg/kg) | | Used in the SERA? | Used in the Update? | Comments |
|---|---|---|---|---|---|
| 500318/SS-43 | 0.400 | u | see note | yes | |
| 500318/SS-44 | 0.380 | u | see note | yes | |
| 500318/SS-45 | 0.400 | u | see note | yes | |
| 500318/SS-46 | 0.410 | u | see note | yes | |
| 500318/SS-47 | 0.420 | u | see note | yes | |
| Representative Conc. | | | 3.70 | 0.42u | |

## TABLE C.A-25
## DETERMINATION OF SERA AND UPDATED REPRESENTATIVE CONCENTRATIONS FOR SURFACE SOIL IN STUDY AREA E - BENZO(G,H,I)PERYLENE

| Sample Location | Concentration (mg/kg) | | Used in the SERA? | Used in the Update? | Comments |
|---|---|---|---|---|---|
| 500318/SS-43 | 0.400 | u | see note | yes | |
| 500318/SS-44 | 0.380 | u | see note | yes | |
| 500318/SS-45 | 0.400 | u | see note | yes | |
| 500318/SS-46 | 0.410 | u | see note | yes | |
| 500318/SS-47 | 0.420 | u | see note | yes | |
| Representative Conc. | | | 3.10 | 0.42u | |

## TABLE C.A-26
## DETERMINATION OF SERA AND UPDATED REPRESENTATIVE CONCENTRATIONS FOR SURFACE SOIL IN STUDY AREA E - BENZO(K)FLUORANATHENE

| Sample Location | Concentration (mg/kg) | | Used in the SERA? | Used in the Update? | Comments |
|---|---|---|---|---|---|
| 500318/SS-43 | 0.400 | u | see note | yes | |
| 500318/SS-44 | 0.380 | u | see note | yes | |
| 500318/SS-45 | 0.400 | u | see note | yes | |
| 500318/SS-46 | 0.410 | u | see note | yes | |
| 500318/SS-47 | 0.420 | u | see note | yes | |
| Representative Conc. | | | 3.30 | 0.42u | |

## TABLE C.A-27
## DETERMINATION OF SERA AND UPDATED REPRESENTATIVE CONCENTRATIONS FOR SURFACE SOIL IN STUDY AREA E - CHRYSENE

| Sample Location | Concentration (mg/kg) | | Used in the SERA? | Used in the Update? | Comments |
|---|---|---|---|---|---|
| 500318/SS-43 | 0.400 | u | see note | yes | |
| 500318/SS-44 | 0.380 | u | see note | yes | |
| 500318/SS-45 | 0.400 | u | see note | yes | |
| 500318/SS-46 | 0.410 | u | see note | yes | |
| 500318/SS-47 | 0.420 | u | see note | yes | |
| Representative Conc. | | | 3.20 | 0.42u | |

## TABLE C.A-28
## DETERMINATION OF SERA AND UPDATED REPRESENTATIVE CONCENTRATIONS FOR SURFACE SOIL IN STUDY AREA E - DIBENZO(A,H)ANTHRACENE

| Sample Location | Concentration (mg/kg) | | Used in the SERA? | Used in the Update? | Comments |
|---|---|---|---|---|---|
| 500318/SS-43 | 0.400 | u | see note | yes | |
| 500318/SS-44 | 0.380 | u | see note | yes | |
| 500318/SS-45 | 0.400 | u | see note | yes | |
| 500318/SS-46 | 0.410 | u | see note | yes | |
| 500318/SS-47 | 0.420 | u | see note | yes | |
| Representative Conc. | | | 1.10 | 0.42u | |

## TABLE C.A-29
## DETERMINATION OF SERA AND UPDATED REPRESENTATIVE CONCENTRATIONS FOR SURFACE SOIL IN STUDY AREA E - INDENO(1,2,3-CD)PYRENE

| Sample Location | Concentration (mg/kg) | | Used in the SERA? | Used in the Update? | Comments |
|---|---|---|---|---|---|
| 500318/SS-43 | 0.400 | u | see note | yes | |
| 500318/SS-44 | 0.380 | u | see note | yes | |
| 500318/SS-45 | 0.400 | u | see note | yes | |
| 500318/SS-46 | 0.410 | u | see note | yes | |
| 500318/SS-47 | 0.420 | u | see note | yes | |
| Representative Conc. | | | 3.00 | 0.42u | |

## TABLE C.A-30
## DETERMINATION OF SERA AND UPDATED REPRESENTATIVE CONCENTRATIONS FOR SURFACE SOIL IN STUDY AREA G - ANTIMONY

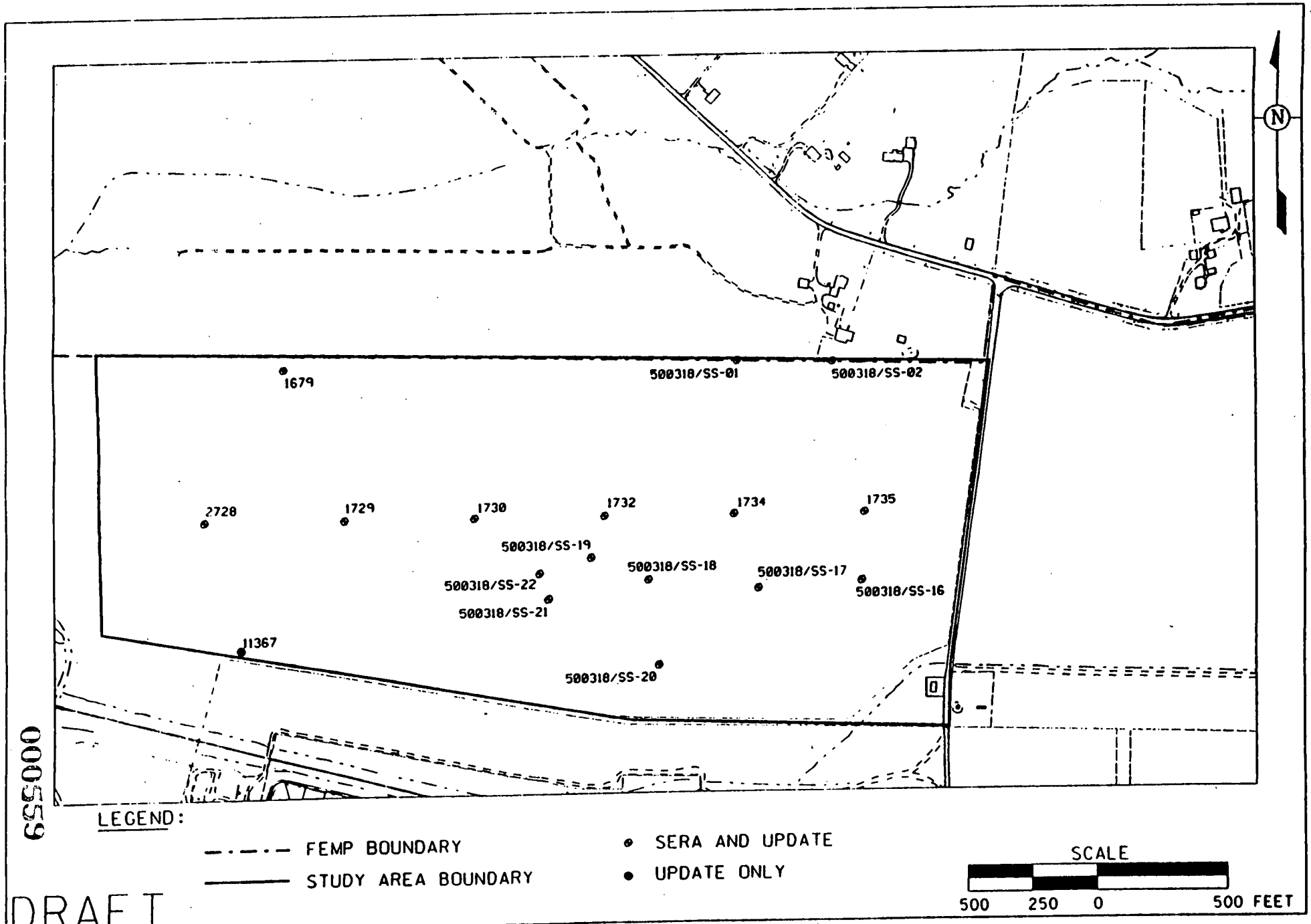
| Sample Location | Concentration (mg/kg) | | Used in the SERA? | Used in the Update? | Comments |
|---|---|---|---|---|---|
| 500318/SS-33 | 2.7 | uj | see note | yes | |
| 500318/SS-34 | 3.3 | u | see note | yes | |
| 500318/SS-35 | 3.3 | u | see note | yes | |
| SS-36 | 3.4 | u | see note | yes | |
| 500318/SS-38 | 3.4 | u | see note | yes | |
| SS-39 | 3.5 | u | see note | yes | |
| 500318/SS-40 | 3.5 | u | see note | yes | |
| 500318/SS-41 | 3.2 | uj | see note | yes | |
| 500318/SS-42 | 3.6 | uj | see note | yes | |
| AFP-SS-04 | 1.8 | j | see note | yes | |
| Representative Conc. | | | 29.5 | 3.5u | |

# TABLE C.A-31
## DETERMINATION OF SERA AND UPDATED REPRESENTATIVE CONCENTRATIONS FOR SURFACE SOIL IN STUDY AREA G - CADMIUM

| Sample Location | Concentration (mg/kg) | | Used in the SERA? | Used in the Update? | Comments |
|---|---|---|---|---|---|
| 500318/SS-33 | 1.2 | uj | see note | yes | |
| 500318/SS-34 | 1.2 | u | see note | yes | |
| 500318/SS-35 | 1.2 | u | see note | yes | |
| SS-36 | 1.2 | u | see note | yes | |
| 500318/SS-38 | 1.2 | u | see note | yes | |
| SS-39 | 1.2 | u | see note | yes | |
| 500318/SS-40 | 1.3 | | see note | yes | |
| 500318/SS-41 | 1.1 | u | see note | yes | |
| 500318/SS-42 | 1.3 | u | see note | yes | |
| AFP-SS-04 | 1.2 | u | see note | yes | |
| WPA-23 | 6.1 | | see note | yes | need to find location on map |
| WPA-24 | 4.7 | | see note | yes | need to find location on map |
| WPA-25 | 2.5 | | see note | yes | need to find location on map |
| 11369 | 0.22 | u | see note | yes | |
| 11370 | 0.18 | u | see note | yes | |
| 11371 | 0.14 | u | see note | yes | |
| Representative Conc. | | | 5.80 | 1.30 | |

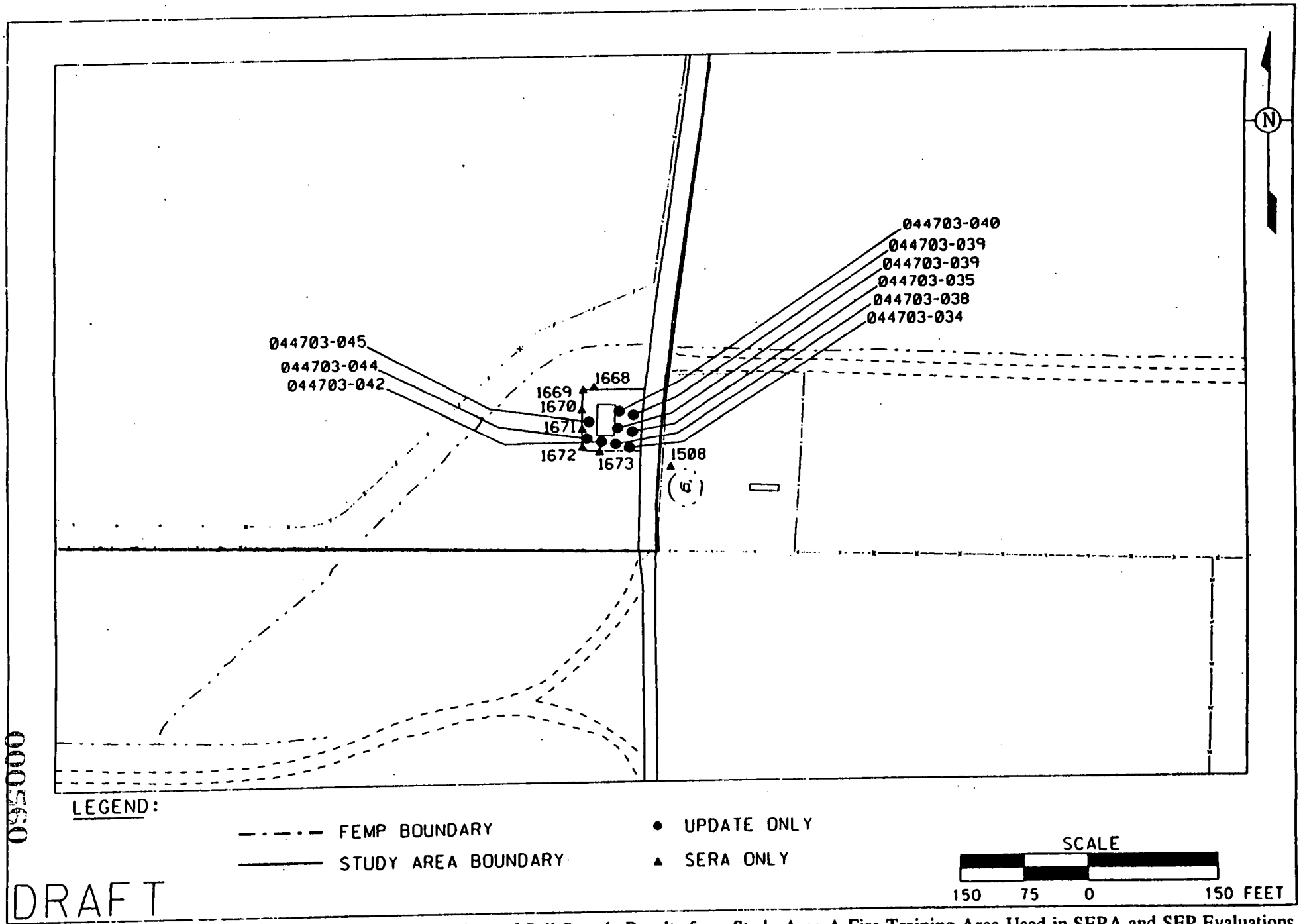
## TABLE C.A-32
## DETERMINATION OF SERA AND UPDATED REPRESENTATIVE CONCENTRATIONS FOR SURFACE SOIL IN STUDY AREA G - SILVER

| Sample Location | Concentration (mg/kg) | | Used in the SERA? | Used in the Update? | Comments |
|---|---|---|---|---|---|
| 500318/SS-33 | 0.25 | u | see note | yes | |
| 500318/SS-34 | 0.47 | | see note | yes | |
| 500318/SS-35 | 0.47 | | see note | yes | |
| SS-36 | 0.48 | u | see note | yes | |
| 500318/SS-38 | 0.48 | | see note | yes | |
| SS-39 | 0.49 | u | see note | yes | |
| 500318/SS-40 | 0.50 | u | see note | yes | |
| 500318/SS-41 | 0.46 | uj | see note | yes | |
| 500318/SS-42 | 0.51 | uj | see note | yes | |
| AFP-SS-04 | 2.40 | u | see note | yes | |
| WPA-23 | 9.70 | j | see note | yes | need to find location on map |
| WPA-24 | 8.40 | j | see note | yes | need to find location on map |
| WPA-25 | 3.80 | j | see note | yes | need to find location on map |
| 11369 | 0.05 | u | see note | yes | |
| 11370 | 0.06 | u | see note | yes | |
| 11371 | 0.06 | u | see note | yes | |
| Representative Conc. | | | 10.3 | 2.4u | |




/usr/ermo/cru5/dgn/map/hor/dpth/nerp003.dgn
STATE PLANAR COORDINATE SYSTEM 1927

Figure C.A-1 Locations of Soil Sample Results from Study Area A Used in SERA and SEP Evaluations




/usr/erma/cru5/dgn/map/hor/:dp11/nrrb004.dgn
STATE PLANAR COORDINATE SYSTEM 1927
19-MAR-1997

Figure C.A-2 Locations of Soil Sample Results from Study Area A Fire Training Area Used in SERA and SEP Evaluations

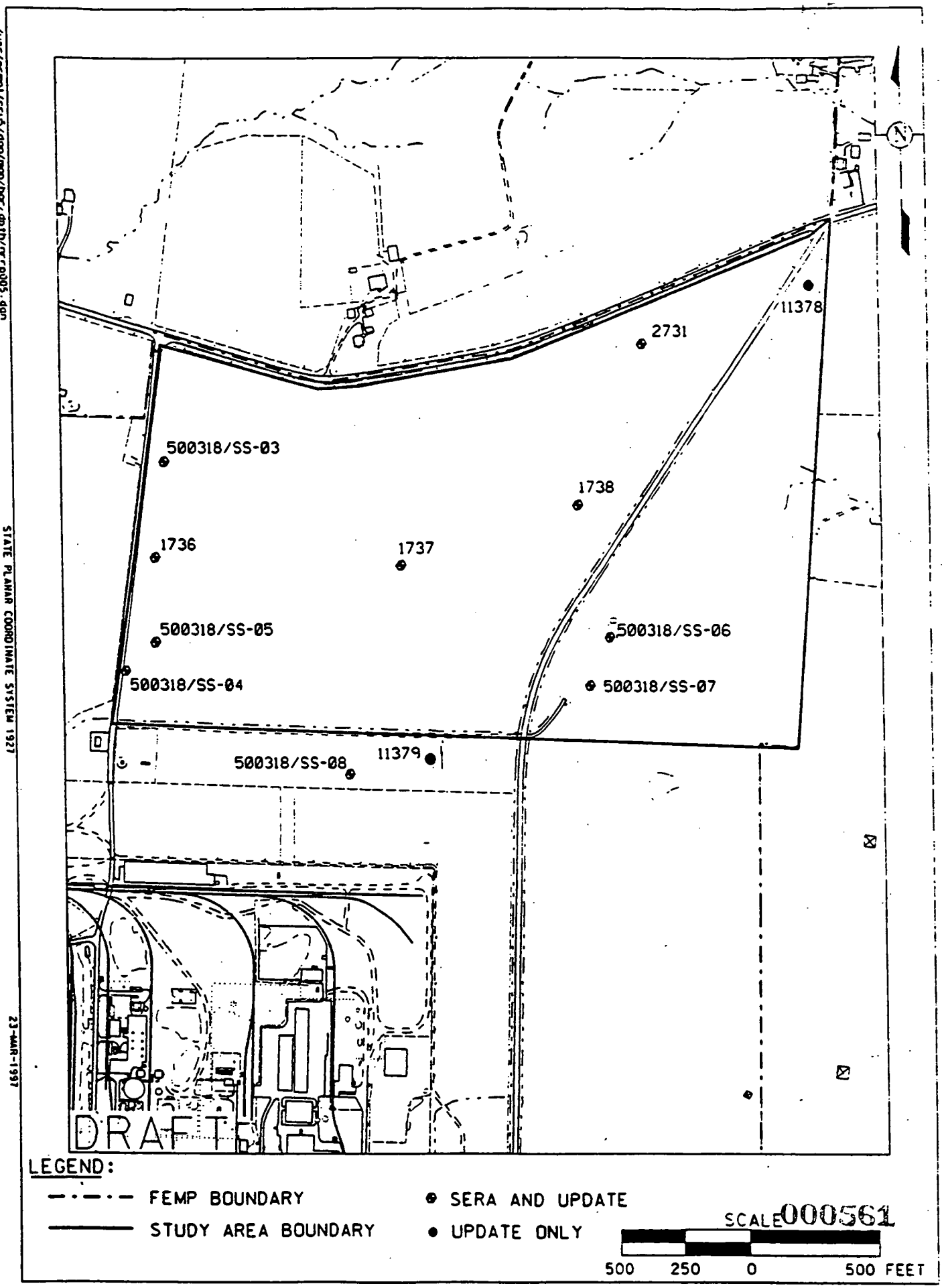



Figure C.A-3 Locations of Soil Sample Results from Study Area B Used in SERA and SEP Evaluations

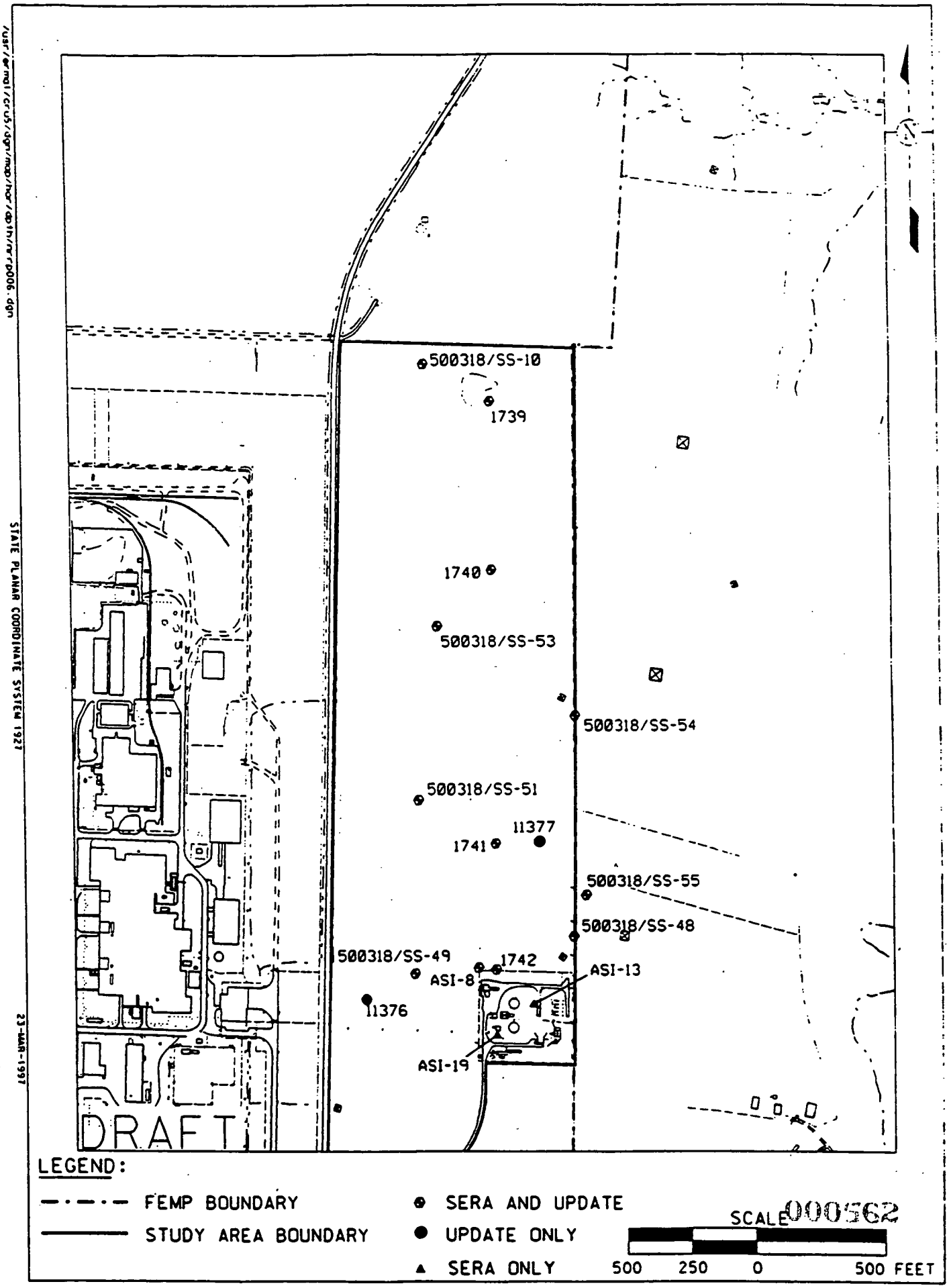
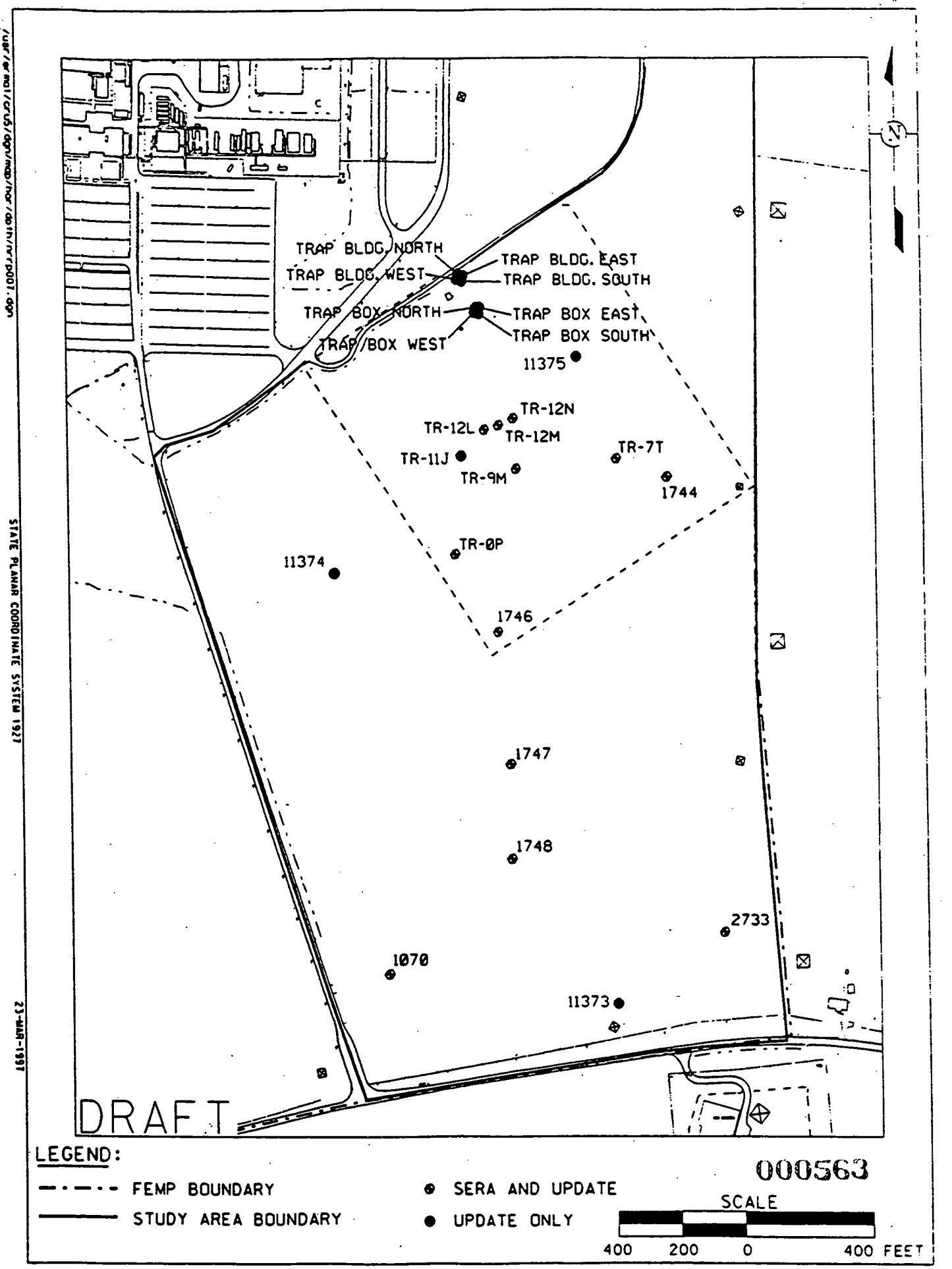



Figure C.A-4 Locations of Soil Sample Results from Study Area C Used in SERA and SEP Evaluations




000563

Figure C.A-5 Locations of Soil Sample Results from Study Area D Used in SERA and SEP Evaluations

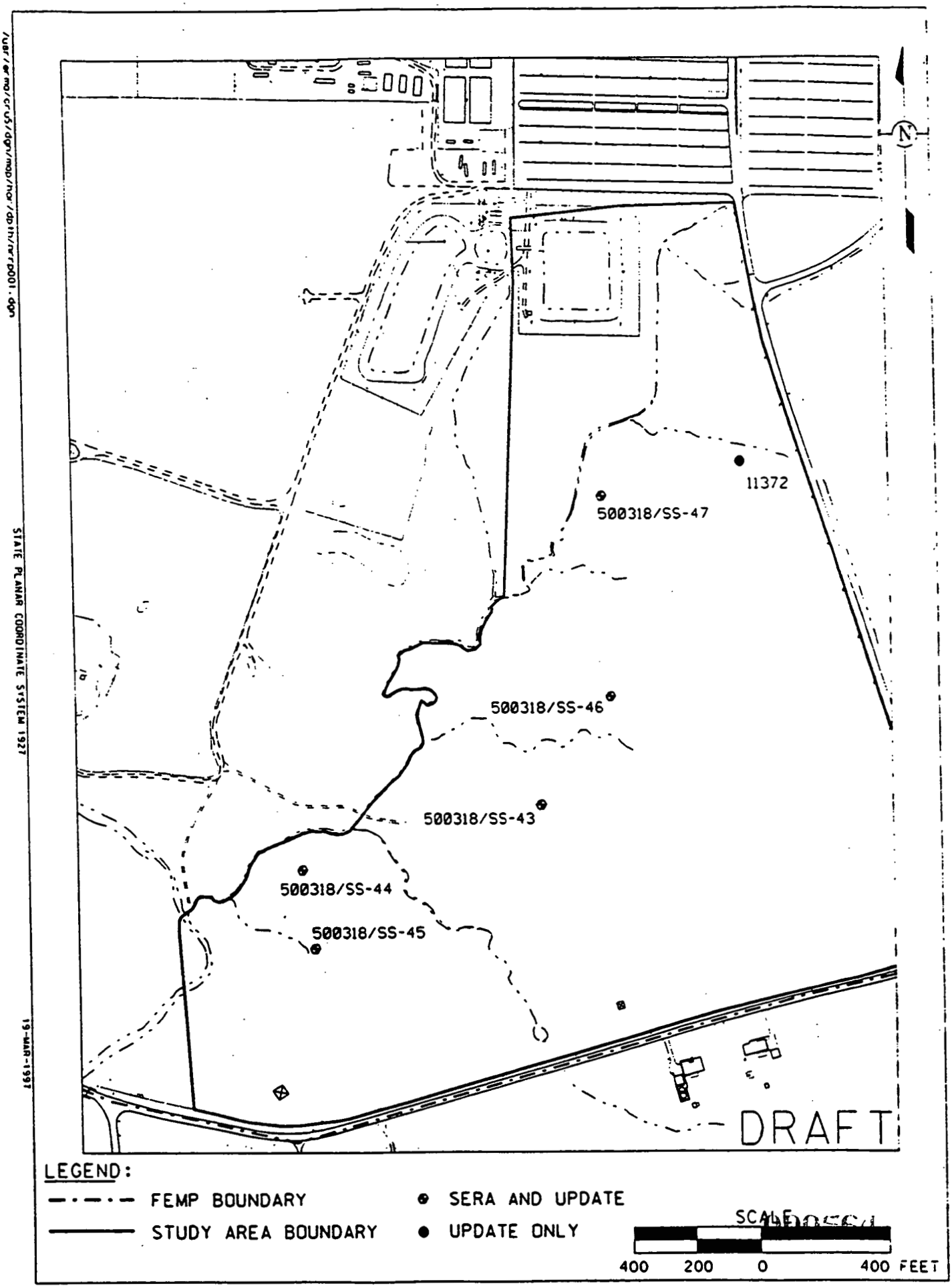



Figure C.A-6 Locations of Soil Sample Results from Study Area E Used in SERA and SEP Evaluations

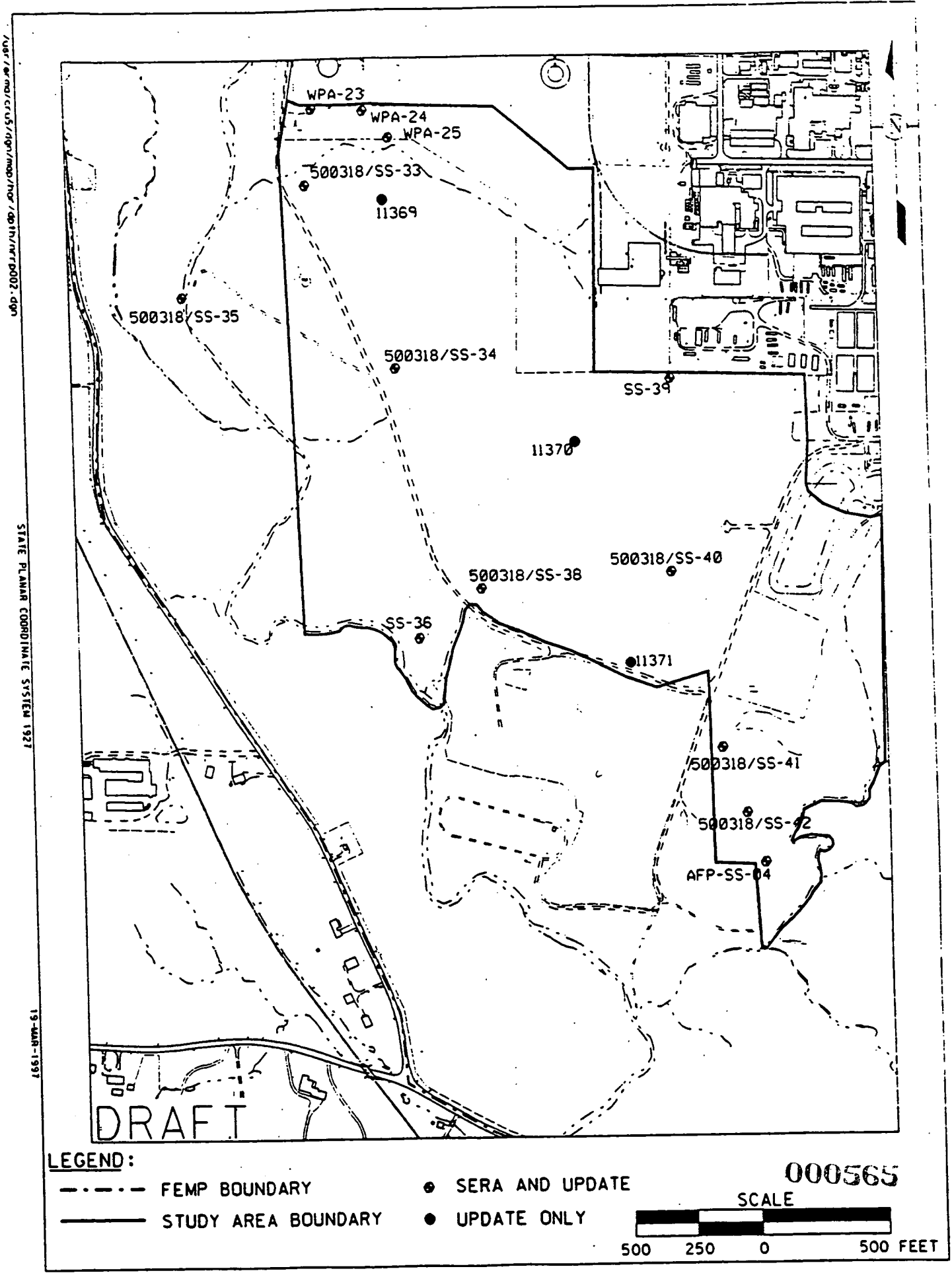





Figure C.A-7 Locations of Soil Sample Results from Study Area G Used in SERA and SEP Evaluations

# APPENDIX D

# WOOD SAMPLING PROGRAM

## INTRODUCTION

The Fernald Environmental Management Project (FEMP) is progressing into the Remedial Design phase of remediation, which will involve removal of saplings and mature trees as a result of construction and excavation activities. As a waste minimization practice, the intent is to recycle cleared trees by chipping and applying the chips as mulch cover for areas that have been excavated. It was therefore necessary to provide information on the contaminant uptake of these trees before they could be used as mulch. The purpose of this sitewide tree tissue sampling program was to provide data on site-specific contaminant concentrations in tree tissue to support a decision to use the tree tissue for mulch application. Tree tissue concentrations were compared to soil final remediation levels (FRLs) in the Operable Unit 5 Record of Decision (DOE 1996d) to ensure that areas of mulch application would not be recontaminated if tree tissue was free-released for use as mulch on-site. Soil FRLs were determined based on modeled reductions in risk to human receptors.

## D.1 SAMPLING METHODOLOGY

Thirty-six (36) live, standing trees of various species at the FEMP were sampled and analyzed by an offsite laboratory for metals and radionuclides (Table D-1) according to the criteria set forth in the "Project Specific Plan for Tree Tissue Sampling" Project No. 50.03.44, November 5, 1996. Tree sampling locations were determined by comparing forested areas shown on aerial photographs of the site with anticipated areas of excavation. Forested areas likely to be felled during remediation were determined by cross-referencing aerial photographs with a surface soil database. This database contained information on areas where contaminant concentrations exceeded soil FRLs. Individual trees in these areas with a minimum diameter (diameter breast height or DBH) of 10 centimeters (cm) were selected to obtain sufficient sample (Figure D-1). Tables D-2 and D-3 list tree tissue sampling locations based upon geographic proximity. Sampling points 1E-7E are designated as East; Sampling points 8E-13E and 1W-6W are designated as North; and Sampling points 7W-21W are designated as South.

Each tree to be sampled was identified in the field with reflective tape containing the sample number. Samples were numbered in relation to their position to the former North Access Road. Those samples located east of the North Access Road were sequentially designated with the project number and an "E" suffix, and those samples located west of the North Access Road were sequentially designated with the project number and a "W" suffix (see Figure D-1). For each tree sample, additional data were recorded, such as tree type, diameter breast height, location, and general health condition.

Sampling was conducted using a portable, 18-volt drill with 1-inch carbon steel drill bits. Tree tissue was collected approximately 4.5 feet from the base of the trunk and consisted of the outer bark to the inner pith of the tree. Polyethylene sheeting was positioned in an apron formation directly below the drilling location to collect wood tissue. Each individual wood tissue sample was transferred from a plastic apron into a 12-ounce, wide-mouth, glass sample jar. To obtain adequate mass for analysis, more than one hole was drilled in each tree. A duplicate tree tissue and rinsate sample was collected for every 20 samples in accordance with the SCQ, by drilling an additional hole(s) immediately adjacent to the location of the original sample location. Approximately 330 grams of tree tissue were required from each tree for analysis. Excess wood tissue sample was placed into a waste container.

Sampling equipment was decontaminated (Level II) prior to transport to the each sampling location, before re-use, and after sampling was complete to limit the introduction of contaminants from equipment to the sampled media. Decontamination was conducted in accordance with SCQ requirements in Appendix K, Section 11.2, of the SCQ. Equipment was dried with a lint-free wipe after final rinse.

### D.1.1 SAMPLE ANALYSIS

All tree samples were homogenized, and each aliquot was weighted and ashed prior to analysis. Table D-1 lists the laboratory methods used to analyze the tree samples. Analyses were conducted in accordance with analytical support level (ASL) B as outlined in the SCQ. Results were reported on a dry-weight basis (mg/kg dry wt).

### D.1.2 RESULTS AND DISCUSSION

To determine whether chipped tree tissue from excavated areas could be applied as mulch, the representative concentrations of tree tissue were calculated. Representative concentrations were calculated using the 95 percent upper confidence limit (UCL) on the arithmetic mean for primary constituents of concern (total uranium, radium-226 & 228, and thorium-228 & 232) and the 90 percent UCL on the arithmetic mean for secondary constituents of concern (all metals and cesium-137, strontium-90, and technetium-99).

Soil FRLs for the FEMP were determined based on modeled reductions in risk to human receptors. Comparing tree tissue concentrations to soil FRLs ensured that areas would not be recontaminated if tree tissue was free-released for use as mulch on site. All area-specific tree tissue representative concentrations were at levels less than the established soil FRLs (Tables D-2 and D-3); therefore, felled trees encountered during site remediation will be chipped and used as mulch.

An additional comparison was performed to identify potential impacts on ecological receptors from possible chemical exposures. Field observations indicate that the trees which exhibited tissue concentrations at or slightly above the benchmark toxicity value (BTV) for molybdenum were in good condition (no signs of disease or dying).

Some constituents of area-specific tree tissue slightly exceeded some soil BTVs, which are media concentrations considered protective of ecological receptors. The use of BTVs is a conservative screening process to indicate whether there is a potential risk to ecological receptors. BTVs are not cleanup levels that must be achieved to ensure protection of ecological receptors. BTVs are discussed in detail in Appendix C.

Specific sampling locations exhibited tree tissue concentrations of selenium and molybdenum at or slightly above the BTV for these constituents. The representative tree tissue concentrations for selenium and molybdenum were influenced from one tree sampling point in each geographic area. The representative tree tissue concentrations for selenium range from 3.23 to 3.74 parts per million (ppm) compared to the selenium BTV of 3 ppm. The representative tree tissue concentrations for molybdenum range from 10.09 to 11.17 ppm compared to the molybdenum BTV of 10 ppm. The results of the tree tissue sampling program do not indicate an impact to the trees from molybdenum and/or selenium. Based on this information, there is no restriction for applying the tree tissue as mulch.

## TABLE D-1

## ANALYTICAL REQUIREMENTS FOR WOOD

| Parameter | Matrix | Container & Volume | Sample Mass | Hold Time | Preservative | Laboratory Analyses | ASL | Sample Type |
|---|---|---|---|---|---|---|---|---|
| | | | | Tree Tissue Sample | | | | |
| Total Metals[a] | S (solid) | 12-ounce glass or plastic | 30 g | 6 months (Mercury-28 days) | Cool 4° C | Inductively Coupled Plasma, Atomic Absorption | B | Grab |
| Radionuclides[b] | S (solid) | 12-ounce glass or plastic | 300 g | 6 months | None | Liquid Scintillation; Lucas Cell, Gas Flow Proportional Counter, Alpha and Gamma Spectroscopy, | B | Grab |
| | | | | Rinsate Sample | | | | |
| Metals | W (water) | 1-liter plastic | N/A[c] | 6 months (Mercury-28 days) | $HNO_3$, pH < 2, Cool 4°C | Inductively Coupled Plasma, Atomic Absorption | B | Grab |
| Radionuclides | W (water) | 6-liter plastic or glass | N/A | 6 months | $HNO_3$, pH < 2 | Kinetic Phosphorescence Analyzer, Lucas Cell, Alpha Spectroscopy Gas Flow Proportional Counter | B | Grab |

[a]Metals - Aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, molybdenum, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, zinc.

[b]Radionuclides -Total uranium, isotopic thorium, radium-226, radium-228, cesium-137, strontium-90, technetium-99.

[c]N/A - Not Applicable

## TABLE D-2

## REPORTED CONCENTRATIONS OF METALS IN WOOD

| Analyte | Mean Concentration (mg/kg dry wt.) North Area | East Area | South Area | Soil FRL (mg/kg) |
|---|---|---|---|---|
| Aluminum | 59.9 | 27.5 | 23.6 | -[a] |
| Antimony | 0.65 | 0.4 | 0.797 | 96 |
| Arsenic | 0.135 | 0.108 | 0.119 | 12 |
| Barium | 23.5 | 33.7 | 17.7 | 68,000 |
| Beryllium | 0.28 | 0.149 | 0.26 | 1.5 |
| Cadmium | 0.2 | 0.052 | 0.064 | 82 |
| Calcium | 5520 | 26,289 | 20,200 | 1 |
| Chromium | 1.527 | 1.129 | 1.02 | 300 |
| Cobalt | 2.12 | 1.31 | 1.6 | 740 |
| Copper | 61.55 | 3.33 | 4.07 | 220,000 |
| Iron | 20.4 | 39.5 | 36.6 | 1 |
| Lead | 0.568 | 0.834 | 0.892 | 400 |
| Magnesium | 711 | 505 | 926 | 1 |
| Manganese | 82.6[b] | 66.5 | 26.3 | 4,600 |
| Molybdenum | 10.09 [b] | 11.15 [b] | 10.4 [b] | 2900 |
| Mercury | 0.069 | 0.043 | 0.143 | 7.5 |
| Nickel | 3.73 | 4.94 | 2.15 | 15,000 |
| Potassium | 2037 | 2929 | 2420 | 1 |
| Selenium | 3.48 | 3.74 | 3.22 | 5,400 |
| Silver | 1.221 | 0.76 | 0.925 | 29,000 |
| Sodium | 20 | 313 | 229 | 1 |
| Thallium | 1.297 | 0.81 | 0.989 | 91 |
| Vanadium | 0.871 | 0.514 | 0.664 | 5,100 |
| Zinc | 19.54 | 9.28 | 11.5 | 120,000 |

[a]Analytes do not have soil FRLs.

[b] Data on molybdenum should be used cautiously. It was detected in soil in these three areas a total of 17 time, and 14 of those analyses were performed by one laboratory between December 1991 and January 1992. Subsequent sampling and analysis programs in these areas do not confirm these results.

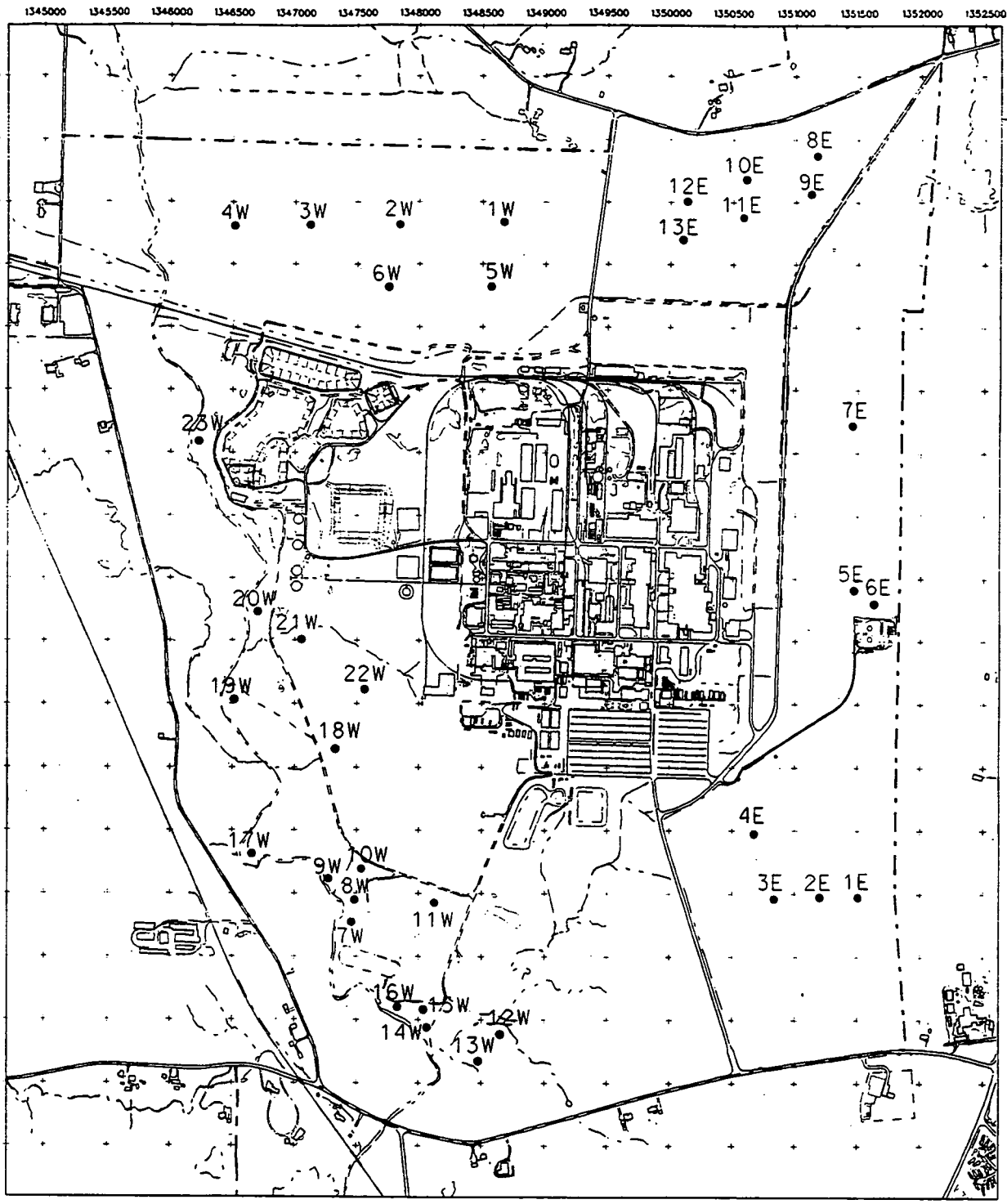
## TABLE D-3

## REPORTED CONCENTRATIONS OF RADIONUCLIDES IN WOOD

| | Mean Concentration (pCi/g dry wt.)[a] | | | Soil FRL |
|---|---|---|---|---|
| Analyte | North Area | East Area | South Area | (pCi/g) |
| Thorium 228 | 0.138 | 0.053 | 0.068 | 1.7 |
| Thorium 230 | 0.104 | 0.049 | 0.05 | 280 |
| Thorium 232 | 0.035 | 0.021 | 0.031 | 1.5 |
| Radium 226 | 0.215 | 0.159 | 0.966 | 1.7 |
| Radium 228 | 0.337 | 0.261 | 0.287 | 1.8 |
| Cesium 137 | 0.082 | 0.062 | 0.064 | 1.4 |
| Strontium 90 | 0.313 | 0.185 | 0 | 14 |
| Technetium 99 | 4.463 | 5.458 | 4.379 | 29.1 |
| Total Uranium | 0.048 | 0.058 | 0.108 | 55 |

[a] Preliminary data. Validation pending.

SRDIG DGN BMP TREE1.DGN 11-8-96 STATE PLANAR COORDINATE SYSTEM 1983




LEGEND:

— · · — · · FEMP BOUNDARY

• 11W TREE TISSUE SAMPLING LOCATIONS

NOTE: 500344 is the prefix for all sampling locations noted on map (e.g., 500344-11W)

SCALE

125 65.5 0 125 FEET

FIGURE D-1. APPROXIMATE TREE TISSUE SAMPLING LOCATIONS

# APPENDIX E

## SEP QUALITY ASSURANCE PROJECT PLAN (QAPP)

## INTRODUCTION

### Purpose

The goal of a quality-oriented project is to produce a product that will meet the stated or implied needs and expectations of the project. Quality Assurance (QA) is an integrated system of management activities involving planning, implementation, assessment, reporting, and quality improvement to ensure that data and products are of the type, quantity, and quality needed. Quality Control (QC) is the overall system of technical activities that measure the QA attributes and how well the processes and results meet defined standards to verify that the stated objectives of the activity are met. The purpose of the SEP QAPP is to establish the necessary QA/QC framework to support SEP-related plans, design, construction, sampling, analysis, and resulting data to satisfy stated objectives. Effective implementation of detailed QA program objectives and specifications is required in management functions to effectively measure and control remediation work scopes so products and services are of the appropriate type and quality for their intended use. Activities that generate environmental data will be conducted in a manner that produces legally defensible data.

The SEP QAPP criteria were based on the current version of the Fluor Daniel Fernald (FDF) Quality Assurance Program Description (RM-0012) and the SCQ Sitewide CERCLA Quality Assurance Project Plan (FD-1000). Additional considerations include QA/QC requirements relative to 10 CFR 830.120, Quality Assurance Requirements; DOE Order 5700.6C, Quality Assurance; ANSI/ASQC E4, Specifications and Guidelines for Quality Systems for Environmental Data Collection And Environmental Technology Programs; and ASME NQA-1, Quality Assurance Requirements for Nuclear Facilities.

### Scope

The scope of the QAPP covers all SEP activities carried out by FDF and its subcontractors. Key activities covered under this QAPP include radiological surveys, field measurements, sampling, and analysis carried out during pre-excavation investigations; preparation of the data quality objectives and project sampling plans (DQO/PSPs); engineering controls of the remedial design; preparation of the IRDPs; soil excavation and segregation; WAC attainment; preparation of the Certification Design Letter and implementation of the certification process; and preparation of the certification report.

Should SEP requirements differ from established FEMP QA programs, SCQ, or the SEP QAPP for substantive technical considerations, the SEP planning document must justify the basis for change and obtain DOE and EPA concurrence.

## E.1 PROGRAM

General flowdown from FEMP site policies and programs regarding quality affecting requirements will be applicable in SEP planning and implementation processes. The matrix correlating SEP content to FDF QAP RM-0012 is summarized in Table E-1. Organizational structures will be established to adequately support the FEMP and SEP functions necessary to accomplish planned QA/QC objectives. The SEP QA program organization is presented in Figure E-1.

### E.1.1 Organization

SEP functional organizational interfaces with FDF management and DOE/EPA interfaces will be defined to establish roles and responsibilities for decisions directing work and certifications. This includes soil excavation activity interfaces when crossing other FDF project work scopes.

Integrated remedial design packages (IRDPs) and PSPs will define operational roles of SEP functions as they pertain to SEP implementation. Planning documents for SEP activities will describe how supporting organizations controlling work such as health and safety, industrial hygiene, radiation (rad) control, waste disposition, validation, and quality assurance applies to work activities. The extent of decision authority to stop-work will be defined. The Quality Assurance organization has stop-work authority.

### E.1.2 Project Functional Responsibilities

USEPA

DOE-FEMP submits SEP deliverables to USEPA and OEPA. The USEPA reviews and comments on SEP submittals. The comments and/or approvals are then presented by letter to DOE-FEMP. Deviations or changes to the SEP, if needed, will be described in subsequent IRDPs, which require USEPA approval. As soil remediation progresses, deliverables such as IRDPs and Certification

Reports will be submitted by DOE-FEMP for USEPA acceptance. The USEPA has access to SEP activities, documents, and data bases to assess and verify submittal compliance to SEP requirements.

OEPA

The OEPA provides the same approval and oversight functions as the USEPA relative to SEP submittals. Additionally, OEPA has operations oversight responsibility for OEPA and FEMP regulatory agreements, such as NPDES, RCRA, dust and noise control, groundwater monitoring, air and water radiological pathways, and related split-sampling programs. The OEPA has ready access to SEP activities pertaining to implementation of EPA-related agreements to conduct audits, surveillances, and inspections.

DOE Fernald Field Office (DOE-FEMP)

The DOE-FEMP Remediation Program Manager reviews and concurs with FDF SEP submittals. Upon acceptance, DOE-FEMP submits SEP project documents to USEPA/OEPA for approval. The Remediation Program Manager designates a DOE-FEMP SEP representative as a field oversight interface for SEP remediation design, construction, QA/QC control, and health and safety. The DOE SEP representative will immediately notify the DOE Remediation Program Manager in an effort to seek prompt resolution of any issues or problems that affect quality. The DOE Remediation Program Manager determines performance measures in attaining compliance with DOE and EPA requirements and milestones pertaining to SEP project-specific tasks.

FDF President

The FDF President is the highest FDF authority responsible for the FDF Quality Assurance Program. The authority for establishing, administering, and evaluating the effectiveness of the QA program is delegated to the FDF Director of Quality Assurance.

FDF Vice President

The FDF Vice President is the highest SEP project authority needed to approve deliverables to DOE-FEMP and USEPA/OEPA. Because the SEP program impacts other FDF projects, this authority should ensure effective integration to accomplish SEP objectives.

FDF SEP Project Manager

The FDF SEP Project Manager is responsible for implementing this SEP QAPP. This authority assures that project documents are controlled and SEP records are properly maintained until project closure. The SEP project will be accessible to internal and external assessment groups. The SEP project will allow for organizational QA independence not tied to schedule or cost, and will support evaluation and verification of IRDPs/PSPs and subsequent deliverables for subcontractors and FDF SEP tasks. The SEP Project Manager assigns SEP-specific assignments to project functional managers and determines schedule and cost considerations to stage and resource load the planning and implementation processes.

FDF SEP Project Leads

FDF SEP Project Leads are responsible for the training and qualification of personnel so technical functions can be performed in accordance with SEP requirements and professional standards. Project Leads develop DQOs, PSPs, IRDPs, implementing procedures, assessment plans, Certification Design Letters, and Certification Reports. Documents and related changes must be controlled by the respective functional Project Leads. The Project Leads interface with other FDF-related organizations needed to facilitate SEP work processes and is responsible for approving budget resource and cost allocations to execute assigned Scopes of Work. Anticipated project support functions are as follows:

- Engineering. Remedial design, IRDP preparation, Title I and II design, procurement Certified for-Construction (CFC) and subcontract procurement package
- Construction. Determines subcontract award, monitors subcontract performance to final deliverables, which includes Title III execution, construction turnover package, and subcontract closure
- Characterization. Prepares DQO/PSPs, sampling, field scanning with RTRAK /HPGe, lab analysis, data management, software V&V
- Certification. WAC and FRL attainment data packages, qualification and validation of data deliverables
- Waste Disposition. Controls access to certified areas, soil stockpiles, debris stockpiles, maintains waste stream profiles, prepares WAC attainment data package
- Regulatory. Environmental compliance, natural resources, cultural affairs, IEMP compliance
- Health and Safety. Rad control, industrial hygiene, and general safety site requirements will be monitored, enforced, and verified by the respective health and safety discipline.

- Quality Assurance. Provides independent assessment verification of SEP requirements and processes, approves project plans, procedures, and purchase requisitions. WAC and certification attainment deliverables will be independently verified by the sitewide QA function. All construction QC inspections will be performed by QA, except where specified that the construction subcontractor will perform inspections. External SEP audits, surveillances, and other types of assessments will be facilitated by project QA. Project QA will conduct audits, surveillances, inspections, vendor qualification surveys, and other internal assessments required to verify quality in SEP-related work processes.

Subcontractors

Subcontractors will be monitored for compliance with submitted QA/QC plans required to meet contract specifications. The subcontractor will have a QA/QC officer who conducts internal assessments and reports observations, test acceptance, and nonconformances to the FDF Construction Manager and SEP QA program lead. Subcontractor work will be performed to the requirements described in the SEP, the SEP QAPP, and QA/QC specification in the FDF contract. The subcontractor must meet all DOE, FDF, and SEP QA/QC requirements. Expected types of subcontractors include laboratories, construction, cultural resources, waste disposition, and suppliers providing items and materials. The SEP QA function must determine prequalification requirements for subcontractor approval and the required periodic qualification assessment to measure QA/QC performance in maintaining qualification status.

### E.1.3 Project Planning

Project planning should include measurement systems for schedules, resources, and costs to discrete project tasks; charge numbers, procurements, etc. Project Leads typically are Control Account Managers (CAMs) for project-specific scopes of work. Budget tracking and control is accomplished by the FDF Primavera project control system.

Project IRDPs, sampling plans, DQOs, and subcontract task orders are used to describe how SEP work will be accomplished in accordance with accepted standards and practices. All associated hold points, inspection criteria, and verification requirements will be specified.

## E.2 PERSONNEL TRAINING AND QUALIFICATION

All personnel performing SEP work will be trained for their function commensurate to the skill level required by assigned tasks. General Employee Training (GET) will be required for FDF employees, subcontractors, and other individuals needing access to the FDF work sites.

The IRDP, PSP, and subcontract QA plans will identify work functions requiring special training when certification is required. Training records will be maintained for skill-specific training needed to perform procedure-specific tasks that verify training, proficiency demonstration, when required, and qualification status. Training will be provided on the use of equipment, the nature of particular excavation areas, or conditions requiring special consideration (e.g., unusual hazards, motor vehicle operators, confined-space workers). Specific examples include:

1. Field sampling technicians for RTRAK and HPGe will be trained to respective operations manuals and demonstrate ability to calibrate gamma-sensitive detectors and associated QC controls in system functions and data transfer. Sampling technicians will be trained to complete chain-of-custody and field logs in a manner that will be traceable to original work and legally defensible.

2. Personnel conducting analysis of soil and debris samples will be certified to complete analyses in accordance with established methods. Periodic requalification will be required to maintain qualification. Requalification may involve satisfactory performance sample analysis.

3. Health and safety training requirements will be met by completing site access training and job-specific radcon qualifications necessary for Radiological Work Permit (RWP) compliance.

4. Subcontractor training plans will address the personnel qualification process needed to certify any nondestructive examination (NDE) testing for Title III placements and inspections to those specified in IRDPs. This includes geomembrane weldments/sealing, soil construction, concrete testing, steel weldments, and HDPE manholes and associated piping. All certifications will be submitted to FDF project management upon request.

5. Personnel handling data transfer or manipulation, data statistical treatment, data validation, and subsequent report generation will be technically capable of determining acceptance/validation and abnormal conditions necessary to control data to support precertification and certification reports from verifiable database fields.

## E.3 QUALITY IMPROVEMENT

Improvement of quality in the work to be performed is a goal of the DOE throughout remediation. FDF and DOE encourage a policy of "no fault" attitude toward the identification of nonconformances.

### E.3.1 Nonconformance

Tracking of internal and external deficiencies with respect to SEP work processes and deliverables will follow established FEMP QA nonconformance reporting and corrective action procedures. Process controls will be established to identify nonconforming conditions that apply to procedure noncompliant field practices, field samples, analytical method QC failure, incomplete data packages, off-specification materials and services, and deviations resulting from construction inspections. Items, activities, and processes that do not meet specified requirements are to be identified, controlled, and corrected to prevent their inadvertent use. Project QA will have the authority to place hold tags on nonconforming items. Documentation of nonconformances will be in the respective project records.

### E.3.2 Lessons Learned

A lessons-learned survey should be completed at the end of each IRDP to assess the effectiveness of implementing SEP programmatic requirements. The survey should include effectiveness of corrective action implementation for nonconformances. Recommendations identifying strengths and weaknesses should be incorporated into subsequent project plans.

## E.4 DOCUMENTS AND RECORDS

The SEP Functional Project Leads will prepare, review, approve, distribute, and revise project-specific plans, procedures, drawings, specifications, instructions, and other work affecting documents in accordance with FEMP document control, engineering, and construction procedures. Project QA will review all work-affecting documents to verify compliance to established site policies and procedures.

Documents and records pertaining to SEP soil remediation that provide work instruction will be controlled, and all records documenting work implementation will be placed in Engineering/Construction Document Control (ECDC) designated project files. Identified SEP documents include PSPs and geotechnical plans for remedial design planning in IRDP development,

waste characterization plans and related soil-tracking records, Certification Design Letter, Certification Report, and final construction turnover documents such as as-built drawings. Data collected during SEP implementation will be traceable to the planning and operating documents actually used and to the personnel collecting the data.

E.4.1 Document Control

1. Centralization and Indexing will include a master index of project-specific documents. ECDC will assign document numbers and distribution where applicable. Copies of this index will be distributed to design and quality engineers and other impacted personnel within the project.

2. Document issuance and distribution will include the project manager authority, and when required, QA approval prior to controlled distribution. Project-related plans will be routed to internally affected organizations for review prior to approval such that affected external organizations such as subcontractors may provide comments. Planning documents will include titles, unique project numbers, effective date, revision number, approval signatures, and a unique document control number.

   A partial list of documents to be controlled includes:

   - Design Specifications
   - Design and Work Drawings, Certified-for-Construction and As-Built Drawings
   - Spreadsheet/Database Revisions and V&V Calculations
   - Test Reports
   - Initial Calibration Records
   - Field Change Requests and Design Change Notices
   - IRDPs, DQOs, PSPs, Procedures
   - Field Logs

3. Electronic information such as photos, spreadsheets, databases, access, custodians, backups and hard copies pertaining to PSPs, IRDP, and certification will be controlled by instructions or procedures to ensure retrieveability and traceability.

4. Document revisions will be approved by the same level of approval as the original document. PSPs may be amended in accordance with the SCQ. Engineering and construction revisions will follow engineering and construction change-control processes.

5. Revisions to electronic media, such as software, spreadsheets, and databases, will require change controls, such as software validation criteria NQA-1 11-S2.

6. Construction, engineering, and environmental document control will be centralized in ECDC. Engineering and construction drawings will be controlled in the field. "For Information" drawings will not be used to perform field work.

7. SEP agency reports: Certification Reports (CR), Remedial Action Report (RAR), Site Closeout Report (SCR) will have established reviews to effectively control deliverable reporting between SEP project and agency interfaces and subsequent distribution.

E.4.2 Document Control

1. ECDC will maintain documents in a manner conducive to FDF records archiving requirements.

2. For SEP activities, QA records must be retained in ECEC-designated project files. Project personnel will maintain active records until task completion. Upon completion of PSP and IRDP work scopes, active records are considered to be complete and will be placed in ECDC custody. Typical examples of records are IRDPs, DQO/PSPs, construction as-built drawings and associated field logs, subcontractor submittals, contracts, analytical data, sample field logs, geotechnical data, waste manifests, waste disposition logs, WAC/Certification reports, and all QA/QC oversight documentation and inspection reports.

## E.5 WORK PROCESSES

SEP environmental and engineering work processes that will be controlled to ensure that tasks performed meet the QA/QC objectives of the QAPP include collection and recording of field data, sampling and analysis, engineering design, construction controls, document preparation and review, database management and control, and project management controls.

### E.5.1 Procedures and Instructions

Procedures will be developed, documented, and implemented for appropriate routine, standardized, special, or critical operations. Procedures that specify technical requirements will be reviewed for adequacy and approved by qualified personnel before use. During implementation, the need for expedited changes to established plans should be addressed. When expedited changes are made, prior verbal authorization is always required, and approval by normal review and approval will be conducted

within a subsequent time frame. Planning documents, such as IRDPs and PSPs, may contain sufficient description for field use and may be considered as instructions.

### E.5.2 QA/QC Objectives for Environmental Work Processes

During the pre-design investigation (Section 3.1), field data will be collected and recorded, and sampling and analysis will be implemented to define above-WAC and above-FRL boundaries of the COCs . The geotechnical properties of the soil in the defined excavation volumes will be determined. Environmental activities will be planned using accepted EPA protocols, such as DQOs and PSPs. The content and execution of environmental planning is described in the EPA-approved SCQ. All environmental activities supporting the SEP will be in compliance with SCQ requirements. The SCQ is the principal environmental QAPP for the FEMP, which has been developed to cover the EPA QAMS-005/80 requirements for environmental sampling and analysis to support ultimate remediation of the site. Table E-2 lists typical sampling functions and correlating reference documents.

### E.5.3 Collection and Recording of Field Data

Field data will be recorded in accordance with the performance criteria outlined in SCQ. Instruments used to characterize gamma radiation in the field (NaI and HPGe detectors) will undergo performance testing of their gamma detector systems to document that the systems perform within acceptable bounds (FDF procedure EQT-22). Portable instruments used to record field information on organic vapors (e.g., HNu and PID meters) will be maintained and operated in accordance to the performance criteria defined in SCQ. Precision, accuracy, calibration, and minimum detectable activities of the HPGe instrument are presented in the FEMP Characterization Comparability Study (in preparation).

### E.5.4 Field Sampling

Sample collection, containers, preservatives, handling, and analytical protocols for radionuclides, metals, and organic constituents will conform to the performance criteria defined in SCQ. Trip blanks, equipment rinsates, and field duplicates will be collected at a minimum rate of one each per 20 samples for analytical sampling level (ASL) C and D data. In-place sampling for combinations of WAC, precertification, and certification will include the required QC samples and field control of the highest ASL level. Field personnel will record sampling location and date on the chain-of-custody forms, and

laboratory services will follow chain-of-custody requirements in demonstrating sample traceability from sampling events to analytical data package transmittal for validation. Only lab services that qualify to SCQ requirements will be used. If analytical results cannot be related to a date and location, the data are unusable for quantitative decisions for SEP report deliverables.

E.5.5 Sample Analysis

Sample analysis for investigative characterization, WAC attainment, pre-certification, waste characterization, and certification sampling will be conducted at on-site laboratories for ASL A, B, C, and D, as specified in IRPD, DQO, and PSP planning documents. For certification analyses, 90 percent of the samples will be analyzed on site, and 10 percent will be analyzed off site to demonstrate interlaboratory comparability verification. Currently, the on-site laboratory capability is limited for organic COCs and TC-99 analysis. Therefore, these analyses will be sent to off-site laboratories until on-site capability is developed. The ratio of on-site to off-site sample analysis may change if laboratory capacities are reached, as determined by the volume of submitted samples.

Certification analysis will be to ASL D for all primary and secondary radiological analytes. Certification analysis for non-rad metals and organics will be to ASL C or D. On-site ASL C and D analyses will be performed only if the on-site laboratory can submit data packages equivalent to off-site data packages meeting data validation criteria. Typically, all non-certification analyses should be to ASL B, unless otherwise specified in IRDPs or DQOs. Only laboratory services that qualify with SCQ requirements will be placed on the laboratory Approved Vendor List (AVL).

Independent data verification and validation will be performed on all analytical data commensurate to the ASL level required in planning documents (e.g., ASL B, ASL C, or ASL D). The assessment of data quality will determine data usability. Quality indicators to be evaluated include completeness, comparability, representativeness, precision, and accuracy. The highest level of validation will be performed on ASL C and D data packages and at a minimum 10 percent of data packages for a sampling event. Additionally, all field sampling data packages pertaining to ASL C&D sampling will be validated.

E.5.6 Document Preparation and Review

All documents prepared as milestone deliverables for work performed under the SEP (Section 7.0) will be reviewed by project management and appropriate QA personnel to ensure completeness and quality have been met. Appropriate document review forms will be routed and signed by the designated reviewers. Document control will be implemented as discussed in Section E.4.

Work processes resulting in records/reports will be reviewed to check validity of information as inputs to post-remediation documents, such as Certification Reports. A typical listing of these reports is described in Table E-3.

E.5.7 Computer Hardware, Software, and Database Management

Computer hardware/software configurations will be tested prior to actual use, and the results will be documented and maintained. Computer hardware/software configurations that are commercial grade and are configured or calibrated for a specific purpose do not require further testing unless the scope of the software usage changes, or modifications are made to the configuration. If any components/software are changed or modified and a new configuration results, the configuration must be retested and re-documented.

The SEP database integrity is maintained in accordance with the FEMP Computer Software Management Plan (FDF, PL-3058). Database access will be controlled and access will be granted on an as-needed basis using the standard FDF Computer Access process (FDF, PL-3058). In general, users will be granted access to read-only operations, with entry and edit privileges restricted to the database custodian and/ or his/her designee.

Data change control for SEP data entered into the Sitewide Environmental Database (SED) will be documented by the data user requesting changes. Each database custodian and/or the custodian's designee will record additions, updates, and deletions through the use of a "history" table, which maintains the original data prior to each change. The date of the change, the user requesting the change, and the individual who makes the change will be recorded to provide a means of tracking all changes made to the database. Records that have been added, changed, or deleted will be summarized in a database change report.

Before new data packages or transmittals are placed in the database, a QC hold point will be established where each data set will be verified and validated. The database custodian and/or a designee will confirm which records in the database have had adequate QC control and will flag these records as "verified". Records which are not initially flagged as verified because of missing documentation and/or analytical problems will be updated to indicate QC verification if the necessary documentation and/or analytical information is provided.

Data sets used in statistical calculations will be controlled from the SED in a manner that can be traced from the Certification Report back to the SED CU data set. All associated calculations and spreadsheets will be tied to the proper data in the SED.

E.5.8 Access Control

Certified clean areas must be posted and access to posted areas must be controlled to prevent recontamination. Impacted soil stockpiles are fenced and secured for authorized access. Access documentation and traceability will be a part of access control measures used. Movement of impacted materials around certified clean areas to stockpiles, and from stockpiles to the OSDF, will be monitored for compliance to waste disposition programmatic controls established to track clean areas, impacted material volumes, and the associated decontamination to prevent cross-contamination during SEP remediation. Inspections will be performed by waste disposition functions and SEP QA to verify cross-contamination control systems.

E.5.9 Project Management Controls

Project management controls will include measurement systems for schedules, resources, and cost tracking as well as procedures for implementing nonconformance and change-order policies. The Project Lead will be responsible for executing these controls and dealing with personnel issues that affect quality-related objectives of the SEP. Section E.1.3 provides additional information on project management responsibilities.

E.5.10 QA/QC Objectives for Engineering and Construction Work Processes

During the preparation of the remedial design and performance of the remedial actions, a variety of work processes will be carried out that require QA review. Examples include issuing a statement of work (SOW) for area-specific excavation; preparation of engineering drawings, specifications, and the IRDP; preparation of construction quality control plans, measurement tests, and equipment; and technical review of documents. Each of these areas must be reviewed with respect to attainment of QA objectives to demonstrate that soil excavation was carried out as designed.

E.5.10.1 Statement of Work (SOW)

The statement of work will be prepared and reviewed with the appropriate project manager, engineers, and procurement individual to ensure the successful solicitation of contractor services. The quality control provisions for excavation activities are specified in the remediation subcontract. The remediation subcontractor is responsible for developing a QA/QC plan that will be approved by the SEP QA representative. An example of QA elements associated with a subcontract SOW request-for-proposal (RFP) is described in Attachment E. Additionally, the remediation subcontractor will be required to submit, in conjunction with or separately from the QA elements, a detailed Construction Quality Control Plan. The subcontractor will also prepare a Health and Safety Plan which will detail plans and instructions necessary for project workers to determine the tools and equipment needed top perform work in a safe manner.

E.5.10.2 Construction Quality Control Plan

Prior to initiating construction activities, a construction quality control plan will be prepared by the contractor with input from FDF. This plan must address, as a minimum, access controls, decontamination areas and procedures for personnel and equipment, line management coordination of safety controls between tasks occupying the same work area, guidance for posting and control of soil contamination areas, maintenance of segregated soil piles, attainment of excavation design specifications, and reporting of survey and field test information used to demonstrate attainment of the design specifications. All construction testing and inspection methods will be specified. Any QC hold points necessary for construction staging will be identified with applicable acceptance criteria. This

plan will be reviewed by FDF to ensure all applicable FEMP QA and construction specification criteria are satisfied.

E.5.10.3 Engineering Drawings, Specifications, and the IRDP

The area-specific remedial design will be presented in the IRDP. All engineering drawings and specifications specified in the IRDP will meet FDF engineering drawing and specification protocols (ED-12-4006, Specifications Preparation and Issue and ED-12-4007, Drawing Preparation and Issue). Appropriate independent verification of QC design criteria will be completed prior to regulatory review of the IRDP. Technical specifications include those developed the ASTM, IEEE, EPA, and other national standards/methods required to demonstrate acceptability of design criteria (e.g., Speciication/Requirement Identification Document).

E.5.10.4 Measurement Tests and Equipment

Measuring tests and equipment (MT&E) used during construction tasks will be of the proper type, range, and accuracy and will be properly calibrated, maintained, and used according to design specifications and other planning documents. Equipment found unsatisfactory for its prescribed use will be recalibrated and certified within tolerances before being used. The validity of any measurements and tests performed with out-of-calibration equipment will be evaluated, and such measurements and tests will be repeated, as required, at the contractors expense. All measuring and test equipment used in construction and fabrication work that affects the quality of the final product will be calibrated. The basis for calibration will be documented and maintained as a record that is traceable to the equipment. Traceability of calibrated equipment to nationally recognized performance standards will be required. All analytical methods and equipment used to demonstrate attainment of the design specifications will be calibrated to NIST traceable standards. Calibration and control measures may not be required for some devices (e.g., rulers, tape measures, levels) if normal commercial equipment provides adequate accuracy.

E.5.10.5 Technical Review of Documents

All engineering design documents and final survey records that establish the attainment of the design specifications will be reviewed by the appropriate registered engineer to ensure QA protocols are met. A document review form will be circulated and signed by the designated individuals to establish a record of the review process. The review form will become a formal project record and will be controlled with the document as discussed in Section E.4.2. Final construction punchlist walkdown will require QA participation, and the QA representative will approve the Final Acceptance Form for completed turnover punchlists (per FDF procedure CT-3.6.1).

## E.6 DESIGN

Engineering design for SEP tasks will provide control of design of items and processes to appropriate standards necessary for project support functions and subcontractors to accomplish IRDP objectives.

### E.6.1 Design Document Preparation

The results of the final design will be appropriately documented in specifications and/or drawings that define design baseline. Design documents will specify the necessary technical and quality acceptance criteria and detail the required inspections and tests to verify acceptable construction.

### E.6.2 Technical Review, Verification, Validation, and Readiness

#### E.6.2.1 Review

Design documents will be peer reviewed by technically qualified discipline experts to verify compliance with SEP program criteria. The project manager will assure that all relevant interfaces to design implementation are involved in the design review process. Quality Assurance will be part of the design review.

External independent reviews by DOE-FEMP and/or EPA may be performed upon request. In project planning, it should be determined whether the DOE field office may wish to conduct Management Reviews on any given project.

Typical design review stages are at Title I (30 percent), Title I (60 percent), Title II (90 percent), and final CFC, which readies the design package for the IRDP and the procurement bid package when subcontractors are utilized.

E.6.2.2 Verification and Validation

At appropriate stages of design, independent design review will be performed to verify and validate systems, structures, components, computer programs, calculations, and tests. Designs must be verified for adequacy as early as practical, but in all cases, prior to dependence upon the design to perform its intended function. All V&V will be documented.

E.6.2.3 Readiness Assessment

Required readiness assessments (RAs) will be conducted on systems requiring formal start-up evaluations in accordance with Conduct of Operations criteria. The necessity of SSRs, RAs, and ORRs will be determined by the appropriate level of quality as specified in 10 CFR 830.120. Engineering will specify Performance Grade of structures, systems, or component (SSC). Health and Safety will determine the Nuclear Hazard Category.

Quality Assurance will determine the Quality Level associated with Performance Grades and Hazard Categories. Quality Level 4 applies to work processes, purchased services, or commercial-grade items, which are not safety-significant. QA requirements for Quality Level 4 items and services are listed in project-specific plans or the purchase order.

E.6.3 Design Change Control

Changes affecting approved design documents will be standardized. A Request for Clarification of Information (RCI) formally documents additional information which does not affect approved documents or configuration. A Design Change Notice (DCN) provides a method for requesting a change to CFC design documents, existing installations, or modifications to SSCs. DCNs may also change the project scope to meet additional design basis performance requirements. All previous DCNs and related design documents are to be considered when evaluating the proposed change. When DCNs affect requirements documents such as Records of Decision (RODs), Remedial Work Plans,

SEP, SCQ, or other OEPA and USEPA approved documents, annotation will be provided showing that the effects of the change have been reviewed and will be incorporated. The same levels of review that were imposed during the initial design will also be rendered for subsequent changes.

The RCIs and DCNs will be controlled in the same manner as original design documents by ECDC. Project QA receives copies of completed RCIs and DCNs.

### E.6.4 Procurement Requirements

Design documents will identify acceptability criteria for purchase items, initial conditions, intermediate and end products.

### E.6.5 Required Hold Points

Design documents will specify QC hold points and provide inspection and/or acceptance testing criteria to verify conformity to design specifications.

## E.7 PROCUREMENT

Evaluation of SEP quality criteria in procurement documents is part of the selection and award function. When required, subcontractors will submit QA plans supporting work scopes. Subcontractors will pass down SEP quality elements to the lowest-tier subcontractor. QA review signatures are required on all procurement ordering documents.

### E.7.1 Vendor Qualification, Selection, and Award

Engineering and construction will develop procurement documents, which include Purchase Requisitions, Invitation for Bid (IFB), Request for Quote (RFQ), or Request for Proposal (RFP), in accordance with FDF engineering, construction and procurement procedures. Procurement documents will identify systems, structures, and components requiring inspection and/or acceptance testing. Associated quality verification of design specifications will be clearly defined in subcontractor deliverables. Title II phase will include QA on the planning and bidding teams, and QA will finalize the QA plan. Potential subcontractors will submit a QA plan and be prequalified prior to contract award to

verify ability to perform to contract requirements. Environmental procurements relating to field sampling, sample analysis and validation will be performed in accordance with the SCQ.

## E.8 INSPECTION AND ACCEPTANCE TESTING

Inspections and testing may involve survey, surveillance, and other assessment evaluations commensurate to establishing verification of specifications, operability, and performance of components and systems. Results of these activities will be documented and retained as project records. Inspection and testing used to evaluate and verify design will be planned, controlled, and documented.

Work that is nonconforming to design specifications or good practice will be identified, documented, and corrected by the appropriate project lead. Corrective measures will be completed in a timely manner. Items rejected by inspection will be tagged, segregated, and dispositioned in accordance with FEMP QA procedures.

### E.8.1 Engineering and Construction

All Title III inspections will be performed by the appropriate FDF QA qualified and/or subcontractor QA certified inspector. Punch list and final turnover acceptance activities will include the project FDF QA representative who signs the Final Acceptance Form verifying construction subcontractor closure for completed construction tasks.

#### E.8.1.1 Welding

Welding inspections consist of welder certifications, weld filler materials, and welded joints performed to AWS standards. All welding inspections will be performed by FDF QA and/or the QA subcontractor representative.

#### E.8.1.2 Geomembrane Liner

Geomembrane liners used in sediment basins will satisfy the requirements of OAC 2745-27-08(C)(2). The liners will be manufactured of at least 60-mil-thick, high-density polyethlyene; be physically and chemically resistant to attack by solid waste, leachate, or other materials which may come in contact

with the geomembrane; be seamed to allow no more than negligible amounts of leakage with the seaming material physically and chemically resistant to attack. Geomembrane seaming apparatus will be tested each day of use by peel and shear tests on scrap pieces at the beginning of each seaming period and every 4 hours thereafter. Nondestructive testing will be performed on 100 percent of the geomembrane seams. Destructive testing for peel and shear will be performed at least once every 550 ft of seam length.

E.8.1.3 Geotechnical

Geotechnical investigative sampling will be conducted to determine the geotechnical properties of soils within areas of excavation, including the coarse- and fine-grained materials for use in design and evaluation of excavation, dewatering, grading, borrow fill materials and site restoration. Penetration/resistance testing performed in the field will be used to correlate strength and consistency (or density) of soils. Geotechnical testing required to determine soil classification, moisture content, strength, and permeability will be performed on samples obtained from test borings for subgrade characterization. Typical QA/QC measures associated with geotechnical analysis are described in respective ASTM methods and are presented in Table E-4. Geotechnical physical soil testing is considered to be ASL E. Geotechnical laboratories will be pre-qualified by SEP QA.

E.8.1.5 Earthwork

SEP project QA will monitor the subcontractor earthwork activities to verify compliance to technical specifications. During construction, conformance and performance testing of the subgrade soil materials will be performed. For soil materials obtained from on-site borrow areas or stockpiles, visual inspections and conformance tests will be performed by construction QC prior to material excavation. For off-site borrow material sources, the visual inspection and conformance testing may be performed at the source location or as the borrow materials arrive at the FEMP. Initial evaluation of various soil types by construction QC personnel may be largely visual. Therefore, QC personnel must be experienced with visual-manual soil classification procedures (ASTM D 2488). Compacted fill materials placed to achieve grades will be tested by construction QC to specified test methods and frequencies. Areas of proofrolling or compacted fill that do not meet technical specifications will be

delineated and reported to the Construction Manager. The areas will be retested after any reworking by the subcontractor. The proofrolling and testing will be repeated until passing results are achieved. QC will monitor the repair and rework of subgrade that is damaged by moisture (causing softening) and insufficient moisture (causing desiccation and shrinkage), or by freezing. If such conditions are determined to exist, the suitability of the subgrade will be evaluated by moisture/density testing, continuous visual inspection during proofrolling, and checking consistency of cohesive soils using a penetrometer or other suitable field-expedient measurement device in suspect weak soil areas.

E.8.1.6 Surveying

Land surveying will be performed at all locations using the 1983 NAD coordinate system. Surveying results for construction process and final as-builts will be approved and certified by a State of Ohio Registered Professional Land Surveyor. All surveyed locations will be accurate to the nearest 0.01 ft elevation accuracy. Survey points will be located to within 0.5 ft horizontal accuracy and integrated into the existing FEMP Geographic Information System (GIS), and incorporated into the site Geotechnical Database and the SED. Periodically, the construction subcontractor will submit as-built surveys to indicate compliance of excavation lifts, residual contours, lines, and grades. The SEP QA representative will review the information in a timely manner and notify the construction manager of any noncompliance.

The Global Positioning System (GPS) may be used during surveying to mark locations for in-process and as-built topographic contours. Additionally, the GPS will be used extensively to mark sampling locations, extent of surface impacted areas, hot spots, and Geoprobe or other borings to determine depth of contamination. The use of GPS must be proceduralized with the necessary calibration program that will periodically verify GPS unit accuracy.

E.8.2 Environmental

The SCQ contains the acceptance requirements for field sampling, analytical analysis, and data validation. Special considerations outside the SCQ must be defined, technically justified, and the appropriate QA/QC specifications established.

E.8.2.1 In-Situ Gamma Technology

Quality Control performance specifications for gamma-sensitive detectors such as used in RTRAK and HPGe systems will be commensurate to field application. A discussion of in-situ gamma systems is provided in Appendix H, which includes related performance QC criteria required for acceptable field use. GPS readings must accompany in-situ gamma readings related to RTRAK and HPGe.

RTRAK

Current RTRAK performance criteria allows the system to scan surface areas for average gamma activity with confidence at 3 times the FRLs. Additional work is being performed to determine the proper ASL for data collected in the scannning mode. When completed, this work will include the related QC data pertaining to field screening methods.

HPGe

The HPGe system is capable of scanning for isotopic uranium, thorium and radium with confidence at and below primary COC FRLs. Calibration will be required at the beginning of a scanning event at the beginning of the day and at the end of the same day. Acceptable calibration criteria are described in the HPGe calibration procedure. The applicable ASL level can be B or D, depending on the area specific application and the respective performance criteria.

E.8.2.2 Sediment Basin

Sediment basin monitoring will be monitored in accordance with the IEMP and SWPPP programs. The IRDP will specify maximum acceptable sediment and uranium loadings before corrective actions must commence. The frequency and conditions for sampling will be specified in the IRDP.

E.8.2.3 Waste Characterization

Waste characterization for waste disposition materials will meet the SCQ requirements for sampling and analysis. Appropriate DQOs and PSPs will describe acceptable QC performance criteria.

E.8.2.4 Dust Monitoring

Dust control management will follow requirements specified in EPA Method 9, Visual Determination of the Opacity of Emissions From Stationary Sources, and EPA Method 22, Visual Determination of

Fugitive Emissions From Material Sources and Smoke Emissions From Flares. Observers must be EPA certified opacity readers and must recertify every 6 months in order to retain certification.

## E.9 MANAGEMENT ASSESSMENT

SEP Project Leads will assess effectiveness of IRDP implementation. The SEP management assessment plan will encompass SEP activities. At a minimum, an annual management assessment report will summarize project specific assessments, management surveys, and effectiveness of corrective action implementation. Process improvement actions should be applied to subsequent SEP planning and operations.

## E.10 INDEPENDENT ASSESSMENT

Planned and periodic independent assessments will be conducted on SEP activities to measure item quality and process implementation to established plans, procedures, and standards.

### E.10.1 Assessments

Assessments include inspection, surveillance, audit, peer review, and readiness review and should be performed at a frequency commensurate to the activity and as required by planning documents. Planning documents such as PSPs and IRDPs will designate a QA representative to conduct independent assessments. The QA representative will be responsible for verifying subcontractor quality performance to contract requirements. Assessments conducted by outside organizations will be facilitated by the QA representative. Personnel performing independent assessment must have no direct responsibilities in the area they are assessing. Results of assessments will be documented, reported to, and reviewed by management.

### E.10.2 Corrective Action

Nonconforming conditions will be identified and addressed promptly. Appropriate corrective actions will be taken and their adequacy verified and documented in response to the findings of the assessments.

## TABLE E-1

## QUALITY ASSURANCE CRITERIA CROSSWALK

| Sitewide Excavation Plan | FDF Quality Assurance Criterion - RM-0012 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Introduction | | | | | | | | | | |
| Purpose & Scope | √ | | | | √ | | | | √ | |
| Key Components of the Selected Remedy (SR) | | | | | | √ | | | √ | |
| Remedial Management Strategy | | | | | | | | | | |
| Contracting during RD & RA | | | | √ | | | √ | | | |
| Application of the SR | | | | | √ | √ | | | | |
| Application of New Technologies | √ | √ | | | √ | | | | √ | |
| Regulations, Permits, and Enforceable Agreements | | | | | | | | | | |
| ARARs (Appendix) | √ | | | | √ | | | | √ | |
| Permits | √ | | | √ | √ | | | | √ | |
| Enforceable Agreements | √ | | | | √ | | √ | | √ | |
| Natural Resource Trustees | | | | | | | | | | |
| RA Implementation | | | | | | | | | | |
| Contracting and Preparation | | | | | √ | √ | √ | | | √ |
| Existing and Anticipated Site-Wide Conditions for At-and Below-Grade Features | | √ | √ | | | √ | | | | |
| Area-Specific Excavation Control | √ | √ | √ | √ | √ | √ | | | | √ |
| Environmental Monitoring | | | √ | | √ | | | √ | | √ |
| Environmental Monitoring | | | √ | | √ | | | | | |
| Excavation Material Management | | | | √ | √ | | | √ | | √ |
| Remediation Maintenance Procedures | | | | √ | √ | | | | | √ |
| Encounters with Threatened and Endangered Species, Artifacts, and Historical Landmarks | | | √ | | √ | | | | | |
| Criteria for Implementation of the SR | | | | | | | | | | |
| Application of Selected Remedy Terminology | √ | √ | | | | | | | | |
| Precertification Sampling and Analysis (Environmental Reference Document) | √ | | | √ | √ | √ | | √ | | |
| Certification Sampling and Analysis | √ | | | √ | √ | | | √ | | √ |
| Project Health and Safety | | | | | | | | | | |
| Sitewide Health and Safety Matrix (appendix) | √ | | | | | √ | | | | |
| Remediation Access Controls | | √ | | | | | | | | |
| Emergency Preparedness | | | | √ | √ | | | | | |

QA Criterion 1 - Program/Organization
QA Criterion 2 - Personnel Training and Qualification
QA Criterion 3 - Quality Improvement
QA Criterion 4 - Documents and Records
QA Criterion 5 - Work Processes
QA Criterion 6 - Design
QA Criterion 7 - Procurement
QA Criterion 8 - Inspection and Acceptance Testing
QA Criterion 9 - Management Assessment
QA Criterion 10 - Independent Assessment

## TABLE E-2

## SAMPLING REFERENCE GUIDELINES

| Administrative Procedures | Reference Documents |
|---|---|
| QA/QC | SCQ Sections 4, 5, 10, and 11; Appendix A/Table 2-2; Appendix D; Apendix J |
| Chain of Custody | SCQ Volume I, Section 7.1;<br>RI/FS Fernald Project Policy and Procedures Manual, FPP-401, Section 5.1.12 |
| Corrective Action | SCQ Volume I, Section 15.2;<br>RI/FS Fernald Project Policy and Procedures Manual, FPP-210 |
| Daily Logs | SCQ Appendix J, Subsecton J.4.1 |
| Document Change Request | SCQ Volume I, Section 4.4.3.2;<br>RI/FS Fernald Project Policy and Procedures Manual, FPP-200 |
| **Field Procedures** | **Reference Documents** |
| General Drilling Practices | SCQ Section 5.2.1; Appendix J, Subsection J.4.2 |
| Subsurface Sampling | SCQ Appendix K, Section K.5.3 |
| Surface Sampling | SCQ Appendix K, Section K.5.1 |
| Abandonment | ASTM D5299-42 "Standard Guide for Decommissioning of Groundwater Wells, Vadose Zone Monitoring Devices, Boreholes and Other Devices for Environmental Activities";<br>OAC 3745-9-10 "Abandonment of Test Holes and Wells";<br>ASTM C150-92 "Standard Specification for Portland Cement" |
| Field Screening of Samples for Radioactive Contamination | SCQ Appendix K, Subsection K.5.3.2;<br>RI/FS Fernald Project Policy and Procedures Manual, FPP-600 |
| Decontamination | SCQ Appendix K, Subsection K.11 |
| **Sample Handling/ Laboratory Procedures** | **Reference Documents** |
| Classification, Transportation, and Shipment of FEMP RI/FS Samples | RI/FS Fernald Project Policy and Procedures Manual, FPP-601;<br>SCQ Appendix K, Subsection K.10; Volume I, Subsection 6.7;<br>Compendium of Superfund Field Operations Methods, Section 6.0 |
| Geotechnical Sampling and Testing Methods | ASTM reference standards as shown in Table E-4 |

# TABLE E-3

## RECORD KEEPING AND REPORTING REQUIREMENTS

| Record/Report | Method | Post-Remediation Document |
|---|---|---|
| Chronology - Activities Log | • Field log/WP log | |
| Performance Standards and Construction QA/QC<br>• Design criteria<br>• Construction specifications<br>• Field log | • Field log/WP log<br>• As-built drawings<br>• Change-order summary<br>• IIMS<br>• IEMP | CR, RAR, SCR |
| Certification - Area Operational/Functional<br>• Certification data for in-place materials (lab and field)<br>• Certification of substantive RCRA closures of HWMUs, i.e., CERCLA FRLS met<br>• Certification of characteristic WAC areas (TCLP/SW-846)<br>• OSDF manifesting requirements<br>• Maintain characterization of excess soil from point of generation through final disposition<br>• Accountability for volumes of excavated materials (estimated) | • Certification, in-place: IIMS<br>• Certification, HWMUs: IIMS<br>• Certification, TC WAC: IIMS<br>• OSDF Manifesting: IIMS<br>• Excess material: IIMS | CR, RAR, SCR |
| IEMP Monitoring Results: Groundwater (GMA), Surface Water, Air<br>Remediation Standards | | CR, RAR, SCR |
| Sitewide Risk Assessment | | SCR |
| Other OU documentation | | |
| Institutional Controls Documentation | | NRRP, SCR |

Notes:

CR = Certification Report
RAR = Remedial Action Report
SCR = Site Closeout Report
NRRP = Natural Resource Restoration Plan

## TABLE E-4

## SUMMARY OF ASTM GEOTECHNICAL PROCEDURES

| ASTM Test No. | Title |
|---|---|
| D 420 | Standard Guide for Investigating and Sampling Soil and Rock |
| D 421 | Standard Practice for Dry Preparation of Soil Samples for Particle-Size Analysis Determination of Soil Constants |
| D 422 | Standard Test Method for Particle Size Analysis for Soils |
| D 698 | Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort |
| D 854 | Standard Test Method for Specific Gravity of Soils |
| D 1452 | Standard Practice for Soil Investigation and Sampling by Auger Borings |
| D 1586 | Standard Test method for Penetration Test and Split-Barrel Sampling of Soils |
| D 1587 | Standard Practice for Thin-Walled Tube Sampling of Soils |
| D 2166 | Standard Test Method for Unconfined Compressive Strength of Cohesive Soil |
| D 2216 | Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock |
| D 2217 | Standard Practice for Wet Preparation of Soil Samples for Particle-Size Analysis and Determination of Soi Constants |
| D 2434 | Standard Test Method of Permeability of Granular Soils (Constant Head) |
| D 2487 | Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System) |
| D 2488 | Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) |
| D 3080 | Standard Test Method for Direct Shear Test of Soils Under Consolidated Drained Conditions |
| D 3550 | Standard Practice for Ring-Lines Barrel Sampling of Soils |
| D 4220 | Standard Practices for Preserving and Transporting Soil Samples |
| D 4318 | Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils |
| D 4767 | Standard Test Method for Consolidated-Undrained Triaxial Compressive Test on Cohesive Soils |
| D 5084 | Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall |
| D 5299 | Standard Guide for Decommissioning of Ground Water Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities |

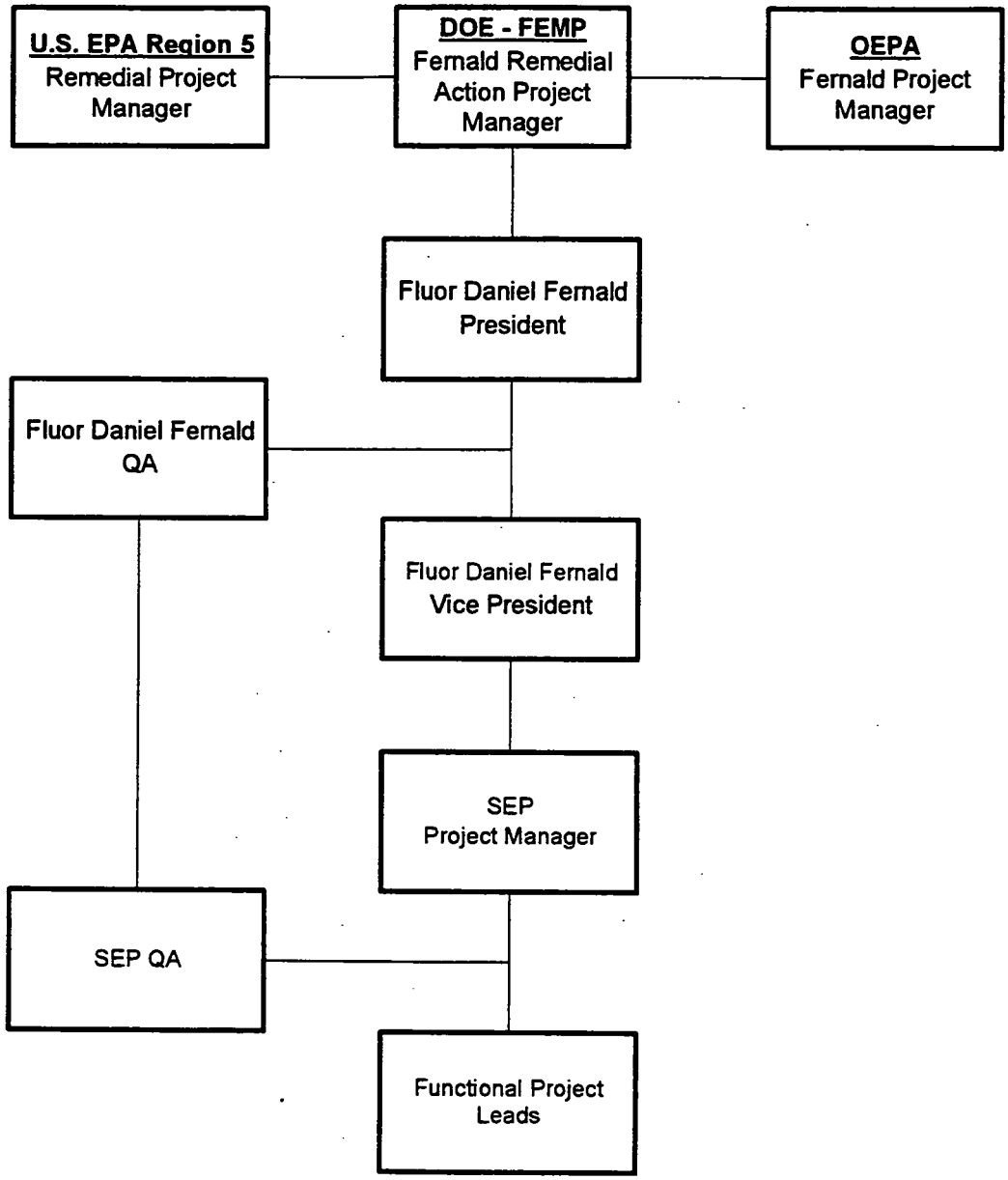



**FIGURE E-1 SEP QA PROGRAM ORGANIZATION**

# ATTACHMENT E

# CONSTRUCTION SOW QA REQUIREMENTS

A. GENERAL REQUIREMENTS

Refer to the General Provisions, Part 3, Quality Assurance Program, which requires that the subcontractor comply with the Fluor Daniel Fernald's Quality Assurance Program. Fluor Daniel Fernald's Quality Assurance Program Description (RM-0012) satisfies the requirements of ANSI/ASME NQA-1, EPA QAMS - 005/80, DOE Order 5700-6C and 10 CFR Part 830.120.

Fluor Daniel Fernald has incorporated quality requirements throughout the subcontract documents. Those quality issues not identified in other sections are incorporated within Part 9, Quality Assurance Requirements.

By complying with all requirements of this contract, including those contained in this section, the subcontractor will comply with parts of Fluor Daniel Fernald's Quality Assurance Program applicable to this subcontract.

B. SUBCONTRACTOR QUALITY PLAN REQUIREMENTS

Within 10 calendar days after Notice to Proceed, the subcontractor shall submit a Quality Plan, for Fluor Daniel Fernald compliance review, meeting the following requirements:

1. Organization

1.1 Describe, and show with an organization chart, the company organizational structure from the company's top manager through the lowest level of field management/supervision, including those responsible for assessing the adequacy of work on this project.

1.2 Provide an orientation outline for an orientation to be given by subcontractor managers/supervisors to employees on the necessity and expectation of performing quality work. Maintain on-site records and names of persons oriented.

2. Documents and Records

2.1 Describe how and by whom subcontractor documents and records are reviewed, approved, issued, used, revised and stored by the subcontractor. This should address internal subcontractor procedures, not Fluor Daniel Fernald review, etc., of subcontractor submittals.

2.2 Describe how and by whom Fluor Daniel Fernald and subcontractor-issued drawings, specifications, procedures, etc., are controlled to assure that only current revisions are used.

2.3 Describe how the subcontractor will document the completion of designated process steps and how these records will be reviewed by subcontractor management.

2.4 Describe what organizational position has the responsibility to maintain records and how the following requirements will be met:

A. Ensure controlled documents issued by Fluor Daniel Fernald are controlled by the subcontractor when reproduced and issued to lower-tier subcontractors such that only current, controlled revisions are in the field and used for work.

B. Fluor Daniel Fernald transmittal forms shall be signed, indicating receipt of documents, and returned to Fluor Daniel Fernald Construction Document Control (CDC).

C. Certified for Construction (CFC) engineering documents received by the subcontractor which do not have a "CDC/Controlled Copy" stamp with red control numbers shall be returned to CDC.

D. Superseded and canceled controlled documents shall be either destroyed or, if required by reference, marked "VOID" and removed from the field or work area. "VOID" drawings shall be maintained only in the subcontractor's field office.

E. Controlled documents reproduced by the subcontractor shall have a subcontractor control number designated on the document in red. The subcontractor shall maintain a log of its control numbers showing to whom they were issued.

F. No work shall be performed from documents other than those marked "CDC/Controlled."

G. Upon receipt of a Fluor Daniel Fernald transmittal of controlled documents, the subcontractor shall verify that the document numbers and revision numbers correspond to those on the transmittal. Deviations shall be reported to CDC.

H. Approved Design Change Notices (DCN) containing the "CDC/Controlled" stamp shall be annotated by the subcontractor on the affected documents.

I. The subcontractor shall routinely review documents used in the work to assure that current, controlled documents are in use, that DCNs are properly noted on the affected documents, and that work is performed in accordance with all applicable design documents.

## 2.5 Control of Subcontractor Submittals

2.5.1 The Subcontractor will describe how and by what subcontractor organizational position the following requirements are met:

A. Submittals will be made in accordance with the "Subcontractor Submittal Records Technical Specification" in Part 7.

B. Submittals will be reviewed for accuracy, completeness, and compliance with contract requirements and so marked in accordance with Part 3, General Provision, Specifications and Drawings for Construction.

C. The Subcontractor will ensure that QA records are not erased or obliterated when revised. Revisions shall be made using a line through the error or items deleted and shall be initialed and dated by the person making the revision.

3. Design Control (Applicable only when subcontractor provides design.)

3.1 Describe how control is maintained of designs produced by the Subcontractor or a lower-tier subcontractor. Include the following:

- Describe the process for ensuring that sound engineering/scientific principles and standards are used
- Describe how design criteria are transmitted from subcontractor to the designers
- Describe how the design process is controlled using design inputs/outputs, processes, changes, verifications, interfaces, records and organization interfaces
- Describe the process for ensuring that revisions to the final design (including "Use-As-Is" and "Repair" dispositions are subjected to the design control process and original review/approval process.
- Describe how issues of documents are controlled to ensure that the correct revisions are used for this work.

3.2 Describe how and by whom as-built drawings are maintained for both Fluor Daniel Fernald and subcontractor drawings. Include provisions for assuring that changes, including "Use as is" or "Rework/Repair" dispositions of nonconforming items, are subjected to the design and control and review/approval process as the original design. The subcontractor is not required to incorporate Fluor Daniel Fernald Design Change Notices (DCNs) in the red line marking. Redlined documents must be clearly identified as containing As-Built information. They must be a clear, concise, up-to-date, legible representation of the changes.

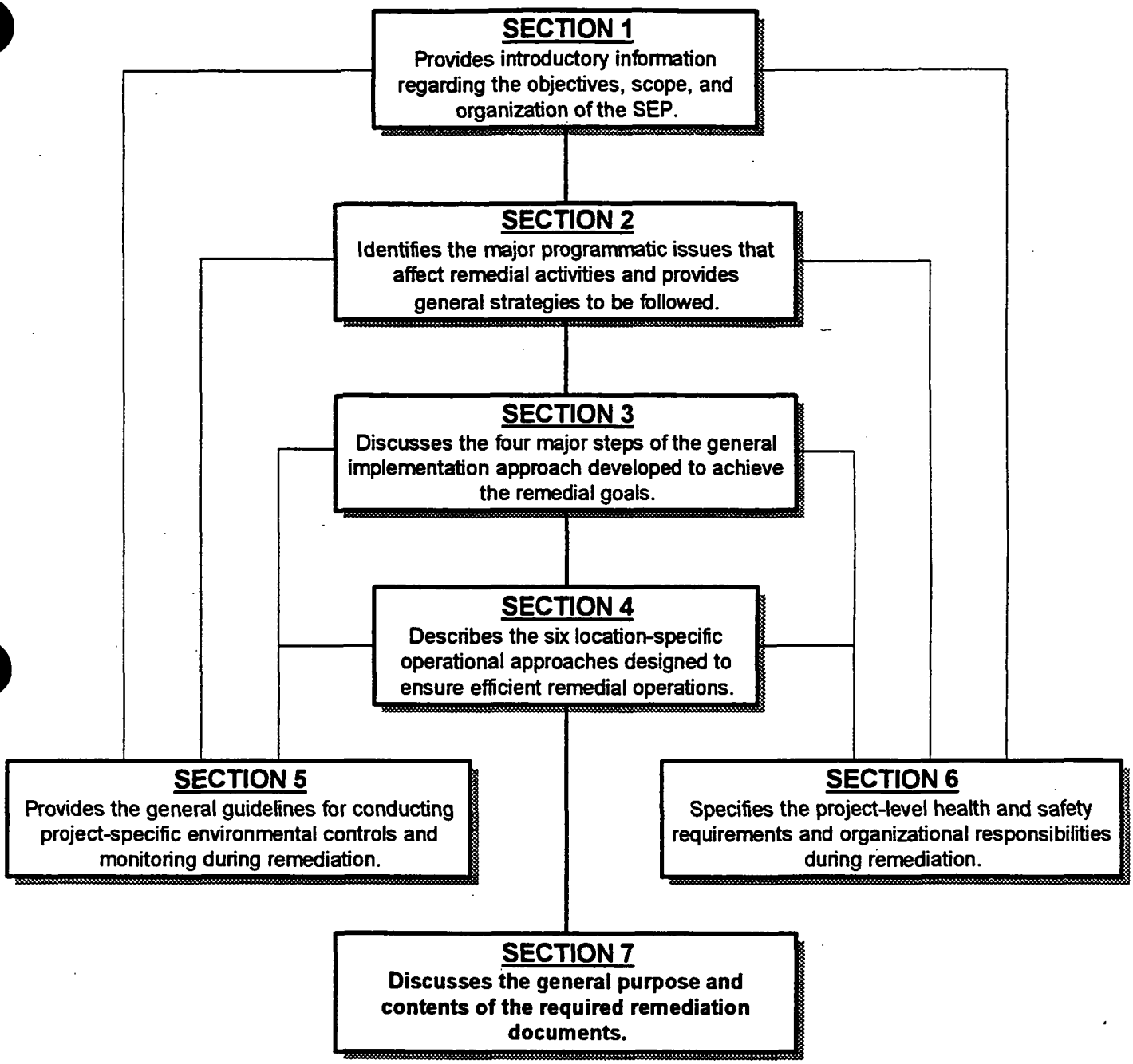
C. RESOLUTION OF QUALITY PROBLEMS

1. Quality problems identified by subcontractor personnel shall be identified, in writing, to Fluor Daniel Fernald's Technical Representative immediately after discovery. The Technical Representative may require that the subcontractor use Fluor Daniel Fernald forms to report quality problems.

2. Fluor Daniel Fernald shall have the right of rejection of any "rework," or "repair" or "accept-as-is" disposition.

The subcontractor shall identify and, where applicable, segregate nonconforming items so that they will not be used prior to resolution of the nonconformance.

# SITEWIDE EXCAVATION PLAN




**APPENDIX A** - Soil Remediation ARARs and TBCs
**APPENDIX B** - Sitewide Sequencing Plan
**APPENDIX C** - Constituent of Ecological Concern Selection
**APPENDIX D** - Wood Sampling Program
**APPENDIX E** - SEP Quality Assurance Project Plan (QAPP)
**APPENDIX F** - Implementation of Construction
**APPENDIX G** - Certification Design Rationale
**APPENDIX H** - Summary of Field Measurement and Laboratory Analytical Technologies
**APPENDIX I** - Sitewide Extent of Contamination by Constituent

**FIGURE E-1 SITEWIDE EXCAVATION PLAN ORGANIZATION**

# APPENDIX F

# IMPLEMENTATION OF CONSTRUCTION

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# APPENDIX F IMPLEMENTATION OF CONSTRUCTION

## INTRODUCTION

Appendix F presents material associated with the implementation of construction activities. Procurement and subcontracting of services is discussed in Section F.1. Standard practices associated with preparing a site for excavation are reviewed in Section F.2. Section F.3 summarizes the excavation of soil and at- and below-grade structures. Contingency plans for unexpected excavations scenarios are described in Section F.4. Management of excavated soil and debris is discussed in Section F.5. Section F.6 deals with the management of monitoring wells. Sections F.7, F.8, and F.9 deal with the restoration guidelines, maintenance activities, and surveillance and inspections.

## F.1 PROCUREMENT AND SUBCONTRACTING

Procurement and subcontract awards for all activities to support and implement remediation projects will generally be performed through fixed price/unit price subcontracts. The FDF acquisition system follows requirements of the Federal Acquisition Requirements (FARs) and is designed to ensure adequate and effective competition among prospective bidders/proposers. The procurement process is described in the following sections.

### F.1.1 Solicitation Process

The general solicitation process involves prequalification of prospective subcontractors, issuance of an Invitation for Bid, a pre-bid meeting and tour, receipt and review of bids, and award. Each of these steps is discussed in the following subsections.

#### F.1.1.1 Prequalification

Prospective construction/excavation subcontractors will be prequalified as the first step in the procurement process. Minimum qualifications will be established in a prequalification solicitation package for each project or group of projects. Such qualification criteria include:

- A minimum number of similar size and scope of projects successfully completed;
- An acceptable safety performance record;
- Minimum bonding and insurability requirements;
- Ability to complete the work; and,
- Availability of qualified personnel.

To be considered for the solicitation process, each prospective subcontractor must demonstrate compliance with these minimum qualifications. Those firms not meeting these minimum qualifications will be eliminated from further consideration.

#### F.1.1.2 Invitation for Bid

A statement of work, technical specifications, and design drawings will be prepared during the design phase of each project by the FDF Construction Engineering Planning and Bidding Group, with input

from Engineering, Health and Safety, QA/QC, and Procurement personnel, and other applicable disciplines. These will be combined with the General Conditions and Special Conditions to complete the contract documents. The contract documents will be sent to prequalified, prospective bidders in a solicitation package, which includes an Invitation for Bid specifying the date and time of the pre-bid meeting and the date and time bids are due. Development of a clear and complete solicitation package will be emphasized to avoid protests, minimize change orders, and establish the framework for compliance with ARARs and construction quality acceptance and health and safety requirements.

F.1.1.3 Pre-Bid Meeting and Tour

A pre-bid meeting will be conducted for each project, as necessary, to ensure a consistent understanding of the overall requirements and to solicit clarification requests prior to receipt of bids and contract award. Prospective bidders will be required to attend the pre-bid meeting and work site tour.

The pre-bid meeting is intended to provide an opportunity for all bidders to ask questions about the solicitation package, site policy, and existing site conditions. Questions will be answered in writing and will become an addendum to the solicitation package. Typical topics covered at the pre-bid meeting include introductions, bid and award process, statement of work and design, terms and conditions, project labor agreement, substance abuse program, PSHSP, QA/QC requirements, training, regulatory compliance, site security, access controls, temporary utilities and facilities, potable water sources, schedule and milestones, reporting, and submittals.

F.1.1.4 Receipt and Review of Bids

Bids will be received at the time and place specified in the solicitation package. Bids not received by the specified time will be returned to the bidder unopened. The bids will then be reviewed to determine if they are responsive to the terms and conditions of the solicitation package. Determination of responsiveness is based on proper completion of forms, acknowledgment of amendments, submission of bond, and any other submittal requirements specifically identified in the solicitation package. If a bid is determined to be nonresponsive, it will be eliminated from further consideration.

F.1.1.5 Subcontract Award

Following the determination that the bid is responsive, the FDF Contract Administrator will recommend and make the final award. Each solicitation package will specify the approximate dates of award and Notice to Proceed.

As the lead agency responsible for CERCLA activities at the FEMP, the DOE retains final approval authority for any procurement action which exceeds established dollar thresholds for each type of procurement action. Any projects with costs over the established limits will require approval by the DOE Contracting Officer prior to award. The time for this approval will be built into the schedule established in the solicitation package.

F.1.2 Equipment and Material Procurement

The majority of the equipment and materials for the excavation projects will be procured by the subcontractor(s) performing the remediation (construction). Procurement of equipment and material will be in accordance with specification requirements and the schedule included in the subcontract. Vendor data will be submitted by the subcontractor, in accordance with the submittal schedule, for review to ensure design and specification requirements are achieved. The subcontractor is responsible for maintenance and repair of procured equipment and material until final acceptance and turnover to FDF on behalf of the DOE.

## F.2 SITE PREPARATION

The IRDP plans and specifications for excavation will be developed based on information contained in the FEMP Integrated Information Management System (IIMS) (Section 2.3 of the SEP) to establish proposed limits of excavation. This information will include remedial design phase (Section 3.1 of the SEP). This information will be presented to the excavation subcontractor in IRDPs.

As described in Section F.1, soil excavation will be implemented by a subcontractor to FDF. The subcontractor will be responsible to prepare a detailed construction work plan that describes how the remediation shown on the drawings and described in the specifications will be implemented. The work plan will describe excavation tasks and activities necessary to complete excavation. The plans will present a remediation sequence and schedule and describe how excavation will be performed.

One of the first activities that will be completed by the subcontractor will be site preparation. Site preparation consists of construction activities and tasks necessary to prepare the site for actual soil excavation and at- and below-grade D&D activities. Site preparation consists of the following:

- Establishing excavation boundaries and access controls
- Establishing support areas
- Installation of decontamination facilities
- Clearing and grubbing
- Removal of surface material
- Implementation of surface water management systems
- Installation of erosion and sediment control measures
- Establishing survey controls
- Field layout of excavation
- Utility maintenance

Each of these activities is discussed in the following subsections.

F.2.1 Establishing Excavation Boundaries and Access Controls

Initial site preparation activities will include establishing defined construction areas and access controls in the field and posting appropriate signs at construction boundaries. Construction areas will be established based on potential radiological exposure, the type of work to be performed (excavation, D&D, etc.), and location. Areas will be posted based on radiological requirements. The types of radiological postings that are anticipated for soil excavation areas include:

- Radiation Area: Areas accessible to individuals in which radiation levels could result in an individual receiving a deep dose of radiation equivalent in excess of 5 mrem in 1 hour at 30 centimeters from the source or from any surface that the radiation penetrates.
- Contamination Area: Areas where removable contamination levels are greater than the removable values specified in Appendix D of RM-0020, but less than or equal to 100 times those values.
- Soil Contamination Area: Areas where radioactive material contamination exists in a matrix (e.g., soil) at levels exceeding natural background and has not been released for unrestricted use in accordance with DOE Order 5400.5, Radiation Protection of the Public and the Environment (DOE 1990).
- Controlled Area: Areas to which access is managed to protect individuals from exposure to radiation and/or radioactive material. Two categories of controlled areas are anticipated:
  - Category I (controlled area): Category I controlled areas are considered to have a potential for individuals to be exposed to low levels of radioactive contamination when working in the area. Eating, drinking, smoking, and/or chewing is prohibited within a Category I controlled area except for controlled break areas approved by the Manager of Radiological Control. Personnel and material monitoring is required to exit a Category I controlled area.
  - Category II (controlled area): A Category II controlled area is an area that has been surveyed and released from contamination controls. No personnel or material monitoring is required to exit.
- Radiological Buffer Area (RBA): Intermediate areas established to prevent the spread of radioactive material and to protect personnel from radiation exposure.

Fencing will be used to establish the construction boundary. The type of fencing used will be based on several factors, including location, amount of traffic in the area, expected depth of excavation, and radiological classification. Some examples of types of boundary fencing and their typical uses are:

- Chain link fencing, which may be used in highly congested traffic areas and may include pedestrian and vehicle access gates.
- Perimeter rope and stakes, which will be placed at the boundary of remote, relatively low contaminated areas. The construction area will be defined by stakes, yellow rope and signs. The perimeter rope will also define the radiological control boundary for the site. Chain link fencing and gates may be installed at vehicle access points.
- Construction fencing, which is a cloth, plastic or similar material used to delineate construction areas and restrict access.
- Silt fencing, which may be used in some locations to delineate construction boundaries and provide sediment control.
- Combination fencing, which is a combination of chain link fencing and rope. The rope and stakes will define the site boundary in remote areas. Fencing and gates may also be installed at the perimeter of sensitive areas such as the support area and retention basins.

The guidelines referenced in this section represent the current standards that are to be followed during the development of each IRDP (see Section 7.1 of the SEP). These guidelines may be revised/updated during the development of each IRDP to reflect changes in the current standards or specific conditions encountered in each of the remediation areas for which an IRDP is being developed.

### F.2.2 Establishing Support Areas

Support areas will be established in the vicinity of the construction area. Access to the construction area will generally be provided through a support area. The support area will include vehicle and personnel radiological monitoring and decontamination facilities, office and storage trailers, parking, storage yard, restroom, and other subcontractor facilities. If properly located, one support area may be used for multiple construction areas. The size, location, and complexity of each support area will vary depending upon area-specific requirements that will be identified in each IRDP (Section 7.1 of the SEP).

F.2.3 Installation of Decontamination Facilities

Decontamination facilities will be used to monitor and decontaminate personnel and equipment leaving a controlled area. Each IRDP will identify specific requirements related to the construction of new, or use of existing, decontamination stations. Personnel decontamination stations will generally be located in the support area at the entrance to the construction area. The stations will typically consist of one or more trailers containing radiological monitoring equipment, emergency showers, wash basins, and change-out room(s).

Similarly, equipment decontamination facilities will also be located in the support area and be used to decontaminate equipment before it leaves the construction area. Again, depending on its location, the facility may be used to support multiple remediation areas. In addition, it may be necessary to construct a decontamination facility for construction equipment that leaves the FEMP. These facilities will be used within a controlled area to minimize the spread of soil and mud onto haul roads and other areas of the site. These facilities will typically consist of vehicle and wheel wash facilities and be constructed where haul vehicles exit excavation areas onto dedicated haul roads within contaminated areas. Their function is to remove larger pieces of soil and debris from vehicles before they leave the excavation area. These facilities will typically consist of high pressure wash equipment and a concrete pad with a trench drain and sump. Water collected in the sump will be managed in accordance with existing site procedures. Specific decontamination requirements for each phase of remediation will be identified in area-specific IRDPs.

F.2.4 Clearing and Grubbing

Clearing (cutting and removal of trees) will typically be the first step of excavation. There is no evidence that the majority of trees are contaminated, based on the results of the wood sampling program (Appendix D). Therefore the upper sections of trees (greater than 2 feet above the ground surface) are considered to be below FRLs. The tree trunks and upper branches can be chipped and temporarily stored near the excavation for later use as mulch. This material will be hauled to a wood chipper located within the control area boundary. Logs/brush below FRLs will enter the chipper in the controlled area and exit the chipper outside of the controlled area. Utilizing the trees for mulch will

minimize the amount of organic material going into the OSDF and provide mulch to later restore the excavation.

The stumps, roots, and above-ground portions of trees with demonstrated contamination will be considered part of the contaminated surface soil and dispositioned according to the Waste Disposition Program (Section F.5).

### F.2.5 Removal of Surface Material

Surface material such as gravel, pavement, and railroad ties and ballast will be removed during excavation. This material will be managed according to the Waste Disposition Program (Section F.5).

### F.2.6 Implementation of Surface Water Management Systems

Surface water management systems will be installed during the site preparation phase to control surface water run-off/run-on, provide erosion and sedimentation control, minimize potential recontamination of remediated areas, and to minimize discharges of potentially contaminated surface water during remediation. Surface water management and erosion and sediment control facilities will be designed for each specific area as the IRDPs are developed. The following documents will be used as guidance and/or for reference during the development of specific plans:

- Rainwater and Land Development, Ohio's Standard for Storm Water Management Land Development and Urban Stream Protection. Ohio Department of Natural Resources (ODNR), Division of Soil and Water Conservation, Columbus OH. Second Edition, January 1996.
- Storm Water Pollution Prevention Plan (SWPPP) Checklist, Ohio EPA, Division of Surface Water, 1995.
- Construction and Material Specifications, State of Ohio Department of Transportation (ODOT), 1995.
- FEMP Storm Water Pollution Prevention Plan (SWPPP) (DOE 1996a).

Surface water management systems and sediment and erosion control measures will be designed using the appropriate design guidance, engineering judgment and experience from earlier phases of remediation. Surface water management systems will be designed to divert storm water run-off from

upgradient areas around excavations, collect run-off from areas that will be disturbed during excavation/ remediation, convey water to appropriate facilities, and provide the necessary and appropriate controlled and/or treatment facilities.

The overall approach for remediation activities and surface water management system practices will be performed to achieve, to the extent practical, the following objectives:

- Minimize storm water run-off from contaminated areas
- Minimize storm water run-on to remediated areas
- Minimize the acreage of disturbed area actually undergoing excavation at any one time
- Collect, control and provide adequate hydrologic and sedimentation wastewater/storm water capacity for run-off from disturbed areas
- Collect and treat potentially contaminated run-off in existing FEMP treatment facilities, as appropriate.

Run-on and run-off will be minimized through the installation and construction of diversion channels, diversion berms, culverts, and similar drainage control structures. The area disturbed at any one time will be minimized and disturbed areas will be stabilized in accordance with recognized design standards. Sumps, traps, basins, and/or ponds will be constructed in and near disturbed areas to provide sedimentation capacity. Collection channels will be constructed to collect and convey run-off from disturbed areas to sedimentation facilities. All storm water run-off currently conveyed to the controlled storm sewer system (former production and waste pit areas) will continue to be collected and treated through the AWWT until these areas have been certified clean. Run-off from radiologically contaminated areas (above FRLs) and potentially contaminated areas located outside of the controlled storm sewer system will be controlled, monitored, and treated if degradation of run-off quality is expected. As necessary, specific details on the control, monitoring, and potential treatment of storm water from each remediation area will be provided in subsequent IRDPs.

The general components of the surface water management system will consist of:

- Diversion channels and related devices
- Excavation sumps
- Collection channels
- Traps, basins and ponds
- Existing wastewater/storm water treatment facilities.

Surface water management systems will address run-off from disturbed areas during each phase of remediation (i.e. soil excavation). Run-off from all disturbed areas will be collected and conveyed to appropriate erosion and sedimentation control devices and/or wastewater treatment facilities prior to discharge. The Sitewide Sequencing Plan (SSP) conceptually addresses run-off for each phase of remediation.

F.2.6.1 Diversion Channels and Related Devices

Surface water run-on from areas that are upgradient or adjacent to a disturbed areas will be diverted away from disturbed areas and the associated surface water collection systems to the extent possible. Diversion devices may include diversion ditches, berms, grass swales, pipes, and other control devices used to convey storm water run-on away from undisturbed or previously remediated areas.

Diversion ditches will generally be constructed on relatively flat slopes (typically 1 to 5 percent slope). Because of their relatively flat slope, the ditches will typically be stabilized with vegetation. Diversion ditches convey large flows or are excavated with steeper bottom grades (25 percent) will be engineered and stabilized with erosion control matting or other appropriate stabilization techniques.

F.2.6.2 Excavation Sumps

Where practical, active areas of excavation will be graded to drain to collection points located within the excavation as remediation is performed. Temporary "Excavation Sumps" will be installed in these collection points. Excavation sumps will minimize the amount of run-off that may flow overland and provide sedimentation capacity near the active area of excavation. An excavation sump will include:

- Sediment Storage Capacity
- Sediment Filter Device(s)
- Pump.

Sediment storage capacity will be provided within the sump and below the pump intake. Water will be pumped out of the sumps and into sediment traps, basins, or ponds as necessary to keep the excavation area functional. Multiple excavation sumps may be used at one time. They will be continually moved as remediation progresses to keep them in close proximity to the active excavation. The excavation subcontractor may propose alternate means of controlling sediment within the excavation.

F.2.6.3 Collection Channels

Collection channels will be constructed at the downstream area of excavation to collect run-off from the disturbed areas and convey it to collection areas, traps, basins or ponds. Collection channels will be designed to handle the flow that will be generated in the upgradient areas and safely convey it to the appropriate facilities. Generally, collection channels in areas where overflow has the potential to discharge off site will be designed for the 10 year 24 hour storm. Channels will be lined with vegetation, matting material, or other material based on the design flow. When necessary, an infiltration barrier (typically clay) will be installed in collection channels where excavation to construct the channels extends into the sands and gravels of the Great Miami Aquifer.

F.2.6.4 Traps, Basins, and Ponds

Traps, basins, and ponds will be constructed to provide storm water management and sedimentation control. Run-off from disturbed areas will discharge directly into these facilities, or will be collected and conveyed to them through collection channels. The decision to use traps, basins, or ponds will be based on area-specific conditions and presented in IRDPs. These area-specific conditions include: site of disturbed area, existing conditions (before excavation), expected final conditions (after excavation), location of nearby water management facilities and other conditions. Traps, basins and ponds will be sited to provide both sediment and storm water storage capacity. Each facility will have appropriate outlet devices. Larger basins and ponds will have both principal and emergency spillways. Principal

spillways will include pumps, risers, outlet barrels, and open channels. Emergency spillways will generally consist of open channels.

F.2.6.5 Existing Water Control Facilities

Existing water handling and treatment facilities will be utilized during construction to take maximum advantage of existing FEMP infrastructure, and to minimize construction costs to the extent practical. These facilities include:

- Storm sewer (collection and conveyance) systems
- Storm water retention basins (SWRB)
- Advanced wastewater treatment (AWWT) facility
- Bio-surge lagoon.

F.2.7 Installation of Erosion and Sediment Control Devices

Storm water management system components (such as channels, basins, etc.) will also provide erosion and sediment control. However, additional measures will be used as required to provide control of erosion and sedimentation. These measures may include but are not limited to:

- Silt fence
- Temporary seeding
- Permanent seeding
- Crusting agents
- Other devices.

Erosion and sediment control components will be selected and utilized in general conformance with applicable ODNR, OEPA, and ODOT requirements. Specific components will be presented on the construction drawings and specifications of the IRDPs.

### F.2.8 Establishing Survey Controls

Existing benchmarks and survey monuments will be provided by FDF and shown on the drawings. The subcontractor will establish project site survey control points (including baselines and temporary benchmarks) in the field based on the coordinate system shown on the drawings.

### F.2.9 Field Layout of Excavation

All areas to be excavated will be staked in the field and approved by FDF before actual excavation.

### F.2.10 Utility Maintenance

FDF will identify and address all underground utilities in areas before excavation begins. All active utilities within areas to be excavated will be either permanently shut off or rerouted. Utility lines will be shown on the drawings. The excavation subcontractor will be responsible to protect utilities at the edge of areas to be excavated and remove those within the excavation as shown on the drawings. The Sitewide Sequencing Plan (SSP) (Appendix B) was developed to be performed in a logical manner by sequencing areas of the site that can be "shut down" without affecting future areas to be excavated.

## F.3 EXCAVATION

The IRDP plans and specifications for excavation will be developed based on information contained in the FEMP Integrated Information Management System (IIMS) (Section 2.3 of the SEP) to establish proposed limits of excavation. This information will include data collected during the RI/FS process as well as during pre-design investigations associated with the remedial design phase (Section 3.1 of the SEP). This information will be presented to the excavation subcontractor in IRDPs. When the limits of the excavation shown on the IRDP construction drawings are achieved, confirmation sampling for precertification and certification will be performed as described in Section 3.0 of the SEP.

As described in Section F.1, soil excavation will be implemented by a subcontractor to FDF. The subcontractor will be responsible to prepare a detailed construction work plan that describes how the remediation shown on the drawings and described in the specifications will be implemented. The work plan will describe excavation tasks and activities necessary to complete excavation. The plans will present a remediation sequence and schedule and describe how excavation will be performed. Depending on the existing conditions in an area, the plans will address the following excavation activities:

- Removal of shallow utilities
- Excavation of shallow soil
- Demolition of at- and below-grade walls and structures
- Deep excavation
- Excavation of special materials
- Removal of roads and transportation systems
- Removal of existing water management systems.

### F.3.1 Removal of Shallow Utilities

Shallow utility lines (typically less than 4 feet deep) include storm, sanitary, water, electric, gas, and sump lines. Excavation of utilities will include the utility lines themselves and backfill material which typically consists of sand or gravel and extends below the lines.

All utilities will be shut off or rerouted before excavation. Excavated material will be managed according to the Waste Disposition Program (Section F.5).

F.3.2 Excavation of Shallow Soil

Excavation of shallow contaminated soil (less than 4 feet) will be performed using standard excavation equipment, including scrapers, dozers, loaders, or similar equipment. Excavation Approaches A and E in Section 4.0 provide conceptual details regarding the procedures to be used in shallow excavation areas to meet remediation goals. The excavated soil will be managed according to the Waste Disposition Program (Section F.5).

F.3.3 Demolition of At- and Below-Grade Walls and Structures

This work includes the removal of interior walls, slabs, and structural steel below the existing ground/slab levels.

F.3.3.1 Interior Walls and Structures

The interior walls of basements that are not support walls will generally be removed before exterior wall and foundation removal. The type of equipment used will depend on the location and construction of the structures. This material will be managed according to the Waste Disposition Program (Section F.5).

F.3.3.2 Exterior Walls and Foundations

This work involves the excavation of soil along the outside of walls and foundations sufficient to remove the exterior walls and foundations and to provide access to the subbasement slabs and sumps. Slabs and foundations will be systematically cut or broken up within each working excavation area. During soil excavation and size reduction of slabs and foundations, water misting or other methods will be used for dust control. Excavation for foundations, slabs, and piers will be done with proper shoring techniques or will be laid back on a safe cut slope. Excavated material will be managed according to the Waste Disposition Program (Section F.5).

F.3.4 Deep Excavations

This work involves the excavation of below-grade building footers, slabs, grade beams, piles, and deep contaminated soil, including perched water and sand lenses. Deep excavation of contaminated soil will be accomplished with dozers, loaders, excavators, and backhoes. Storm water will be contained by the installation of storm water run-on/run-off controls, such as collection ditches, berms, and sumps. Excavation Approaches B, D, and F in Section 4.0 provide conceptual details regarding the procedures to be used in deep excavation areas to meet remediation goals.

As described in the Sitewide Sequencing Plan (Appendix B), surface water will generally be pumped into the existing storm water facilities on the FEMP. Perched groundwater will be addressed based on the specific conditions anticipated for each area. Perched groundwater will generally be pumped to the AWWT for treatment. However, if the groundwater has contacted a listed hazardous waste, pretreatment will be required prior to treatment through the AWWT. The IRDPs will describe the anticipated groundwater conditions expected in the areas, the conceptual requirements for dewatering systems (i.e., number and location of wells and pumping rates), the required pretreatment, and compare expected flow and quality to waste acceptance criteria for the AWWT facility. The subcontractor's Safe Work Plan will describe specific methods, equipment, and procedures that will be used for excavation dewatering.

F.3.5 Excavation of Special Materials

Special materials that are known to exist as a result of RI/FS data, pre-design data, or process knowledge should be addressed as early as possible in a given remediation area to allow for laboratory turnaround times, archaeological excavation or surveys, or to prevent potentially adverse environmental conditions. The requirements for excavation will be identified in the IRDPs. The subcontractor will describe the specific methods that will be used for special materials in the Safe Work Plan and the associated standard operating and health and safety procedures. The subcontractor will submit this information for review prior to commencing excavation activities. All special materials will be managed in accordance with the Waste Disposition Program (Section F.5).

Special materials that are encountered unexpectedly during excavation activities will be managed in accordance with contingency plan outlined in Section F.4.

### F.3.6 Removal of Roads and Transportation Systems

Existing roads will be used to transport impacted material from excavation areas to the OSDF and interim storage areas whenever possible. In some cases, new haul roads will be constructed to transport material. To the extent practical, paved roads will be used for hauling, because this will provide a more durable and reliable surface and will minimize dust generation. Also to the extent practical, nonessential vehicular traffic will be minimized on haul routes. In general, roads will remain in operation through remedial activities, as long as they are needed, and be one of the last materials remediated.

### F.3.7 Removal of Existing Water Management Systems

The FEMP maintains and operates a complex water management system. The major components of this system include a storm water collection system, storm water retention basins (SWRBs), and an advanced wastewater treatment (AWWT) facility. Excavation plans will utilize the components of the existing systems, to the extent practical, during remediation for conveyance and appropriate treatment. Proposed conveyance routes and treatment systems are described in the Sitewide Sequencing Plan (SSP) (Appendix B). Like roads, the water management systems will be among the last to be remediated.

## F.4 CONTINGENCY PLANS

Contingency plans are provided here for those circumstances when unexpected conditions or materials are encountered. Typically, these events will require special handling which cannot be managed through standard excavation guidelines or analytical methods. The three general categories of unexpected events are:

- The unearthing of materials which require special handling
- The discovery of unexpected cultural or historic resources
- Encountering contamination or soil conditions which may pose a risk to human health or the environment if standard excavation practices are used, or which are significantly different than expected, or which may affect other operations.

### F.4.1 Materials Which Require Special Handling

The following potentially contaminated or hazardous materials will require special handling if encountered during soil excavation activities. The management strategy for each category is provided in the following subsections. Planning for boxes, drums, bags or other containers potentially required for disposal or storage of non-conforming materials is the responsibility of each project. Each project is also responsible for recording and transferring information required for subsequent management of the discovered materials (Section F.5).

- Asbestos
- Construction debris
- Lead acid batteries
- Medical/Infectious waste
- Miscellaneous debris
- Nonpressurized containers
- Piping
- Pressurized containers
- Non-soil residues
- Tires

- Transformers
- Uranium metal.

It may be determined during the development of an IRDP that a specific area has the potential to contain significant quantities of one or more of these materials. In those instances, special programs for handling the material may be presented within the IRDP that incorporate the procedures outlined in the following subsections and area-specific economics of scale. In all cases, the Construction Manager or designee will coordinate field activities relevant to non-conforming materials. The SCEP Waste Programs Core Services (WPCS) Representative will be contacted for assistance in field decisions and, if applicable, movement of materials to appropriate FEMP storage and handling areas for characterization, treatment evaluation, and final disposition arrangements. Existing waste storage and handling facilities will be utilized for the processing of special materials until those facilities are dismantled. A new temporary central facility will be utilized thereafter. The location of the temporary facility will be selected to facilitate ease of operation and to prevent contamination of certified areas during the movement of affected materials.

The Impacted Materials Placement (IMP) Plan (DOE 1996b) includes further details regarding OSDF waste acceptance criteria and impacted material categories.

F.4.1.1 Asbestos

Potential forms of regulated and non-regulated asbestos-containing materials (ACM) include, but are not limited to, transite panels, floor tile, electrical cable, and piping insulation. All such material will be managed in accordance with the Waste Disposition Program (Section F.5).

In general, insulation from wrapped pipe will be segregated, optionally size-reduced, and double-bagged or equivalent. Other ACM meeting OSDF Category 5 criteria will be segregated from the soil, double-bagged for on-site disposition and, if necessary, containerized for interim storage. ACM which does not meet the OSDF WAC will be containerized and moved to a FEMP interim storage area for characterization, treatment evaluation, and final disposition.

F.4.1.2 Construction Debris

Construction debris will be managed in accordance with the Waste Disposition Program (Appendix F.5). In general, construction debris will be evaluated for OSDF Categories 2, 3 and 5. Category 2 material includes materials with a loose thickness of no more than 18 inches. Typical Category 2 materials include compactible construction materials and concrete. In contrast, Category 3 items are primarily structural and require individual handling and placement. These items may be no more than 4 feet high and must be of regular geometry. For Category 3 items, voids greater than 1 $ft^3$ must be filled with flowable, cohesionless material or a quick set grout. Category 5 allows case-by-case evaluation of materials requiring special handling, placement and compaction. If the debris does not meet one of these OSDF categories, it will be containerized and moved to a FEMP interim storage area for characterization, treatment evaluation, and final disposition.

F.4.1.3 Lead Acid Batteries

Lead acid batteries will be managed in accordance with the Waste Disposition Program (Appendix F.5). In general, intact lead acid batteries will be containerized and taken to a FEMP interim storage area for subsequent off-site recycling or disposal. Broken batteries and battery pieces will be segregated from soil, containerized, and stored for subsequent off-site disposal.

F.4.1.4 Medical/Infectious Waste

Examples of medical/infectious waste include syringes and vials. These and related materials will be managed in accordance with the Waste Disposition Program (Section F.5). In general, medical/infectious waste will be containerized and moved to a FEMP interim storage area for characterization, treatment evaluation, and off-site disposal.

F.4.1.5 Miscellaneous Debris

Miscellaneous debris includes oil/air filters, PPE, radiators, cable/wire, tools, heavy equipment, office materials and documents. These materials will be managed in accordance with the Waste Disposition Program (Section F.5). In general, miscellaneous debris will require evaluation against the OSDF WAC on a case-by-case basis .

F.4.1.6 Non-Soil Residues

Examples of non-soil residues that are readily identifiable in the field include, but are not limited to, green salt, black oxide, orange oxide, sump cake, and flyash . Veins or pockets of this material of sufficient size to excavate will be field screened and surveyed to determine radionuclide content. If field screening indicates that the material is a radionuclide-bearing residue, appropriate health and safety procedures must be implemented (Section 6.0 of the SEP). Non-soil residues will be managed in accordance with the Waste Disposition Program (Section F.5).

In general, the material will be excavated, containerized and moved to a FEMP interim storage area where it will be evaluated for sale as nuclear material. If the residues do not meet nuclear material criteria or if a buyer cannot be found, they will be characterized as waste, evaluated for treatment, and dispositioned off site. Non-uranium residues will be stockpiled or containerized based upon operational contingencies. These materials will be evaluated against OSDF WAC and will be managed as Category 1 material if acceptable. Some non-soil residues may require additional physical processing, including dewatering, compaction, or blending with impacted soil before OSDF placement. Non-uranium residues which cannot be placed in the OSDF will be containerized for off-site disposal.

F.4.1.7 Containers

Containers include intact drums, metal and wood boxes, cans, and other types of containers. Such materials will be managed in accordance with the Waste Disposition Program (Section F.5).

In general, containers will be segregated from excavated soil and visually inspected for leaks and indications of the contents. When safety considerations allow, the container will be opened and a description of contents recorded on a Visual Inspection Form. Leaking containers will be either overpacked or repacked before movement from the immediate area of discovery. When these actions have been completed, containers will be moved to a FEMP interim storage area for characterization, treatment evaluation, and final disposition. Off-site disposition is expected for most containerized materials. Empty containers will be managed as OSDF Category 2 debris and staged in an approved stockpile for on-site disposition. The containers will be dismantled as necessary to meet Category 2 criteria.

F.4.1.8 Pressurized Containers

Pressurized containers that may be encountered include aerosol cans, Freon containers, gas cylinders, propane tanks and fire extinguishers. These materials will be managed in accordance with the Waste Disposition Program (Section F.5).

In general, pressurized containers will be segregated from the excavated soil and container integrity evaluated. All intact pressurized containers will be handled as though they contain material. Intact containers will be overpacked and moved to a FEMP interim storage area where they will be emptied or otherwise appropriately managed. Any contents will be characterized, evaluated for treatment, and dispositioned either on or off site. The OSDF IMP Plan prohibits pressurizable gas cylinders; therefore all empty pressurized containers must be punctured, crushed or cut so that the interior is open to the atmosphere before OSDF disposition. Damaged pressurized containers (i.e., no longer containing material at the time of discovery) will either be disposed off site or managed as OSDF Category 2, 3, or 5 debris for on-site disposition.

F.4.1.9 Piping/Pumps

Drain lines, sewer lines and process piping and pumps are expected to be encountered during soil excavations. To the extent possible, excavations will be designed so that sections of piping are exposed intact. One end of the piping will then be elevated, cut, and any flowable material contained therein drained into a container. The length of piping may then be capped and removed.

Containerized pipe and pump contents will be managed in accordance with the Waste Disposition Program (Section F.5). In general, this material will be moved to a FEMP storage area and evaluated for on-site treatment in the AWWT or disposal off site. The empty piping and pumps will also be managed in accordance with the Waste Disposition Program (Section F.5). Typically, they will be managed as OSDF Categories 2 and 3. The piping may be no more than 10 feet in length; voids greater than 1 $ft^3$ must be filled with flowable cohesionless material or a quick set grout. Characterization of impacted materials (piping, soil, others) from trenches that contain process piping will include review of Waste Programs Material Evaluation Form (MEF) files for containerized process residues/equipment that were managed in the associated plant.

F.4.1.10 Tires

Tires will be managed in accordance with the Waste Disposition Program (Section F.5). In general, tires will not be placed in the OSDF. They will be containerized and moved to a FEMP interim storage area for characterization, treatment evaluation, and final off-site disposition.

F.4.1.11 Transformers/Electrical Equipment

Transformers and electrical equipment will be managed in accordance with the Waste Disposition Program (Section F.5). In general, this material will be segregated from the excavated soil and evaluated to determine if it contains fluids. Empty transformers will be evaluated against the OSDF WAC and, if found to be acceptable, managed as OSDF Categories 2, 3 or 5. If an empty transformer does not meet one of these OSDF categories, it will be containerized and moved to a designated FEMP interim storage area for characterization and treatment evaluation, with arrangements for off-site disposal. Transformers containing fluid will be containerized for interim storage and management. The contents will be evaluated for treatment, drained and containerized by WPCS. Containers of drained transformer fluid will be disposed at appropriate off-site facilities in accordance with the Waste Disposition Program (Section F.5). After appropriate flushing (if required), emptied transformers will be filled with grout or crushed to meet the OSDF WAC and will be managed as OSDF Category 2, 3, or 5 material.

F.4.1.12 Uranium Metal

Uranium metal may be encountered in various forms, including but not limited to derbies, ingots, and irregularly shaped scrap. These metals will be managed in accordance with the Waste Disposition Program (Section F.5). In general, uranium metal will be segregated and moved to a FEMP interim storage area and evaluated for classification and sale as nuclear material. If the metals do not meet nuclear material criteria or if a buyer cannot be found, they will be characterized as waste, and disposed off site.

F.4.2 Unexpected Discovery of Cultural or Historic Resources

The FEMP site is located within a 4.8 kilometer-wide (3 mile-wide) subterranean valley formed as a result of Pleistocene glaciation. The remaining glacial overburden made the valley soil rich for

farming. The FEMP site and surrounding area are also located near the Great Miami River, which provided a source of water for early residents. Historically, these combined factors made the FEMP site and surrounding area desirable as a settlement place. As a result of this desirability, the area is rich with diverse cultural resources.

The DOE acknowledges the cultural and scientific value of cultural resources at the FEMP site and recognizes its responsibility for stewardship of these cultural resources. DOE-FEMP's proactive approach to protecting cultural resource at the FEMP site and land impacted by FEMP activities consists of identifying, avoiding (if possible), and mitigating (when necessary) any cultural resources affected by actions at the FEMP.

Management of cultural resources, particularly archaeological sites, is mandated by the National Historic Preservation Act (NHPA, 16 U.S.C. §470), the Native American Graves Protection and Repatriation Act (NAGPRA, 25 U.S.C. §3001, et seq.), and the Archaeological Resources Protection Act (ARPA, 16 U.S.C. §470aa-470ll). The associated regulations for these laws are found at 36 CFR 800, 43 CFR 10, and 43 CFR 7, respectively. These laws and associated regulations ensure that archaeological resources are managed appropriately. Section 106 of NHPA ensures that DOE takes into consideration the effect of its undertakings on properties eligible for listing on the National Register of Historic Places, and that the Advisory Council on Historic Preservation has an opportunity to comment on those effects. NAGPRA and 43 CFR 10 establish that the rightful possession and control of Native American human remains, funerary objects, sacred objects, and objects of cultural patrimony that are discovered at the Fernald site belong to the most closely culturally affiliated federally-recognized tribe. These regulations and their implications to remediation activities at the FEMP are summarized in Appendix A.

DOE has finalized a Programmatic Agreement with the Advisory Council on Historic Preservation and the Ohio Historic Preservation Office that will streamline the NHPA Section 106 consultation process. In addition, DOE has completed surveys of all areas scheduled for disturbance during remediation (approximately 450 acres). Four sites have been identified as requiring additional investigation if they are scheduled for disturbance in the future. Monitoring provisions will be included within the

individual IRDPs to ensure that previously identified sites are not disturbed and that any inadvertent discoveries in previously surveyed areas are managed accordingly. Additional areas of the Fernald site will only be surveyed if activities are proposed in the future that result in a disturbance.

This plan provides a method to ensure compliance with the NHPA, NAGPRA, and other applicable cultural resource regulations in the event personnel, sub-contractor personnel and/or any other persons working or assisting with a project (performing any ground disturbing activity) discover a cultural resource/historic property.

F.4.2.1 Procedural Responsibilities

In the event that a remedial action affects an unidentified cultural resource, project staff will ensure safe handling by isolating the affected area until an emergency on-call contractor (within 4 hours) can perform the necessary data recovery. A contract is in place for such eventualities and has been used during installation of the public water supply. The DOE will consult with the appropriate parties, such as the State of Ohio Historic Preservation Office, pursuant to federal regulations (36 CFR Part 800) to determine an appropriate course of action as necessary. The DOE will avoid and minimize any adverse impacts to the extent practicable.

A site procedure at the FEMP (currently designated as SP-0003) has been established to formalize the notification and consultation process that must follow the unexpected discovery of cultural resources. All ground-disturbing field activities must comply with that site procedure.

F.4.2.2 Native American Graves Protection and Repatriation Act (NAGPRA)

In the event that human remains or an associated funerary object, unassociated funerary object, sacred object, or object of cultural patrimony are discovered during ground disturbing activities, the appropriate Native American tribes will be consulted to expedite removal of the remains and/or objects. While this consultation takes place, the DOE must cease activity in the immediate area and make a reasonable effort to secure the remains and/or objects. Work stoppage in the immediate area could last up to 30 days.

F.4.2.3 Training

Subcontractors will be trained to this plan (e.g., how to recognize a cultural resource), as needed. Additionally, the substantive text of this section will be included in any pertinent procurement packages in order for the subcontractor to estimate potential down time.

F.4.3 Unexpected Contamination/Soil Conditions

In the iterative process of excavating, precertifying, certifying, and re-excavating areas, some excavations may progress to a point where continued work would cause the remedial action to differ from the design. Such a difference could include:

- A contaminated area that extends outside the area of feasible storm water control
- An encounter with soil types or depths of excavation that were not within the design parameters
- A contaminated area that extends laterally to impact site facilities that are currently active or have a planned future use.

In cases where the difference would not be considered significant, it will be addressed via the FEMP design change process. In the event the difference is significant from the design, one of the following options will be exercised:

- Revise the design within the guidelines established in this SEP, submit a letter describing the design change to the regulatory agencies, and proceed with excavation.
- Stop the job at the boundary of the problem condition and address the continued excavation in a subsequent Integrated Remedial Design Package.
- Discuss optional approaches with the regulatory agencies to determine if the area must be addressed as an exception to guidelines otherwise presented in this SEP.

## F.5 EXCAVATED MATERIAL MANAGEMENT

This appendix provides guidelines for managing excavated soil, debris, vegetation, and special materials. Details for management of these excavated materials, where different or more detailed than contained herein, will be provided in the area-specific IRDP (Section 7.1) and will be based on the guidelines established in this section for staging, disposition, data-tracking, and management of impacted materials. Additionally, health and safety issues (Section 6.0) may be associated with some special materials. Further discussion of excavated material management, staging, and disposition procedures is provided in the following subsections.

### F.5.1 Conceptual Waste Disposition Process

The objective of the waste disposition process is to integrate all aspects of remediation associated with the handling, excavation, removal, and disposal of soil, debris, and special materials. Four basic steps have been identified for this process (Figure F.5-1):

- Waste planning, where waste streams are identified and characterized
- Waste generation, where waste is excavated or removed from existing stockpiles
- Waste stream segregation into appropriate OSDF and off-site waste categories
- Waste storage, treatment (if applicable), and disposal

On Figure F.5.1, the process begins with waste identification, data review, and characterization activities to estimate excavation volumes of the waste streams (Section 3.1). Waste planning is finalized by preparing the IRDP, which contains the remedial design to conduct the excavation (Section 3.2). Excavation activities generate the waste and it is segregated into the appropriate OSDF and off-site categories for storage, treatment, and disposal (Section 3.3). Excavated material that is not designated for disposal will be placed under one of the following disposition options:

- Reuse of the material on site (e.g., soil with COCs below FRLs)
- Sale of noncontaminated materials (e.g., scrap metal)

F.5.2 Off-Site Disposal

Material that exceeds the radionuclide, chemical, or physical WAC will be profiled as such and staged for off-site disposal as bulk or containerized material (Figure F.5-1). Bulk materials may be segregated further based on the need for treatment prior to disposal (i.e., the presence or absence of the toxicitiy characteristic). Containerized materials may include special materials (Section F.5.4) Or material that could not be processed to meet the OSDF WAC.

A Field Transfer Log (FTL) will be completed at the initial excavation point prior to moving the material to the designated staging area. The FTL will contain the characterization profile of the material, the approximate volume, the original Material Transfer Location (MTL) (i.e., the initial excavation area), and the destination MTL. All FTLs will be delivered to the Waste Acceptance Operations Project (WAOP) so the material transfer can be matched to its source and destiny via data input to the IIMS. The IIMS will be used to monitor the status of materials staged for off-site disposal.

F.5.3 Placement of Material in the OSDF

Bulk and discrete placement of material in the OSDF is tied to the five general waste-stream categories defined for the OSDF:

- Category 1 Soil and soil-like material
- Category 2 Debris for bulk placement
- Category 3 Debris for individual placement
- Category 4 High-organic content (humus and vegetation)
- Category 5 Case-by-case approval

As defined in the OSDF Impacted Materials Placement Plan (IMPP), Revision G, soil and soil-like material (Category 1) to be disposed in the OSDF is material that:

- Is compactable using standard construction equipment
- Contains no free liquids

- Has no hard agglomerations between 1 and 12 inches in size, except for till or ash with less than 25 percent natural agglomerations or manmade debris.

During the construction of the first OSDF cells, soil determined to meet the OSDF chemical, radionuclide, and physical WAC will be as specified in the IRDP for temporary staging. When the disposal cells become available, staged soil will be taken directly to the OSDF for placement. A soil/debris mix will be managed as a soil-like material when placed in the OSDF.

Debris generated from removal of at- and below-grade structures that is to be placed in the OSDF as bulk material or individual pieces (Categories 2 and 3) consists of:

- Material that is moderately compactable with a bulldozer (e.g, concrete rubble);
- Rebar and associated concrete block
- Large building materials less than 10 feet long by 18 inches wide
- Drained equipment
- Piping greater than 12 inches in diameter that is split in half
- Material that is greater than 25 percent natural agglomerations or manmade debris
- Material that has no free liquids.

Based on the schedule dictating placement of materials in the OSDF, debris may be temporarily staged in a designated area until sufficient soil is available to comply with the OSDF requirements for a proper soil/debris balance to meet the WAC.

Organic materials (Category 4) that may be placed in the OSDF include shrub and tree roots removed during excavation activities. Other pertinent materials may include lumber debris and organic material removed from the Solid Waste Landfill. Shrubs and trees will be managed according to the sitewide protocol established by the tree tissue sampling program (Appendix D). Woody plant species encountered before excavation activities will be cut approximately 2 inches from their base and stockpiled in a certified clean area to be used as mulch cover. The remaining wood material (stumps and associated root system) will be handled and disposed of with the excavated soil.

Category 5 materials that will be evaluated on a case-by-case basis include soil treated to remove the toxicity characteristic and special materials (Section F.5.1.2).

Regardless of the category assigned to material designated for placement in the OSDF, tracking will be conduced on all materials using the FTLs and MTLs described for off-site material tracking (Section F.5.2).

### F.5.4 Special Materials

Special materials may be identified in pre-excavation investigations or during excavation activities. When present, these waste streams require will special handling due to potential health and safety concerns. The special material categories are:

- Asbestos
- Non-pressurized containers
- Pressurized containers
- Piping and sumps
- Non-soil residues
- Transformers
- Lead acid batteries
- Uranium metal
- Medical/infectious waste
- Miscellaneous debris
- Tires

Further description of these categories is provided in Section F.4.1 along with the contingency plan for handling their excavation. Portions of these waste streams will be eligible for OSDF disposition, but may require physical processing, sampling and analysis, or interim containerization. The balance will be evaluated for off-site disposition. The general protocols for managing special materials are provided in Figures F.5-2 through F.5-12.

### F.5.5 Management of Soil with COCs below FRLs

Soil with COCs below FRLs will be generated from both remedial and nonremedial (i.e., maintenance, general nonremediation construction, and removal actions) activities. In some cases, soil with COCs below FRLs will be used as borrow material for construction of the OSDF liner, for surface run-on/run-off control in remediated areas, and/or for backfilling excavations in certified areas. However, no soil may be used for borrow purposes if FRLs are exceeded, and soil used as borrow material in remediated areas will be characterized sufficiently to ensure that recontamination is not occurring.

## F.6 MONITORING WELL MANAGEMENT

Monitoring wells located within each of the remediation areas (Section 1.2.2 of the SEP) will be plugged and abandoned, or excavated as appropriate, to facilitate remedial activities. Portions of the existing monitoring well network will be maintained, as described in Section 3.0 of the IEMP, to ensure that the appropriate groundwater monitoring data continues to be generated throughout remedial activities at the site. The location of specific wells within each of the remediation areas, and the expected status of plugging and abandonment activities, will be addressed in the area-specific IRDPs (Section 7.1 of the SEP).

### F.6.1 Plugging and Abandonment

Monitoring well plugging and abandonment will be conducted in accordance with existing site procedures, Appendix J of the SCQ, and OEPA's well abandonment standards promulgated in OAC 3745-9-10. Information on the abandonment of these monitoring wells will be included in the IRDPs prepared for these areas.

### F.6.2 Monitoring Well Excavation

Soil excavations in some areas of the site will extend to a sufficient depth whereby 1000 series wells may be removed intact during excavation, without going through normal plugging and abandonment procedures. SCEP personnel will coordinate the removal of these wells with the Aquifer Restoration Program (ARP) to ensure the integrity of the existing groundwater monitoring program is maintained.

### F.6.3 Monitoring Well Preservation

Section 3.0 of the IEMP describes the existing groundwater monitoring program and identifies the monitoring wells that will be maintained during remedial activities. These wells will also be identified in the IRDPs and protective measures, such as construction fencing, will be specified to ensure these wells are physically protected during field activities. New monitoring wells may be installed in some areas after the completion of excavation activities to ensure appropriate groundwater monitoring data is generated under the IEMP groundwater monitoring program.

## F.7 RESTORATION GRADING GUIDELINES

The DOE has made the commitment to accelerate the restoration of natural resources into the remedial design process whenever possible, This commitment will add some complexity into the restoration guidelines for design purposes, but will inevitably reduce the cost and the need for repeatedly disturbing the land. The ability to accelerate the natural resource restoration process will also be dependent on the range of environmental conditions in which a proposed habitat may thrive. The development of restoration guidelines is generally a three-phase process that will end with establishing vegetation to develop the proposed habitat for the end land use. The three major phases include:

- Interim grading, to be performed after certification. It will begin after remediation/excavation is completed and will start the restoration process
- Final grading, to include complete restoration grading including the use of borrow material, additional excavation, placement of topsoil and construction of required drainage features
- Habitat development, to include planting the required vegetation for the proposed land use

These phases are described below.

### F.7.1 Interim Grading

Rough or interim grading activities will be performed after each area is certified. Rough grading will be performed to flatten slopes (for stability) and begin the process of grading the remediated area in accordance with the restoration concept. This process will be developed in consultation with the Natural Resources Trustees as the excavation design and actual excavation is performed. Rough grading will consist of grading material from within the area for surface water draining and to begin development of the site into the restored land use type.

### F.7.2 Final Grading

Final grading will include construction of drainage features, placement of topsoil, and other steps necessary to properly grade the area. This may include bringing in additional soil from other areas to restore the site.

F.7.3 Habitat Development

Vegetation will be established for the specific habitat. Vegetation will be established by seeding, tree planting and other methods as appropriate for the habitat. Specific design criteria for the design and development of these habitats will be identified in relevant IRDPs (Section 7.1 of the SEP) and updated in the NRRP. After final grading, habitat restoration, which will consist of establishing appropriate vegetation, will be performed. The following general guidelines were developed for wetlands, open water areas, woodlands, riparian, and grasslands. These habitats have been identified as the feasible natural environments at the FEMP.

F.7.3.1 Wetlands

Wetlands require very specific environmental conditions that are affected by saturation, slopes, water depth, and other mitigating factors. Gradual shoreline slopes of 6 (horizontal):1 (vertical) or flatter to a depth of 1 to 3 feet will encourage plant species diversity and feeding areas. Poorly drained soil types are essential to supply an impermeable substrate for holding water. For a wetland to be functional it must have adequate amounts of water during appropriate times of the year. Subsurface tile drains must be broken or removed if they are identified in a proposed wetlands location.

F.7.3.2 Open Water Areas

Open water areas require slopes of 3 (horizontal):1 (vertical) or higher to a depth of 8 to 20 feet. Soils containing textured and silty clays are most desirable.

F.7.3.3 Woodlands

A woodlands habitat may accept a range of soil conditions to thrive. They can be located in any area on the FEMP that is well drained.

F.7.3.4 Riparian Areas

Soil conditions that would support a riparian habitat would have to be located along a linear topographically low area that receives surface water run-off from the surrounding area. Paddys Run currently supports the only naturally occurring riparian environment at the FEMP.

F.7.3.5 Grasslands

Grassland habitat would require poorly drained soil conditions, and could be located in a wide range of areas on the FEMP property.

## F.8 REMEDIATION MAINTENANCE ACTIVITIES

This subsection discusses maintenance activities that will be implemented during remedial excavation. Post closure maintenance of excavated remediation areas (other than the footprint of the OSDF) will be addressed within the Natural Resources Restoration Plan (NRRP) as part of the site's restoration activities. Postclosure maintenance of the OSDF is specifically addressed within the "Post-Closure Care and Inspection Plan, On-site Disposal Facility."

Maintenance activities during remedial excavation include slope stabilization, sediment basin cleaning, drainage channel maintenance, and winterization.

### F.8.1 Slope Stability

Unstabilized slopes can result in unnecessary erosion. Therefore, remedial construction subcontractors will be required to stabilize inactive slopes via seeding, spraying of crusting agents, or other suitable means. Specific stabilization methods and the time requirement for application of stabilization methods will be presented in the specifications as part of the Integrated Remedial Design Packages for specific areas. Unstabilized slopes that present a safety hazard will be handled via health and safety procedures presented in plans described in Section 6.0 of the SEP.

### F.8.2 Sediment Basin Maintenance

Sediment basin cleanout levels will be determined in the design effort. Material will be removed from the basins by the subcontractor when the sediment level approaches the cleanout level. The removed material may be managed, in accordance with the Waste Disposition Program (Section F.5), as if it were soil originating from the area that drains to the sediment basin.

### F.8.3 Drainage Channel Maintenance

Drainage channels may require mowing and occasional repairs in order to convey water in a controlled manner. The subcontractor will be required to maintain vegetation in and around drainage channels within the subcontractors limits of work, and to repair channels to conform to the applicable construction specifications and drawings.

### F.8.4 Winterization Activities

Winterization encompasses those activities necessary to ensure that an excavation area can be reentered for excavation purposes with minimal time needed for construction to restart. Pre-shutdown activities include:

- Subcontractor observation of all exposed surfaces within the subcontractors work limits, with follow-up stabilization as determined by that observation
- Subcontractor observation of all drainage channels and sediment and erosion control devices, with followup maintenance as determined by that observation
- Subcontractor identification of any liquid lines susceptible to freezing with subsequent modification of those lines to prevent freezing or inclusion of those lines in the plan mentioned in the next activity
- Subcontractor submittal of a plan which itemizes winter maintenance actions and assigns those actions to appropriate personnel for those project systems and/or components that cannot be safely left unobserved and/or unmaintained over the winter
- Followup SCEP site inspection to ensure that the above winterization steps have been addressed.

## REFERENCES

U.S. Dept. of Energy, 1996a, "Storm Water Pollution Prevention Plan," RM-0039, Rev. 0, Fernald Environmental Management Project, DOE, Fernald Area Office, Cincinnati, OH.

U.S. Dept. of Energy, 1996b, "Impacted Materials Placement Plan," Rev. G, Fernald Environmental Management Project, DOE, Fernald Area Office, Cincinnati, OH.

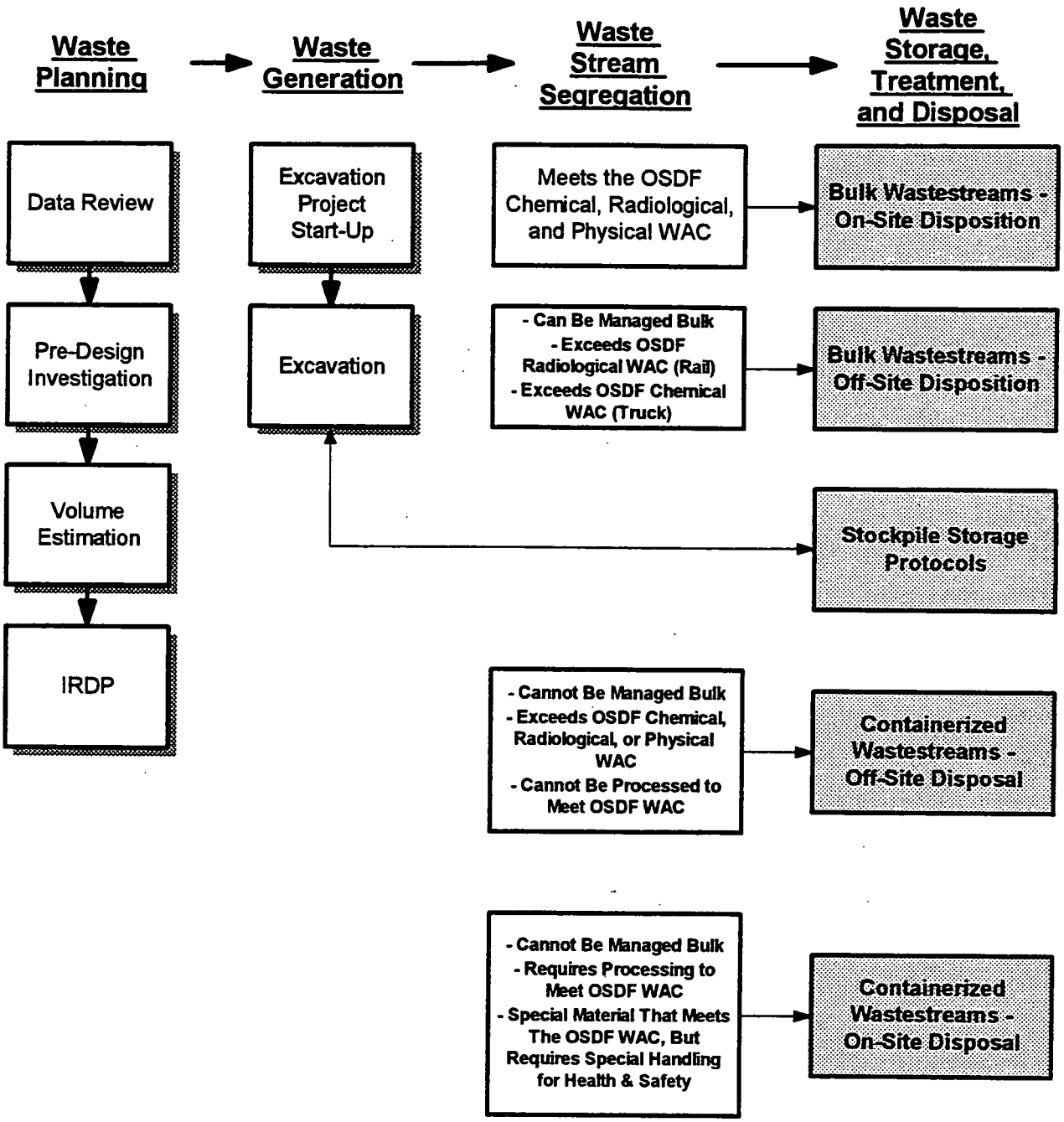



FIGURE F.5-1 CONCEPTUAL SCEP WASTE DISPOSITION PROCESS

**FIGURE F.5-2**

## Asbestos

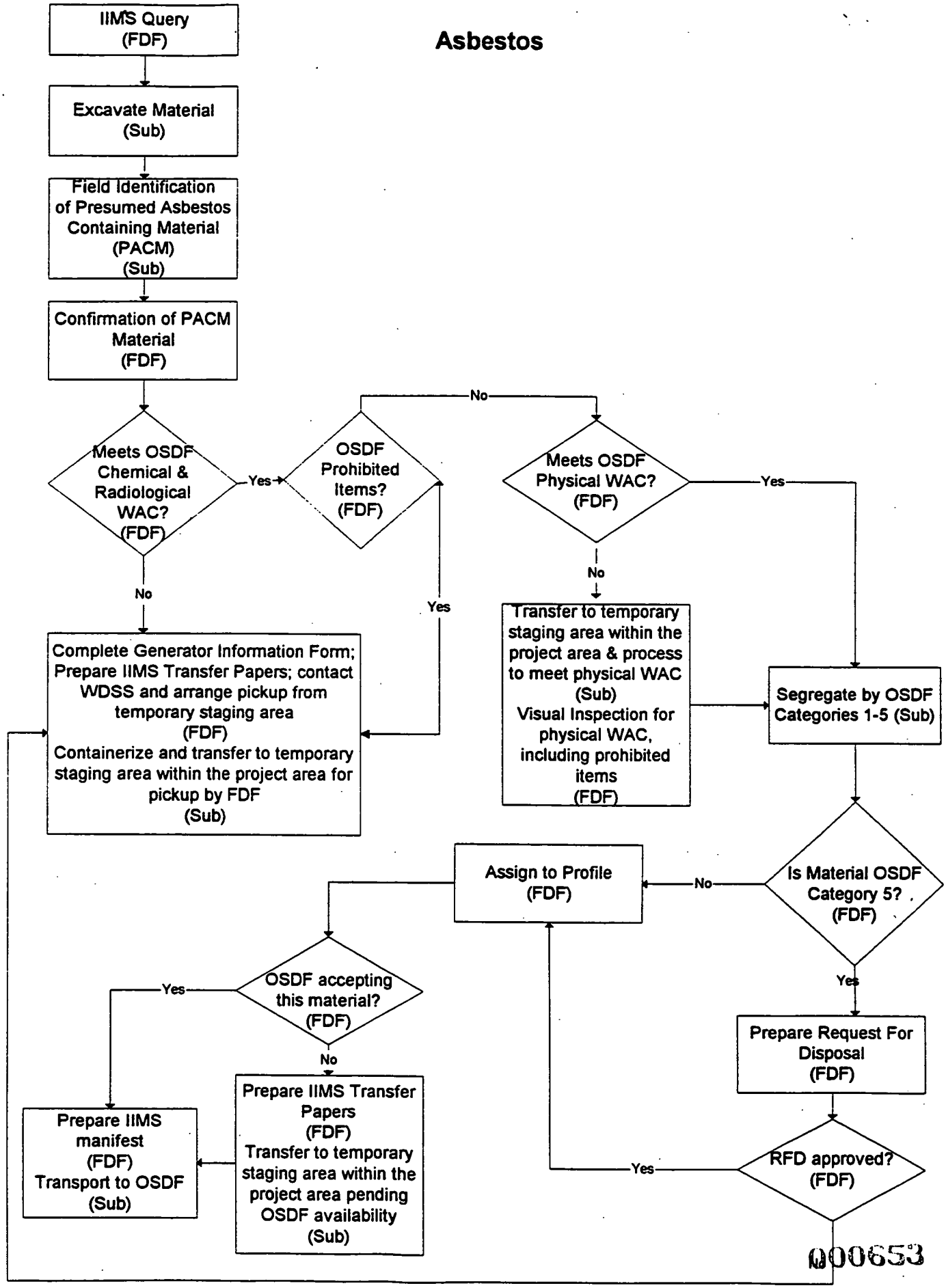


**FIGURE F.5-3**

**Non-Pressurized Containers**

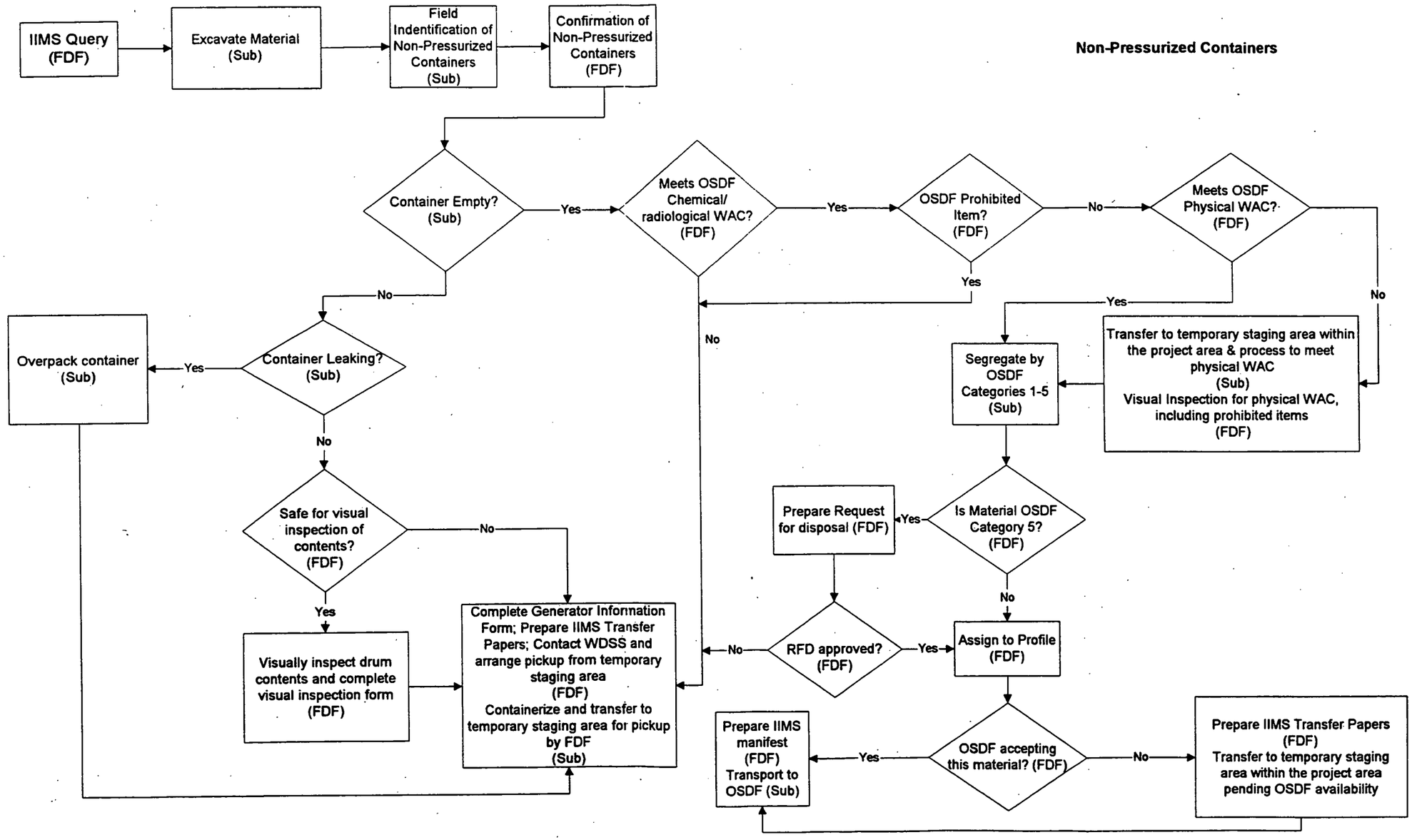


**FIGURE F.5-4**

## Pressurized Containers

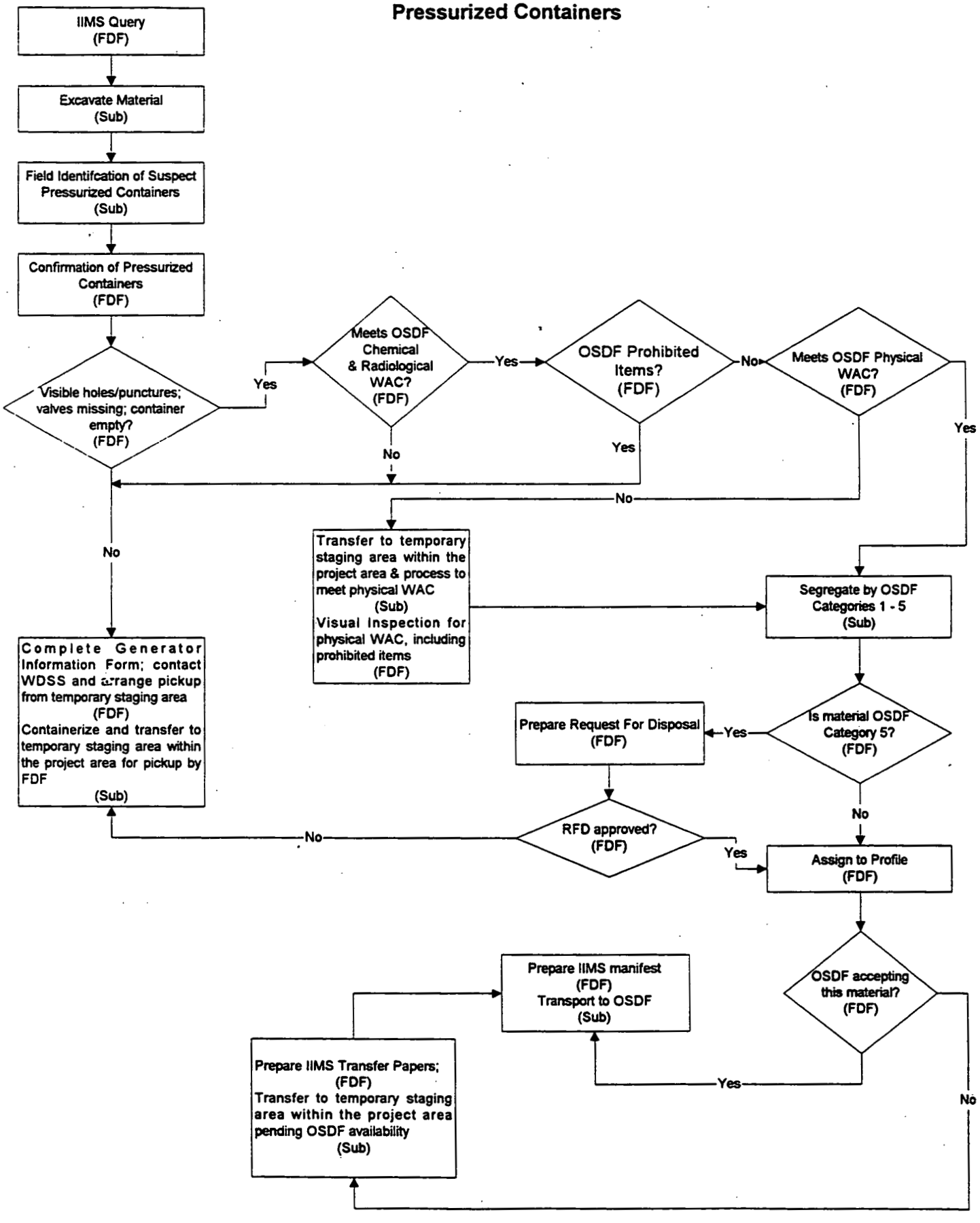
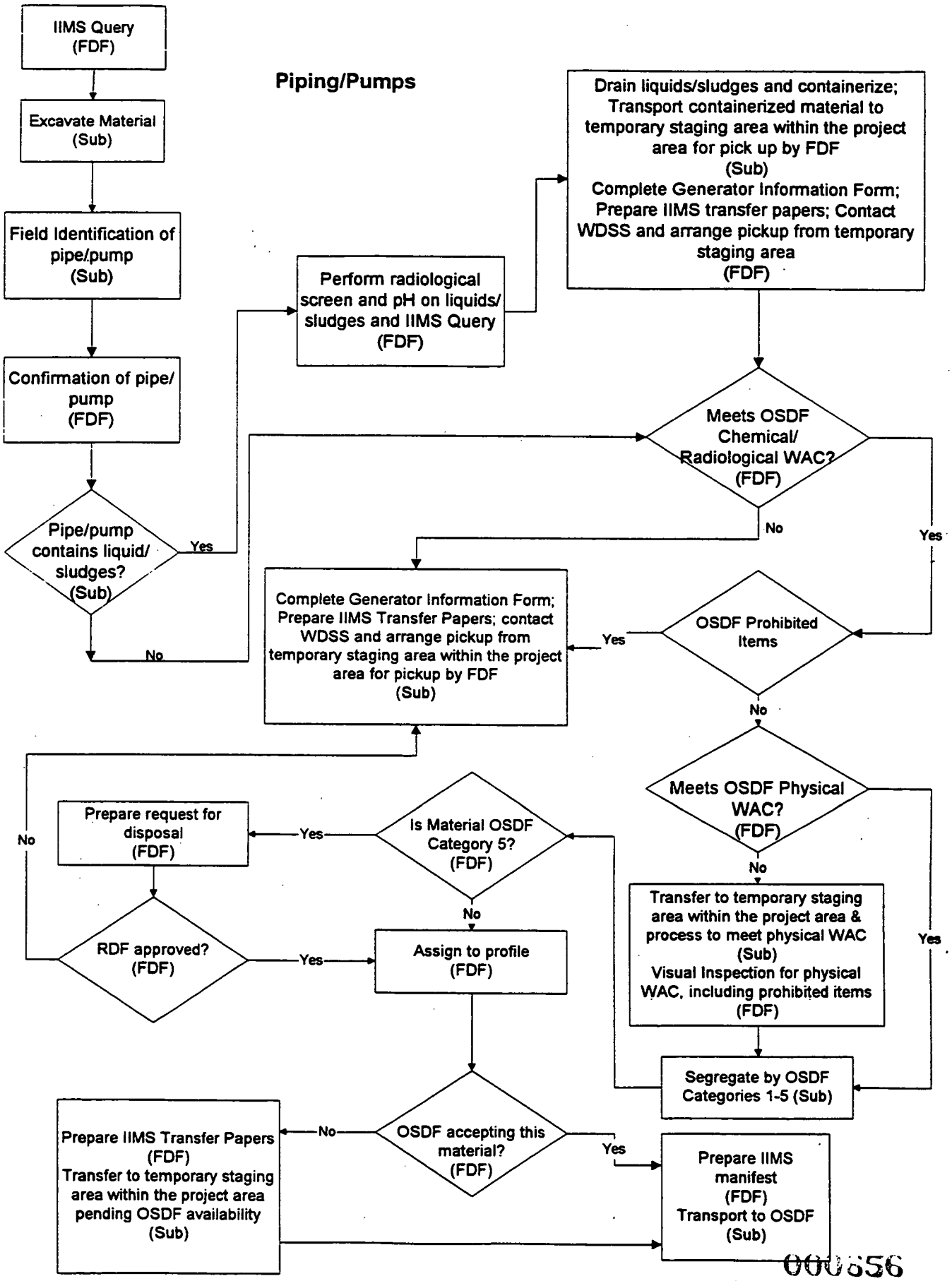


**FIGURE F.5-5**


Piping/Pumps
IIMS Query (FDF)
Excavate Material (Sub)
Field Identification of pipe/pump (Sub)
Confirmation of pipe/ pump (FDF)
Pipe/pump contains liquid/ sludges? (Sub)
Yes
No
Perform radiological screen and pH on liquids/ sludges and IIMS Query (FDF)
Drain liquids/sludges and containerize; Transport containerized material to temporary staging area within the project area for pick up by FDF (Sub)
Complete Generator Information Form; Prepare IIMS transfer papers; Contact WDSS and arrange pickup from temporary staging area (FDF)
Meets OSDF Chemical/ Radiological WAC? (FDF)
No
Yes
Complete Generator Information Form; Prepare IIMS Transfer Papers; contact WDSS and arrange pickup from temporary staging area within the project area for pickup by FDF (Sub)
Yes
OSDF Prohibited Items
No
Meets OSDF Physical WAC? (FDF)
No
Yes
Transfer to temporary staging area within the project area & process to meet physical WAC (Sub)
Visual Inspection for physical WAC, including prohibited items (FDF)
Segregate by OSDF Categories 1-5 (Sub)
Is Material OSDF Category 5? (FDF)
Yes
No
Prepare request for disposal (FDF)
No
RDF approved? (FDF)
Yes
Assign to profile (FDF)
OSDF accepting this material? (FDF)
No
Yes
Prepare IIMS Transfer Papers (FDF)
Transfer to temporary staging area within the project area pending OSDF availability (Sub)
Prepare IIMS manifest (FDF)
Transport to OSDF (Sub)

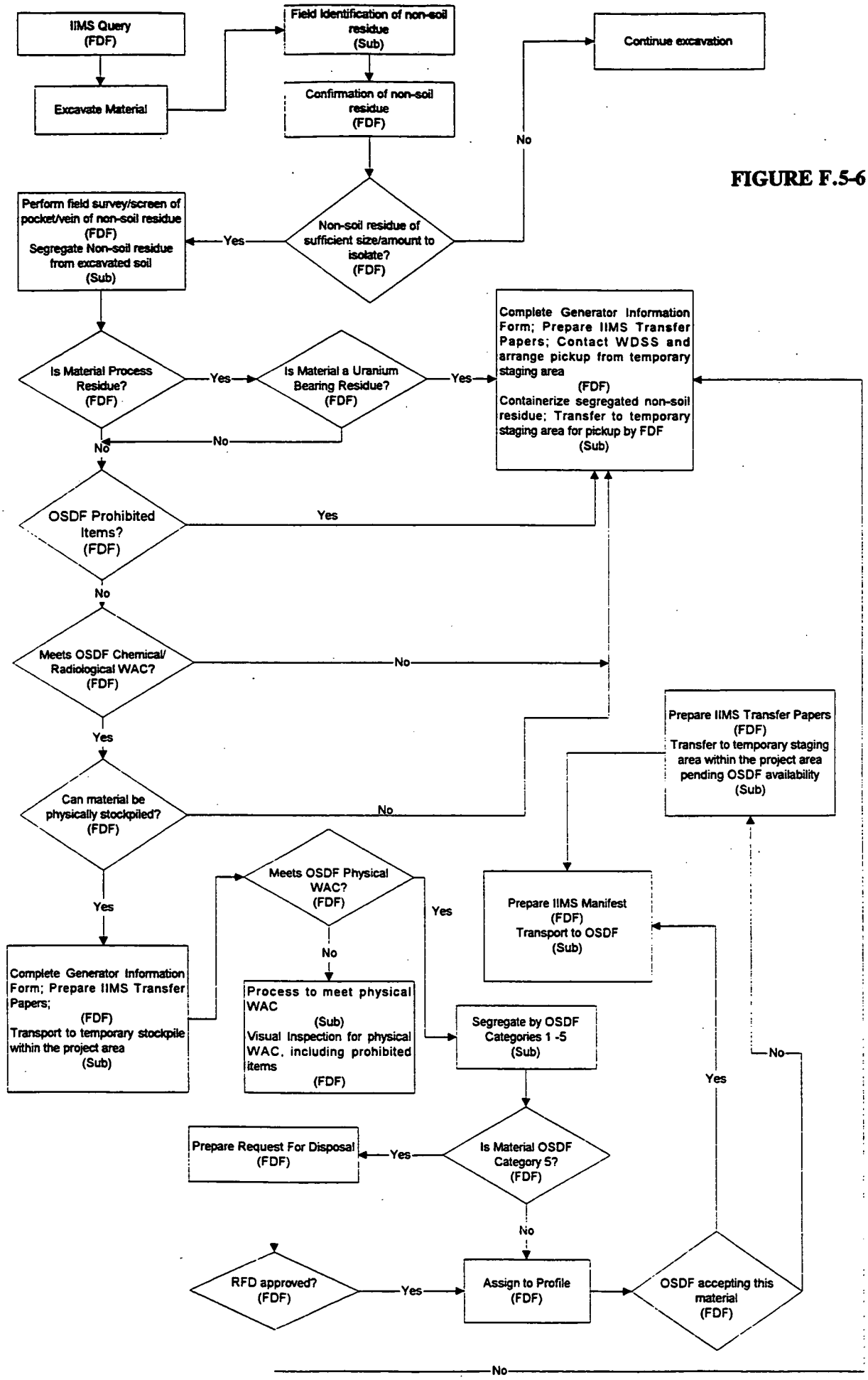



FIGURE F.5-6

Non-Soil Residues

**FIGURE F.5-7**

Transformers/Electric Equipment

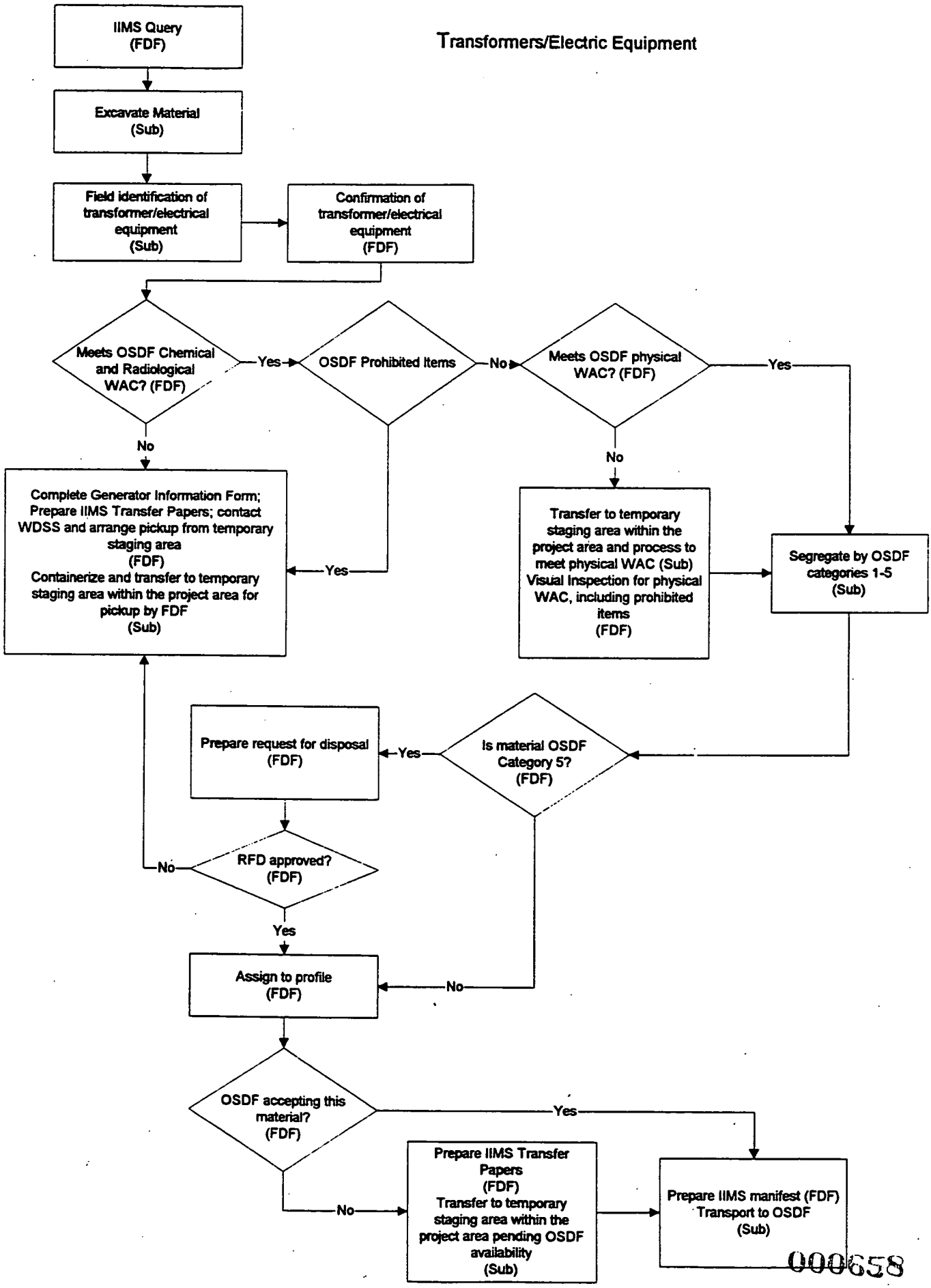
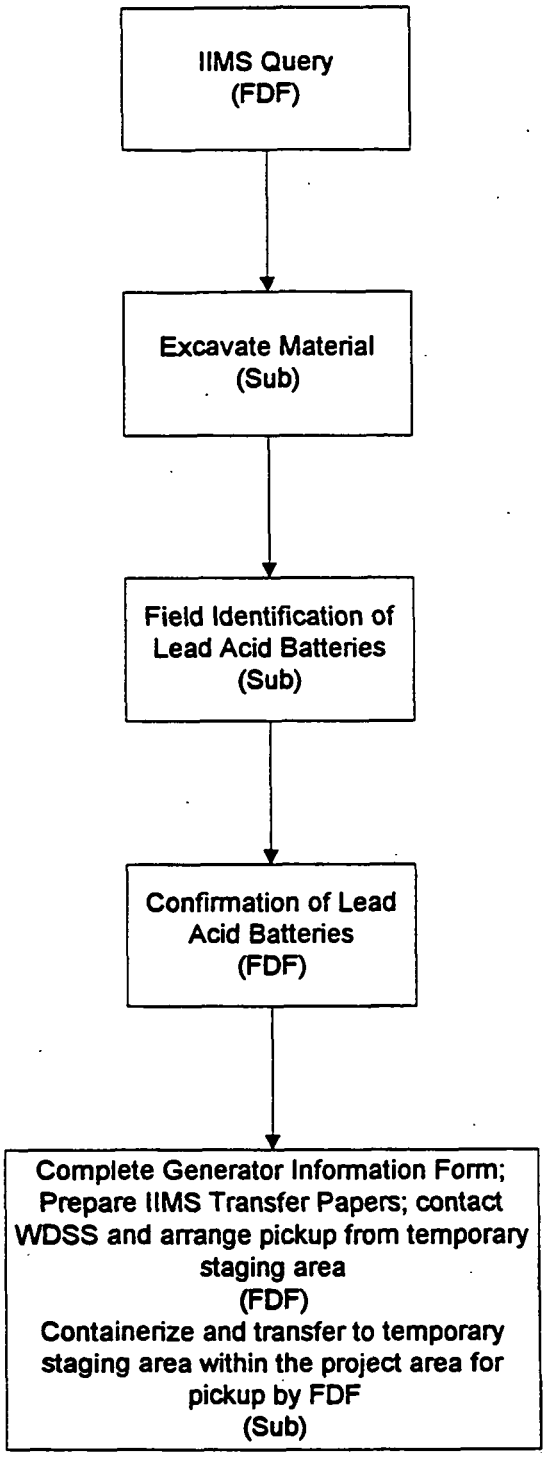
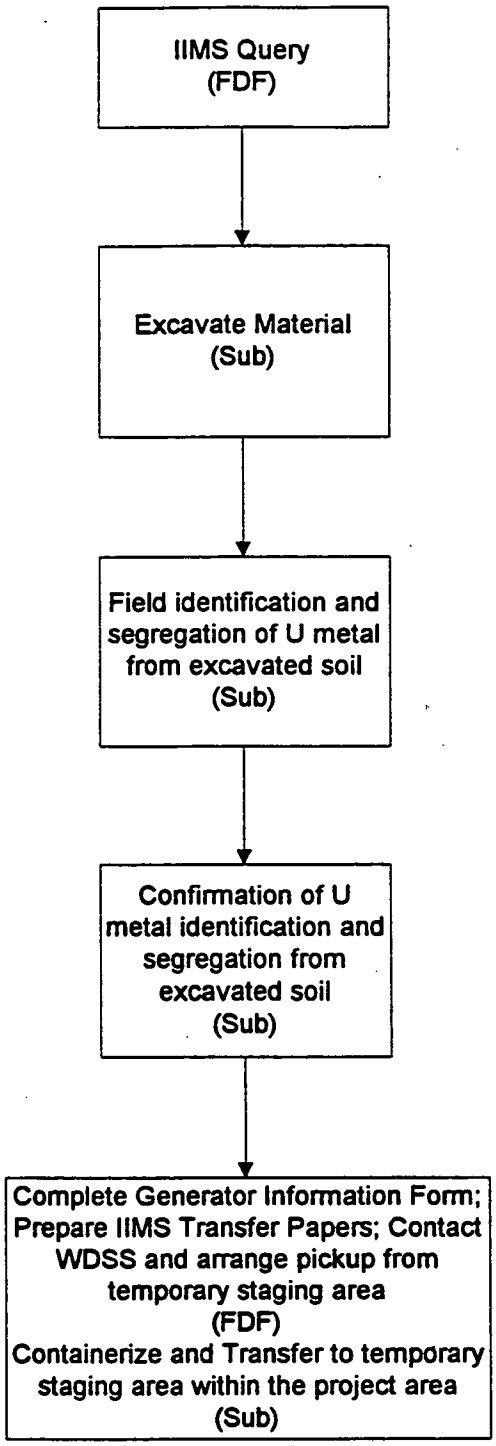


FIGURE F.5-8




**Lead Acid Batteries**

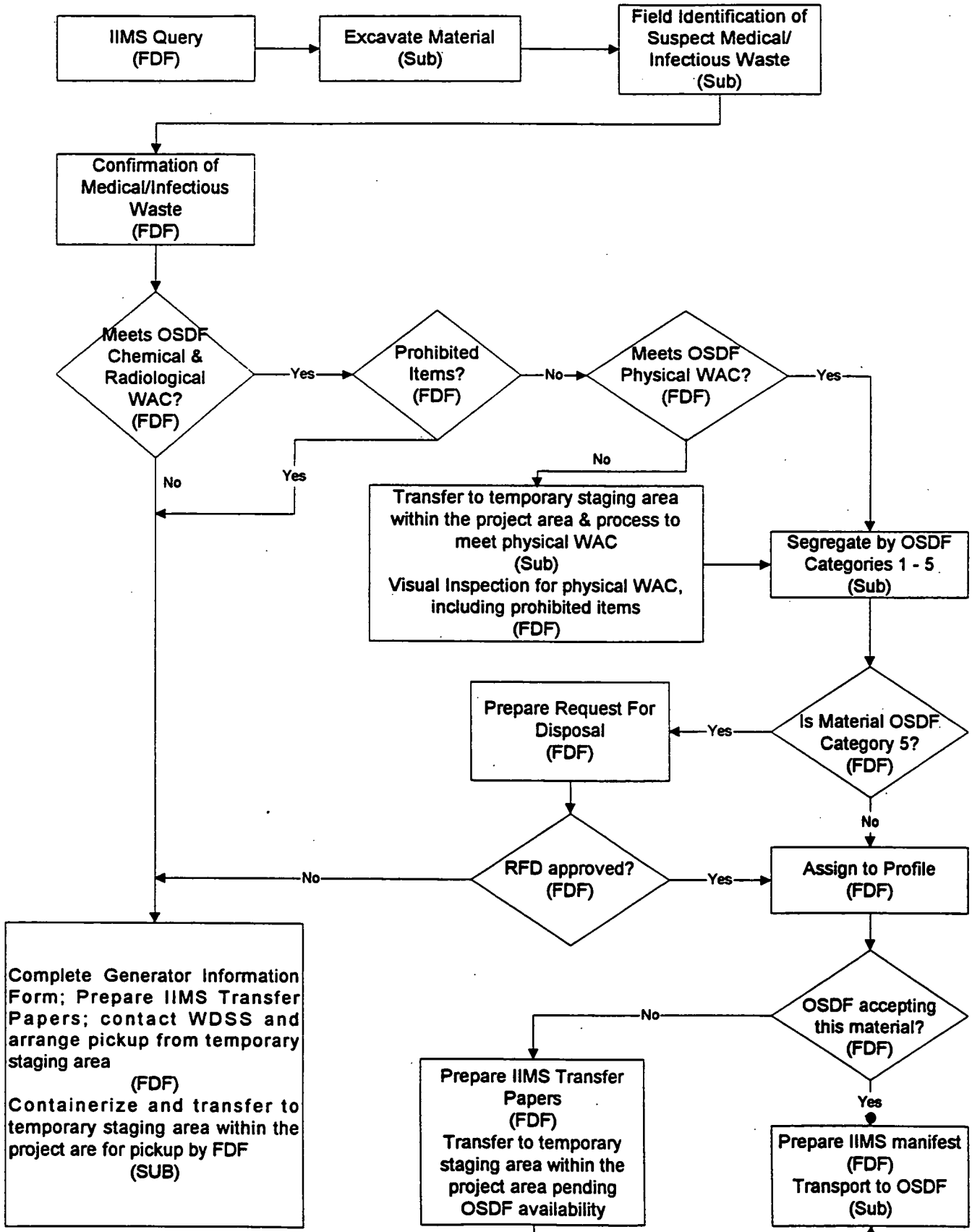
**FIGURE F.5-9**




**Uranium Metal**

FIGURE F.5-10

## Medical/Infectious Waste



# FIGURE F.5-11

## Miscellaneous Debris

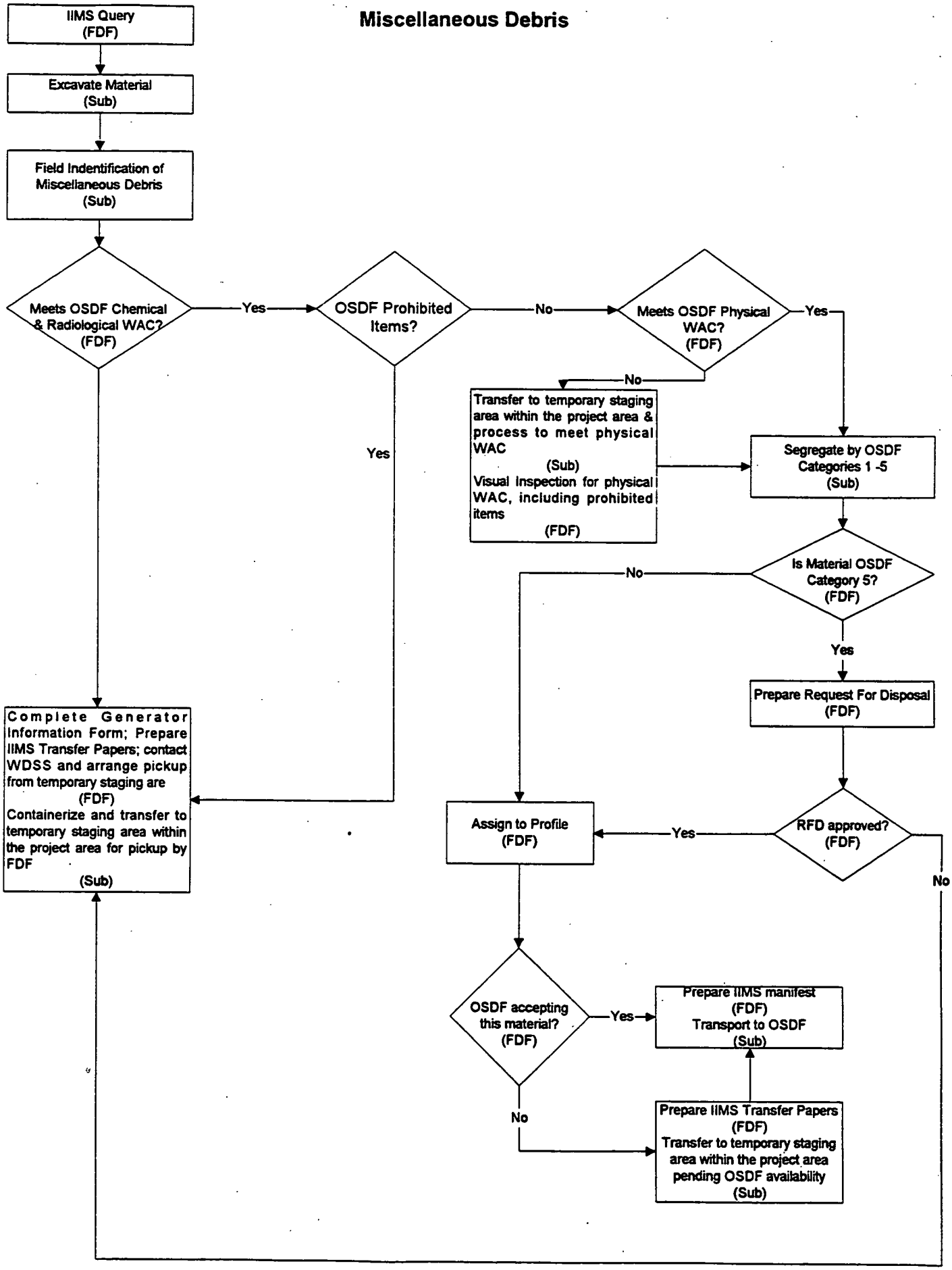
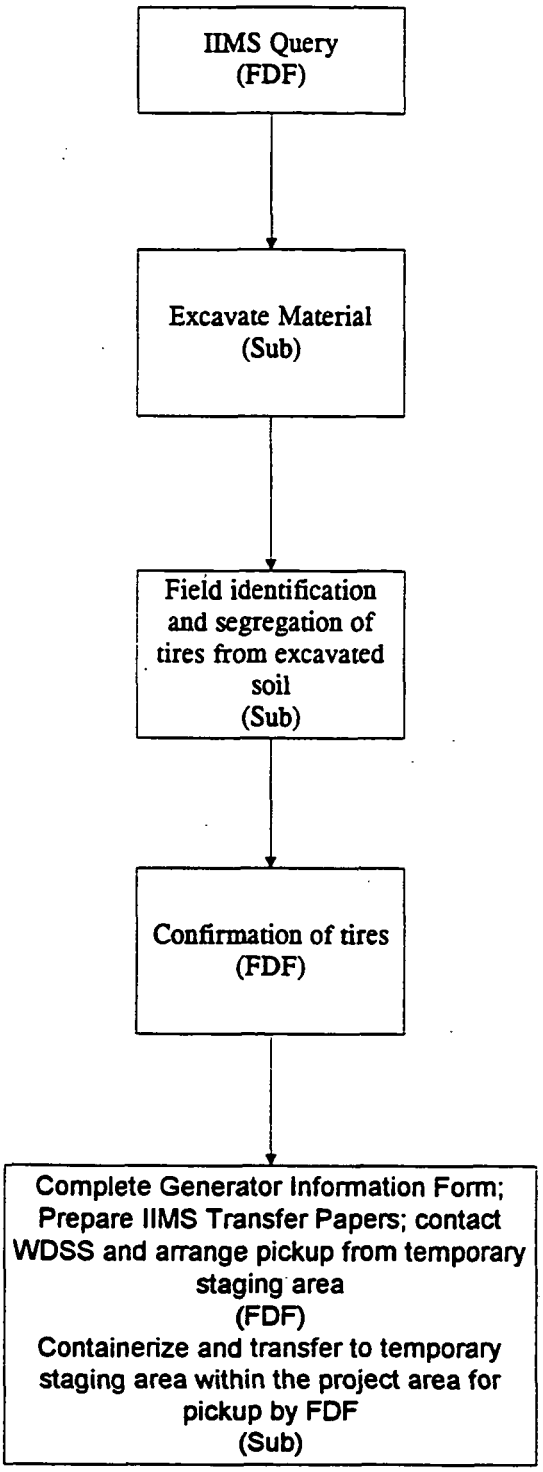


**FIGURE F.5-12**



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# APPENDIX G

# CERTIFICATION DESIGN RATIONALE

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## INTRODUCTION

The objective of the statistical approach set forth in this appendix is to provide a specified level of confidence that the excavations at the site comply with the release criteria developed during the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process at the Fernald Environmental Management Plan (FEMP). Although compliance at a 100 percent confidence level cannot be proven because there will always be some uncertainty with the data, statistical methods can be used to provide a known level of assurance that the release criterion has not been exceeded.

The statistical methods employed to assess compliance with the release criteria depend on the underlying spatial distribution. There are two possibilities in the real world: the residual contaminant may be homogeneously distributed over a given area or nonhomogeneously distributed. The two most common homogeneous distributions encountered when assessing environmental data are the Normal distribution and the Lognormal distribution. These distributions are well understood, and sample sizes can be easily estimated based on observed or estimated variability. The more variable the data, the larger the required sample size needed to attain a prespecified confidence level.

Some environmental contaminants within a given area, however, do not follow a known homogeneous distribution. They may be homogeneous but from an undefined distribution, or they may be multimodal - having one or more areas of higher (or lower) contamination not consistent with the remaining area. In these situations it is possible to require a very large number of samples for laboratory analysis to adequately characterize the contamination over a large area. Judicial use of field analyses techniques can often greatly reduce this burden.

At the FEMP, additional information on the nature and extent of contamination in a given area will be collected using scanning and direct measurement technologies (Section 2.4 of the Sitewide Excavation Plan [SEP]). This approach serves to identify areas of elevated radioactivity so they can be removed before soil certification sampling is performed. This selective removal minimizes the possibility of nonhomogeneous areas of elevated contamination and reduces the expected variability of the remaining soil. The remaining data distribution will most likely be homogeneous (i.e., normal or lognormal).

Additionally, with a known distribution and lower variability, the number of samples required to characterize the contamination in a certification unit's residual soil will be significantly reduced.

The remainder of this appendix is divided in two sections. Section G.1 presents the statistical procedures to be used during certification and the recommended number of certification samples required to document compliance with the cleanup criteria at the FEMP. Section G.2 contains a description of the technical approach used to identify and define areas of elevated activity (i.e., hot spots).

## G.1 DETERMINATION OF SAMPLE NUMBER AND DENSITY

A statistical sensitivity analysis was conducted to estimate the appropriate number of soil samples to collect from each certification unit (CU) so that reliable pass/fail determinations regarding final remediation level (FRL) attainment can be made after soil remediation is completed. The appropriate number of samples presented in this analysis is based on the expected distribution of each constituent of concern (COC) (i.e., mean and standard deviations) and not on the sample's physical size, the expected grid spacing, or the certification unit size. This analysis supports the sampling approach presented in Section 3.0 of the SEP.

### G.1.1 Input Parameters for Estimating Sample Size

To determine the number of samples that should be collected per CU for final certification, the following five parameters are needed:

1. The final COC-specific remediation levels (FRLs).
2. The concentration that is to be reliably declared as meeting the FRL (i.e., the target or expected average residual soil concentration), assuming the specified acceptable error levels.
3. The type I error probability ($\alpha$) that is acceptable. A type I error occurs by falsely concluding that a certification unit meets the FRL when it really exceeds it.
4. The type II error probability ($\beta$) that is acceptable. A type II error occurs by falsely concluding that a certification unit exceeds the FRL when it really meets it.

5. The expected standard deviation of the CU soil sample population.

These five parameters are further described below.

G.1.1.1 Final Remediation Levels

The on-property soil FRLs used for this analysis were taken from the Operable Unit 5 Record of Decision (DOE 1996d).

G.1.1.2 Target Cleanup Levels

Before final certification is begun, the target cleanup level of each COC is chosen as an answer to the question: How much less than the FRL must the CU mean COC concentration (residual COC concentration) be before the CU can be reliably certified for release. There are several factors to consider when choosing a target cleanup level, which is also known as the lower bound of the gray region (LBGR). The upper bound of the gray region is the FRL. The broader the gray region, the fewer certification samples that are required to reliably (with type I and II error probabilities) determine pass or fail of a certification unit. Conversely, the narrower the gray region (i.e., the closer the LBGR is to the FRL) the greater the number of samples needed to reliably determine pass or fail of a certification unit. Since the FRLs are set, it is the LBGRs which must be chosen to provide an appropriate grey region. In general, the LBGR can be interpreted as the maximum expected average residual COC concentration in a successfully remediated area (i.e., after removing most of the above-FRL materials).

As previously stated, the smaller the value of the LBGR, the fewer the number of certification samples required; however, the LBGR should be distinguishable from background. If background creeps up into the gray region, then the probability of falsely excavating clean background soil will exceed the type II error probability and result in wasted resources and disposal cell space. Therefore, the smallest LBGR considered for this analysis is the 95 percent upper confidence level (UCL) on the mean of the background population. The 95 percent UCLs, along with other summary statistics for metals and radionuclides, are presented for background surface and subsurface soil in Tables G-1 and G-2,

respectively. Surface soil data were used only for those COCs not included in the subsurface soil data set. One half of the detection limit was used for non-detect results.

Although the LBGR will not be used to drive any excavation decisions, it should be large enough to be a useful and measurable indicator of a successful remediation during pre-certification activities. For instance, the LBGR should be larger than the practical quantitation limit for the analytical method used to analyze the pre-certification and certification samples. For radionuclides, it should be large enough to enable investigators to use field scanning instruments during pre-certification activities.

G.1.1.3 Type I Error Probability

The type I error probability is usually set at levels such as 10 percent, 5 percent, or 1 percent, depending on the potential consequences of falsely deciding the certification unit meets the FRL based on sample data when, in fact, the average contaminant level really exceeds the FRL. A type I error probability of 5 percent for primary COCs and 10 percent for secondary COCs was chosen for these analyses because it is sufficiently protective of the public and environment.

G.1.1.4 Type II Error Probability

The type II error probability is usually set at levels such as 20 percent, 15 percent, and 10 percent, depending on the consequences of unnecessarily excavating soil that, in actuality, meets the FRL. All three of these type II error probabilities were considered for this analysis.

G.1.1.5 Expected Residual Soil Standard Deviation

The expected standard deviation for the certification soil samples was conservatively estimated from a subset of the Sitewide Remedial Investigation (RI) data using the following procedure.

The RI soil sample data were first filtered to remove any samples that had total uranium results exceeding the applicable area-specific uranium FRLs. This was done to create a remnant soil data file that should resemble the residual surface soil after uranium-driven excavation has been accomplished. Two data files were then created by filtering the remnant data file to remove samples taken from the

top foot of soil and sample results that exceeded two and three times the FRL for each of the sitewide COCs considered (see Section 2.0 of the SEP).

The standard deviations derived from this filtering process should be conservative because they are generated from sitewide data, and the actual remediation will target most of the soil with contaminant levels in excess of FRL concentration of any COC, when practical. Any individual certification unit would be expected to have smaller standard deviations for residual soil contaminant levels because of its limited aerial extent. A comparison of the estimated residual soil standard deviations based on the two remnant data files to background surface and subsurface soil standard deviations, for COCs that are expected to drive the required number of certification samples, is shown in Table G-3.

**TABLE G-3**

**COMPARISON OF ESTIMATED RESIDUAL SOIL STANDARD DEVIATIONS TO BACKGROUND SOIL STANDARD DEVIATIONS ***

| Analyte | Surface Soil Background | Subsurface Soil Background | "2x FRL" Remnant Soil Data File | "3x FRL" Remnant Soil Data File |
|---|---|---|---|---|
| Radium-226 pCi/g | 0.15 | 0.24 | 0.45 | 0.49 |
| Radium-228 pCi/g | 0.12 | 0.27 | 0.38 | 0.38 |
| Thorium-228 pCi/g | 0.23 | 0.32 | 0.50 | 0.52 |
| Thorium-232 pCi/g | 0.19 | 0.32 | 0.36 | 0.39 |
| Uranium-Total mg/kg | 0.32 | 0.58 | 12.60 | 13.90 |
| Arsenic mg/kg | 1.98 | 2.45 | 2.96 | 2.96 |
| Beryllium mg/kg | 0.06 | 0.16 | 0.42 | 0.45 |

* Calculated assuming a normal distribution for comparison purposes.

The data in Table G-3 show that for background soil, subsurface standard deviations are larger than for surface soil. The same relationship is expected for nonimpacted areas where minimum excavation is planned before final certification sampling. These areas are expected to most closely resemble the background reference areas. Thus, eliminating samples taken from the top foot of soil (which may not necessarily be excavated) should add an additional measure of conservativeness to the estimated sitewide residual soil standard deviations. Eliminating COC results that exceed "2x FRL" and "3x FRL" should simulate pre-certification hot-spot removal activities, which will be performed prior to

final certification. Inspection of the "2x FRL" and "3x FRL" estimated standard deviations reveals that they are all significantly larger than the subsurface soil background standard deviations, though not significantly different from each other.

G.1.2 Statistical Test Methods for Certification Compliance

Choice of the appropriate test method to assess compliance with the FRLs is dependent on the underlying distribution of the data. If the sample mean of the data is normally or lognormally distributed, then the Student's t-Test should be used. Alternately, if the data significantly deviate from the assumption of normality, then a nonparametric method would be required. A decision tree as to which procedure to use in the determination of FRL compliance is provided in Figure G-1. It should be noted that the Student's t-Test is the preferred analytical method when its use can be justified. If the data are reasonably normally (or lognormally) distributed, the t-Test will provide more accurate and reliable test results than the nonparametric methods. If the data severely deviate from normality, then the t-Test results can become unreliable and a nonparametric procedure would be required. The analytical procedure selection process, descriptions of methods, and rationale for usage are provided below.

The four basic decision points are sequentially applied to the certification data sets to select the appropriate analytical methodology.

1. Is there a significantly large proportion (greater than 50 percent) of data reported as non-detected? If yes, use the Test for Proportions. If not, continue.

2. Is the data normally distributed? If yes, perform the Student's t-Test. If not, continue.

3. Will a logtransformation of the data normalize the data? If yes, logtransform the data and perform the Student's t-Test. If not, continue.

4. Are the data symmetrically distributed? If yes, perform the Wilcoxon Signed Rank Test comparing the certification sampling data to the FRL. If not, calculate the upper confidence limit of the 50th quantile (median), based on the binomial distribution, and compare to the FRL.

A detailed discussion on determination of the appropriate statistical test to determine compliance with FRLs is presented in Section G.1.3.

G.1.2.1 Student's t-Test

The Student's t-Test is a parametric statistical method that can be used to test whether the mean of the COC sample results from the certification unit is reliably less than the FRL at the specified type I error probability. The following equation is applied to calculate the Student's t-Test statistic (t):

$$t = \frac{FRL - \bar{X}}{\sqrt{S^2 / N}}$$

Where:

$\bar{X}$ = *the sample mean of the certification sample results*
$S^2$ = *the sample variance of the certification sample results*
$N$ = *the number of certification sample results*

This test is performed for each CU-specific COC in each CU that meets the minimum requirements of "near-normality." The t distribution table of critical values for varying numbers of samples and type I error probabilities is consulted to make the pass/fail determination. If the computed value (t) exceeds the critical value, then the certification unit passes. The Student's t-distribution Test requires a near-normal distribution of soil sampling results and is influenced more than nonparametric methods by non-detects.

The Student's t-Test will be used for both normally and lognormally distributed data. This method will most likely be used for the vast majority of contaminants, since environmental data usually follow a normal or lognormal distribution pattern. The t-Test is more accurate and reliable for determining compliance with FRLs than nonparametric methods, given that the underlying assumption of normality is not severely violated. If , however, the normality assumption is severely violated, then the t-Test

results become unreliable and other test methods should be employed. To simplify the process and interpretation of the methodology, the UCL of the mean, based on the Student's t-distribution, will be compared to the FRL. This is equivalent to performing the t-Test of the data mean versus the FRL but more intuitive.

G.1.2.2 Test for Proportions

This procedure tests the hypothesis that at least 50 percent of the data are below the FRL with a given level of confidence. In other words, determine whether the median (a nonparametric estimate of the midpoint of the data) is less than the FRL with a prespecified level of confidence. With the hypothesized proportion set at 50 percent, this is computationally equivalent to the Sign Test.

The Test for Proportions method will be used only in situations where a significantly large percentage of sample results (e.g., >50 percent) is reported as below the detection level. This situation may arise with some of the organic COCs, which are rarely quantifiably observed but which present a potential risk when present. The rationale for the use of this approach is that traditional methods require actual data results to calculate the test statistic. The Test for Proportions only requires that the result be discernible from the FRL. If the sample detection level is below the FRL, the Test for Proportions can be used to determine whether the midpoint of the data (a nonparametric surrogate for the mean) is below the FRL with a specified level of confidence. The test method is robust to wide data variations and large percentages of non-detects (assuming the detection level is below the FRL). The method does not require any prior knowledge of the underlying distribution or that the data be symmetrically distributed.

The one-sample test for proportions is applied as follows. Let $p$ denote the proportion of sample measurements reported as greater than or equal to the FRL for a given CU (i.e., the number of sample results reported as greater than or equal to the FRL divided by the total number of samples within the

CU). Let $P_0$ denote the acceptable proportion of samples that may exceed the FRL. The hypothesis of the test is that $p$ is greater than or equal to 0.5 (i.e., the proportion of samples exceeding or equaling the FRL is greater than half and therefore out of compliance). The test statistic is generated as

$$z = \frac{p + .5/n - P_0}{\sqrt{P_0(1 - P_0)/n}}$$

where

*n = the sample size for the given CU.*

The quantity $z$ is compared to the critical value 1.645 ( the $Z_{1-\alpha}$ value where $\alpha = .05$). If $z$ is less than or equal to 1.645 than we accept the hypothesis that the CU does not meet the clean-up criteria (FRL). If the value of $z$ exceeds 1.645, then we can conclude that there is sufficient evidence to reject the hypothesis and designate the CU as meeting the cleanup criteria.

Since the test statistic $z$ does not depend on the values of the sample results nor on the FRL but only the proportion of results that are greater than or equal to the FRL, $p$, the value of $p$ can be precalculated. For example, with a sample size of 16, the maximum number of results allowable to exceed the FRL is 5 ($z = 1.75$) to have a 95 percent confidence level of meeting the FRL. For a sample size of 12, the maximum number of results allowable to exceed the FRL is 3 ($z = 2.02$) to have a 95percent confidence level on meeting the FRL.

As shown in Figure G-1, when the Test for Proportions is applied the sample average will also be compared to the FRL to support the test conclusion. Additionally, the hot spot criteria will also need to be satisfied before a CU can be released.

G.1.2.3 Wilcoxon Signed Rank (One Sample) Test

If the data are symmetrically distributed but cannot be shown to be normally distributed nor can the

logtransformed data be shown to be normally distributed, then the Wilcoxon Signed Rank Test will be employed to assess compliance with the FRLs. For symmetric distributions, the mean and median are equal; therefore the hypothesis may be stated in terms of either parameter. It may also be possible to transform the data (e.g., logtransformation) to make the data symmetric.

The basic outline of the procedure is to

- Subtract the FRL from each of the certification sample results
- Sort and then rank the absolute deviations from the FRL
- Carry over the sign of the calculated deviation (positive if the result is greater than the FRL or negative if it is less than) to the rank of the absolute deviation
- Sum the negative ranks (those below the FRL) and positive ranks (those above the FRL).

Clearly, to demonstrate compliance with the FRLs, the absolute sum of the negative ranks (results less than the FRL) must exceed that of the positive ranks (results greater than the FRL). The exact probabilities can be obtained from Wilcoxon Signed Rank probability tables. If it can be shown that certification data-set result ranks are significantly below the FRL, then the certification unit can be classified as meeting the FRLs.

### G.1.2.4 Upper Confidence Limit of the Median

If the data cannot be shown to be normally distributed nor can the logtransformed data be shown to be normally distributed, then the UCL on the mean cannot be reliably estimated and the t-Test becomes unreliable. If the data are not symmetrically distributed, the Wilcoxon procedure should not be used to assess compliance with FRLs. Comparing the UCL of the median to the FRL to assess compliance with the remedial goals can be used in place of t-Tests or Wilcoxon tests in these situations. The theory here is that since the actual confidence bounds on the certification unit mean cannot be directly estimated, then a surrogate must be used. Any random sample theoretically should demonstrate the same distributional characteristics as the actual population. The upper confidence on the median is a

conservative approach to assure that the true average contaminant level for a given certification unit is below the FRL with a specified level of confidence.

The upper confidence bound on the median is determined using tables of the binomial distribution. The basic procedure is as follows:

1. Sort and rank the sample results for the CU from low to high.
2. Locate the sample size, $n$, in the tables.
3. Scan down the column headed "$p = .50$" to find the closest percentage value to the pre-specified confidence value of 0.95.
4. Read the corresponding "$y$" value (this represents the rank-1 of the UCL of the median).
5. Add one to the $y$ value. This is the rank of the result from the sample dataset that will approximate the $UCL_{(.95)}$ of the Median result.
6. If the $y^{th}$ result exceeds or equals the FRL, then we conclude that the CU is out of compliance. If the $y^{th}$ result does not exceed the FRL, then we conclude that the FRL for the CU is met.

Because the rank of the $UCL_{(.95)}$ of the median is independent of the underlying distribution, it can be precalculated. For example, if the sample size is 16, the closest probability value from the binomial tables under "p = 0.50" is 0.9616, which corresponds to y = 11. Therefore, the rank of the results which approximates the $UCL_{(.95)}$ of the median is 12 (11+1). So, if the $12^{th}$ ranked result exceeds the FRL, then the CU would be deemed out of compliance (fail certification); otherwise the CU would pass certification. If the sample size is 12, the closest probability value from the binomial tables under "p = 0.50" is 0.9270, which corresponds to y = 8. Therefore, the rank of the results which approximates the $UCL_{(.95)}$ of the median is 9 (8+1). So, if the $9^{th}$ ranked result exceeds the FRL, then the CU would be deemed out of compliance (fail certification); otherwise the CU would pass certification.

Comparing the example results of the two nonparametric procedures, it becomes evident that the UCL on the Median procedure is more conservative than the Test for Proportions. For the example of sample size equaling 16, the Test for Proportions would allow a maximum five exceedences of the FRL to pass certification. Under the UCL of the Median procedure, if the $12^{th}$ ranked result exceeded the

FRL, then the CU would fail. Therefore, only four results may exceed the FRL and still pass certification (samples ranked 13, 14, 15, and 16).

G.1.3 Determination of the Appropriate Methodology to Assess Achievement of FRLs

As outlined in Section G.1.2, four basic decision points will be sequentially applied to the certification data sets to choose the appropriate analytical methodology. The analyst will apply a series of tests to the data set leading to the most appropriate analytical method to use. The step-by-step procedure is detailed below and is also summarized in Figure G-1.

**Step 1. Is there a significantly large proportion of data reported as non-detected?**

Procedure: If yes, use the Test for Proportions. If not, continue to Step 4.

If there is a large percentage of data reported as below the detection level (greater than 50 percent), then the t-Test becomes invalid for assessing compliance with the FRLs. The Wilcoxon Signed Rank test can also be affected adversely if the detection limit is relatively close to the FRL. The direct corollary to a test for the mean being less than or equal to the FRL is to set the hypothesis proportion as 0.5, the midpoint of the distribution. This is equivalent to performing a Sign Test on the differences between the data and the FRL. If there are statistically significantly fewer positive differences (result > FRL) than negative results (result < FRL), then it can be concluded that the median concentration is below the FRL within the proscribed level of confidence.

It is expected that this procedure will be used very rarely. The only anticipated usage will be for those ASCOCs that are rarely detected, such as some of the organic COCs and perhaps Technecium-99. It can properly be thought of as an "if all else fails" procedure. During Area 1, Phase I certification, only 1.5 percent of the primary radionuclide CUs and 11.3 percent overall would have required the use of this procedure. This includes all seven CUs analyzed for polychlorinated biphenyl (PCB) and 19 out of 30 CUs analyzed for beryllium.

**Step 2: Is the data normally distributed?**

Procedure: If yes, perform Student's t-Test. If not, continue to Step 3.

The next step in determining the appropriate methodology to assess compliance with the FRLs is to determine whether the certification data set can be adequately described by a normal distribution. The normal distribution is, by far, the most studied statistical distribution, and thus more is known about its properties and exact probability levels than any other distribution. Consequently, the most accurate determination of compliance with FRLs will be achieved if the assumption of normality can be demonstrated. Additionally, the Central Limit Theorem states that the distribution of sample means of a random sample from any population, whether known or unknown, is approximately normal, provided the sample size is sufficiently large. This indicates that although the underlying distribution may not be precisely normal, the Student's t-Test can usually be used with safety. However, especially with smaller sample sizes, the t-Test is not robust to outliers/extreme values, since the mean and standard deviation can be greatly influenced by such deviations. Tests for normality will therefore be performed to check for significant deviations from the assumption of normality. Data sets that significantly deviate from normality should be analyzed by the Wilcoxon Signed Rank nonparametric procedure, which is far less sensitive to extreme values.

Additionally, a large percentage of non-detects can also affect results adversely. The sample mean and standard deviation become greatly influenced by the MDL (method detection level). In this case, the Test for Proportions is more appropriate.

Tests for normality are widely available though computerized statistical packages. Two widely accepted methods that are most commonly used are the Kolmogorov-Smirnov one-sample test (for larger sample sizes) and the Shapiro-Wilk test (for smaller sample sizes). Additionally, normal probability plots are an invaluable tool to an experienced statistician to assess normality. Probability plots can be very helpful in identifying the cause of a data set failing a test for normality and help to lead the analyst toward a more appropriate analytical method.

<u>Step 3. Will a log-transformation of the data normalize the distribution of the data?</u>

Procedure: If yes, log-transform the data and perform Student's t-Test. If not, continue to Step 4.

Often environment data can be described by a lognormal distribution. A lognormal distribution is simply a distribution whose data are normally distributed once they have been transformed using the natural log function. In this step the log-transformed data are checked for normality as in Step 1. The same limitations apply as above.

It is expected that the vast majority of the data will be analyzed using the t-Test on either the straight data or the logtransformed data. During Area 1, Phase I certification, 89 percent of the primary CUs and 81 percent overall would have passed normality checks for either the straight data or the log-transformed data.

**Step 4: Are the data symmetrically distributed?**

If yes, perform the Wilcoxon Signed Rank (One Sample) test comparing the certification sampling data to the FRL. If not, calculate the upper confidence limit of the 50th quantile (median) based on the binomial distribution and compare to the FRL.

The Wilcoxon Signed Rank (One Sample) Test

The Wilcoxon Signed Rank test does not require that the data be normally distributed but assumes that the data be symmetrically distributed. Tests for symmetry are often devised from the chi-square distribution. Unfortunately, these tests require large sample sizes to provide meaningful results. Fortunately, though, simple histograms can provide enough information to be able to assess the appropriateness of using the Wilcoxon procedure. Generally speaking, the distribution of sample results should be evenly (but not uniformly) distributed on either side of a central point. Assuming that the data are approximately symmetric and there are not too many results with the same value, then this procedure should provide reliable results.

It is not expected that this procedure will be used very often. During Area 1, Phase I certification, only 4.9 percent of the primary CUs and 3.5 percent overall would have required the use of this procedure.

Comparison of the Binomial Upper Confidence Limit on the Median with the FRL

If the data cannot be assumed to be symmetrically distributed, then the Wilcoxon test should not be used. Instead, the UCL on the 50th quantile (the median) will be compared to the FRL. The median is a nonparametric corollary to the mean. Comparing the UCL of the median versus the FRL would be a nonparametric corollary to the Student's t-Test. If the UCL on the median does not exceed the FRL, then we would conclude that the CU should pass certification.

It is not expected that this procedure will be used very often. During Area 1, Phase I certification, only 4.2 percent of the primary CUs and 3.9 percent overall would have required the use of this procedure.

Table G-12 summarizes how often each of the analytical procedure would have been used if this process had been implemented for Area 1, Phase I, certification.

G.1.4 Determination of Number of Samples for Certification

To certify a CU as meeting the FRL clean-up criteria, it must be demonstrated that the average concentration or activity level for each of the CU-specific COCs, with an acceptable level of confidence level, is below its respective FRL. To estimate of the number of samples required per CU to certify the CU, the following formula was employed:

$$n = \frac{(Z_{1-\alpha} + Z_{1-\beta})^2}{\left(\frac{RG - \bar{x}_{target}}{S_{Est.}}\right)^2}$$

where

$\alpha$ = *probability of a Type I Error*
$\beta$ = *probability of a Type II Error*
$Z$ = *critical level (for the designated probability) the normal distribution*
$RG$ = *the Remedial Goal (i.e. FRL for the given analyte)*
$\bar{x}_{target}$ = *target clean-up level mean*
= *LBGR*
$S_{Est.}$ = *standard deviation estimated the remnant soil data*

This equation is based on the assumption that the data are (relatively) normally distributed. The justification for this assumption is that the majority of environmental data follow either a normal or lognormal distribution. A review of the data gathered during the Area 1 Phase 1 sampling and analysis effort indicates that this assumption is valid. The overall percentage of analyte/CU datasets that would have passed normality (or lognormality) checks was 81 percent (89 percent for primary COCs). But this percentage is deceptively low. Three of the analytes were seldom detected above their detection limits with the majority of the analyte/CU datasets having too few detects to determine the distribution. For beryllium, 19 out of 30 CUs had too few detects; for cesium-137, 3 out of 5; and for Aroclor-1260, all 7 had too few detects. If we remove these three secondary COCs as erroneously skewing the results, the overall percentage of analyte/CU datasets that are normal/lognormal climbs to 90 percent. Clearly, the vast majority of datasets could be analyzed using normal probability theory. Therefore, estimating sample sizes based on the assumption of normality is valid.

To meet the confidence levels for certification (95 percent for primary COCs and 90 percent for secondary COCs) additional assumptions are required. The first assumptions are the false negative error rate (Type I Error) and false positive rate (Type II Error). The acceptable false negative rate, the probability of declaring a CU as meeting the FRL when in fact the average exceeds the FRL, for the primary COCs has been established at the 5 percent level, whereas for secondary COCs the rate is set at 10 percent. The false positive error rate, the probability of declaring a CU as not meeting the FRL when in fact the average is below the FRL, was varied over three levels, 10, 15 and 20 percent. A sensitivity analysis of the effects of varying the false positive rate on the estimated sample sizes is

given in Tables G-4 through G-6, assuming the "2x FRL" remnant dataset and Tables G-7 through G-9, assuming the "3x FRL" remnant dataset as described in G.1.1.5.

The second assumption is the maximum expected average concentration or activity level for the CU at the time of certification sampling. This is being referred to as the "target cleanup level" or the LGBR. This assumed target level (LGBR) was varied over four levels and is expressed as a percentage of the FRL. This is the assumed maximum expected average concentration or activity level at the time that certification sampling is to begin. The two levels are 75 and 80 percent of the FRL. The results are provided given in Tables G-4 through G-6 assuming the "2x FRL" remnant dataset and Tables G-7 through G-9 assuming the "3x FRL" remnant dataset.

The last assumption required to calculate certification sample size is an estimate of the data variability (standard deviation) for post-remedial conditions. This has been discussed in section G.1.1.5.

Another way of presenting the estimation of sample size results is provided in Table G-10. This table presents the resultant target levels (LBGR) and percentages of FRL if the samples size was set at 12 samples under the same assumptions listed above.

G.1.4.1 Example Sample Size Calculation

An example calculation of estimated sample size using this method is provided below. The example calculation is based on Thorium-228 remnant soil data, a type I error of 0.05, a Type II error of 0.20, and a target mean (LBGR) of 75 percent of the FRL. These were the parameter values assumed in the estimation of certification sample sizes used in Area 1, Phase I. The standard deviation used in this sensitivity analysis was estimated from the remnant dataset, as previously described. Under the current recommended scenario of

- Type I error rate = 0.05 (primary COC)
- Type II error rate = 0.20

- An assumed estimated maximum residual level of approximately 75 percent of the FRL

the following example equation is presented. Starting with the initial equation:

$$n = \frac{(Z_{1-\alpha} + Z_{1-\beta})^2}{\left(\frac{RG - \bar{x}_{target}}{S_{Est.}}\right)^2}$$

Then, substituting the values for

$\alpha$ = *probability of a Type I Error* = 0.05
$Z_{(1-0.05)} = Z_{0.95} = 1.645$
$\beta$ = *probability of a Type II Error* = 0.20
$Z_{(1-0.20)} = Z_{0.80} = 0.842$
$RG$ = *the Remedial Goal, FRL* = 1.7 *pCi/g*
$\bar{x}_{target}$ = *target clean-up level mean*
= *75% of the FRL* = 1.28 *pCi/g*
$S_{Est.}$ = *standard deviation estimated Remnant dataset* = 0.498 (*from Table x.xx*)

yields

$$n = \frac{(1.645 + .842)^2}{\left(\frac{1.5 - 1.28}{0.498}\right)^2} = 7.2$$

To ensure that the alpha and beta error rates are satisfied, under the given assumptions, we always round the calculated number up to the next highest integer. In this case, the calculated value of 7.2 is rounded up to 8. The additional 20 percent safety factor is added to bring the sample size to 10. Therefore, under the given assumptions, we would need to collect a minimum of 10 samples per CU and analyze 8 samples for Thorium-232 in order to certify the CU.

G.1.5 Summary and Recommendations

Determination of the appropriate sample size to assess compliance with the FRLs is highly dependent on each one of the assumed parameters. The only fixed parameters in the equation are the remedial goal (FRL) and the false negative rate (5 percent for primary COCs and 10 percent for secondary COCs); all others are subject to sensitivity analysis. Briefly, this interdependence on the estimated sample size can be summarized in the following table

| Parameter | Increase Value | Decrease Value |
|---|---|---|
| False Positive Rate (Type II Error) | Fewer Samples | More Samples |
| Target Level | More Samples | Fewer Samples |
| Estimated Standard Deviation | More Sample | Fewer Samples |

A review of Tables G-4 through G-9 indicates that, based on the remnant data, certification of Thorium-228 is most sensitive to sample size limits. The calculated sample sizes used in Area 1, Phase I, were based on estimated residual standard deviations calculated from "unimpacted" areas based on database queries. More refined estimates were derived using the block modeling technique previously described to generate the remnant datasets. Clearly, if the remnant dataset standard deviation is a good estimate of the residual standard deviation and the target level of 75 percent of the FRL is a good estimate of the residual activity level after remediation, then a sample size of 12 used in Area 1, Phase I was very conservative (greater then sufficient size), indeed being a full 50 percent greater than the estimated sample size (Table G-4, LBGR=75%, maximum N = 8 for Thorium-228).

Further evidence of the conservative sample size (greater then sufficient size) used in Area 1, Phase I, can be seen from the summary of analytical results from Area 1, Phase 1, presented in Table G-11. The actual average residual CU mean level for the primary COCs are all below the estimated 75 percent level with Total Uranium concentrations being less than 15 percent of the FRL. For the secondary metals COCs the arsenic results were similar, whereas beryllium was less then 44 percent

(many being non-detects). But, even stronger evidence of the conservative nature of the sample size estimation is the observed variability levels. The actual standard deviations observed in the Area 1, Phase 1, certification datasets were, on average, well below the estimated values. Primary COCs average observed standard deviation was actual down in the range of approximately 35 to 55 percent of estimates, whereas the metals were about 65 to 76 percent of estimates. As shown above, the amount of variability of the data within a CU greatly influences the required number of samples to demonstrate compliance with the FRLs. The lower the variability the fewer sample points are required to accurately estimate the true CU average level/concentration. Observing that the Area 1, Phase I, CUs are far less variable than estimated, especially for the primary COCs, there is strong evidence that the estimated sample size of 12 was very conservative to determine compliance with FRLs.

Because of the apparent conservativeness of the sample size estimation used in Area 1, Phase I, the actual sample sizes will be calculated and justified during the development of the Certification Design Letter for the area to be certified. Better estimates for expected standard deviations may be obtained from pre-certification sampling.

The parameters and assumptions to be used in the calculation of sample size are as follows:

- Data are normally distributed,
- Type I error rate = 0.05 (primary COCs) and 0.10 (secondary COCs)
- Type II error rate = 0.20
- An assumed estimated maximum residual level of approximately 75 percent of the FRL.

For Group 1 CUs, the number of certification samples for primary COCs will be established at a minimum of 12 samples but no greater than 16. In the rare and unforeseen situation where 16 samples would not be enough to meet the Type I and Type II error rates, the target cleanup level may need to be adjusted downward based on actual conditions. Secondary COCs will be sampled in Group I CUs at a rate of 8 to 12 samples. For Group 2 CUs, the sampling rate will be set within the range of 8 to 12

samples for both primary and secondary COCs because the expected variability should be very low, since there should be little or no secondary contamination prior to excavation. Regardless of the numbers of laboratory samples determined, the HPGe gamma spectrometry field measurement will also be conducted at all potential random sampling locations (i.e., 16 locations per CU) for certification purposes as discussed in Section 2.4 and Appendix H of the SEP.

## G.2 JUSTIFICATION FOR SCANNING AS AN INTEGRAL PART OF PRE-CERTIFICATION

The goal of certification is to document that the release criteria for a certification unit (set forth in the IRDP and Certification Design Letter) are met. This will be done by taking direct measurements using a HPGe and by collecting samples of surface soil and analyzing them. This information will be supplemented by the use of scanning technologies during pre-certification activities.

A typical soil sampling program depends on a finite number of individual samples taken over the surface of an area. It is possible that such a program will miss elevated areas of contamination located between the sampling points. The propensity of the sampling program to miss a hypothetical hot spot depends on the spacing between the sampling points. As the distance between two sampling points increases, the possibility of missing an area containing contaminated soil also increases. Performing a 100 percent scan of the surface for gamma-emitting radionuclides addresses this information by supplying semi-quantitative information between the points.

At the FEMP, for example, approximately 125 feet separate sampling locations on a triangular grid in a 500-ft by 500-ft certification unit with 16 sampling points.[1] This spacing would encompass an unsampled circular area of 24,544 $ft^2$. For a 250-ft by 250-ft area with 16 sampling points, the distance between points shrinks to about 62.5 ft, and the unsampled area becomes 6,136 $ft^2$. In order to justify

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1 $\sqrt{\frac{Area}{No.\,Samples}} = \sqrt{\frac{250{,}000\,ft}{16}} = 125\,ft$

the size of these certification units and the resulting grid spacing, it is necessary to demonstrate that any areas that might be missed by this sampling do not significantly affect the final risk to humans.

### G.2.1 Impact of Area Size on Risks

The risks to the undeveloped park user from a large area of soil containing the uranium FRL at 82 parts per million (ppm) were determined during the Operable Unit 5 RI/FS process. Using these risks as a starting point, the impact on the risks to this receptor from shrinking the area was investigated. A well-known computer code, known as RESRAD (DOE 1993c), was used to calculate doses from circular areas of soil containing 82 ppm natural uranium. Table G-13 lists the site-specific parameters used in this exercise. A series of RESRAD runs was performed using the scenario for the undeveloped park user. The only variation between the runs was the size of the contaminated area by varying the area of the contaminated soil.

The result of these RESRAD runs were then used to calculate a ratio of the risks produced by a certification unit with soil containing 82 ppm uranium ratio to the dose produced by a smaller soil area with the same uranium concentration. This ratio, called the Area Factor, provides a measure of the effect that area size has on risk to the receptor from residual levels of uranium. These Area Factors, based on a certification unit size of 500-ft by 500-ft, are plotted in Figure G-2.

The uranium concentration required to produce the same exposure to the undeveloped park user increases as the area decreases for both sets of areas factors. For example, the maximum size of a circlular hot spot that may be missed in a 500-ft by 500-ft certification unit with 16 samples laid out in a randomly placed systematic grid like the one in Figure G-2 is about 25,000 $ft^2$. The area factor for a hotspot this size would approach 10. This means the uranium concentration in that limited area would have to approach 10 times the FRL of uranium to produce the same level of risk to a roving receptor like the undeveloped park user as concentrations of one FRL would in a 500-ft by 500-ft area. Similarly, soil concentrations in a 6,000 $ft^2$ unsampled area would need to exceed 40 times the FRL to match the risks from one FRL of uranium in soil in a 500-ft by 500-ft certification unit.

This exercise is not intended to justify leaving such material in place, but rather to point out that inadvertently leaving a few isolated hot spots does not necessary result in unacceptable risks to users of the site. The "Manual for Implementing Residual Radioactive Material Guidelines Using RESRAD" (DOE 1993c) for states that: "Every reasonable effort shall be made to identify and remove any source that has a radionuclide concentration exceeding 30 times the authorized limit, irrespective of area." ALARA implies that it is desirable to minimize the possibility that these hot spots will remain after excavation. Figure G-1 plots both relationship between area and the FRL for uranium and this 30 times the authorized limit value. Above the 30 times value, the health effects calculations (shown by the dotted line) are provide for reference only, since they are superceded by the DOE directed limit of 30 FRLs.

G.2.2 Scanning Instrument Sensitivity

The proper use of wide area scanning such as RTRAK at the FEMP will greatly reduce the possibility that hot spots will remain undetected. A hot spot is an identifiable area of soil containing radionuclides that is measurably elevated when compared to surrounding areas. The ability of available instrumentation to detect such areas depends on the amount of activity in the area and the size of the area. Larger areas are easier to detect than smaller areas with the same activity, and areas with higher activity are easier to detect than similar sized areas with less activity.

Recent work with the RTRAK and other large volume NaI detectors, and the HPGe systems currently deployed at the FEMP indicate that these systems can be used to identify areas of soil containing elevated uranium concentrations. Running at 1 mph and using a spectrum acquisition time of 4 seconds allows these systems to discriminate uranium, radium-226 and thorium-232 concentrations at levels equal to three times the Operable Unit 5 FRL in areas larger than 300 $ft^2$ (DOE 1997b). These performance-based screening levels, presented in Table G-14 are much lower than the health-based limits derived by the scoping calculation presented in Section G.2.1.

### G.2.3 FEMP-Specific Hot-Spot Criteria

Specific hot spot criteria were developed using the concentration and area size criteria developed in Sections G.2.1 and G.2.2. Because the performance based screening levels are practical goals for field surveys, they will be adopted as the hot spot criteria for the gamma-emitting radionuclides. Table G-15 summarizes the final hot-spot criteria selected for the FEMP.

### G.2.4 Role of Scanning

Because area scanning will be able to reliably detect the activity from most hot spots, and procedures such as the ones described in the precertification activities defined in Section 3 of the SEP will be in place to remove the soil in those areas if required, then the scanning technology can be used to provide assurance that no areas between the fixed sampling points will exceed the hot spot criteria set forth in G.2.3. Since these criteria are well below the health based limits for contamination in small areas, this provides additional confidence the final certification decision is health protective.

Scanning with large-volume NaI detectors currently available at the FEMP will be sufficient to detect elevated areas of radioactivity in surface soils. This technology, when combined with direct measurements taken by HPGe instrumentation and supplemented be discrete soil sampling and analysis, will be adequate to identify elevated areas that may pose a health risk. This implies that the combination of 100 percent scanning, selective use of the HPGe to characterize areas of elevated activity, and a combination of HPGe measurements and the sampling and analysis of discrete soils samples taken on a random sampling pattern for certification will be sufficient to certify that the remediation has met the specific certification criteria set forth for soils.

## TABLE G-1

## BACKGROUND SURFACE SOIL SUMMARY STATISTICS

| Analyte | Number of Samples | Number Detected | Statistical Distribution | 95% UCL on the Mean |
|---|---|---|---|---|
| Radium-226 | 30 | 30 | Normal | 1.223 |
| Radium-228 | 30 | 30 | Undefined | 1.101 |
| Thorium-228 | 30 | 29 | Normal | 1.119 |
| Thorium-232 | 30 | 30 | Lognormal | 1.08 |
| Uranium, Total* | 30 | 30 | Normal | 3.27 |
| | | | | |
| Cesium-137 | 30 | 30 | Lognormal | 0.443 |
| Lead-210 | 30 | 30 | Lognormal | 1.005 |
| Strontium-90 | 30 | 0 | - | - |
| Thorium-230 | 30 | 29 | Normal | 1.496 |
| | | | | |
| Arsenic | 26 | 26 | Lognormal | 6.03 |
| Beryllium | 14 | 1 | Undefined | 0.31 |
| Lead | 27 | 27 | Lognormal | 18.24 |

Source: CERCLA/RCRA Background Soil Study, November 1992.

* Uranium, Total was not included in the Background Soil Study and has been calculated from the original background data.

## TABLE G-2

## BACKGROUND SUBSURFACE SOIL SUMMARY STATISTICS

| Analyte | Sample Depth Interval | Number of Samples | Number Detected | Statistical Distribution | 95% UCL on the Mean |
|---|---|---|---|---|---|
| Radium-226 | 36"-42" | 30 | 30 | Undefined | 1.021 |
| | 48"-54" | 21 | 21 | Undefined | 0.923 |
| Radium-228 | 36"-42" | 30 | 30 | Lognormal | 0.911 |
| | 48"-54" | 21 | 21 | Lognormal | 0.865 |
| Thorium-228 | 36"-42" | 30 | 25 | Normal | 0.955 |
| | 48"-54" | 21 | 16 | Normal | 0.856 |
| Thorium-232 | 36"-42" | 30 | 20 | Undefined | 0.91 |
| | 48"-54" | 21 | 16 | Normal | 0.846 |
| Uranium, Total* | 36"-42" + 48"-54" | 51 | - | Normal | 2.572 |
| | | | | | |
| Cesium-137 | 36"-42" | - | - | - | - |
| | 48"-54" | - | - | - | - |
| Lead-210 | 36"-42" | 30 | 26 | Undefined | 0.658 |
| | 48"-54" | 21 | 17 | Undefined | 0.684 |
| Strontium-90 | 36"-42" | 30 | 0 | - | - |
| | 48"-54" | 21 | 1 | Undefined | 0.283 |
| Thorium-230 | 36"-42" | 30 | 26 | Normal | 1.268 |
| | 48"-54" | 21 | 19 | Normal | 1.311 |

**TABLE G-2**
**(Continued)**

| Analyte | Sample Depth Interval | Number of Samples | Number Detected | Statistical Distribution | 95% UCL on the Mean |
|---|---|---|---|---|---|
| Arsenic | 36"-42" | 26 | 26 | Lognormal | 6.77 |
| | 48"-54" | 18 | 18 | Normal | 5.42 |
| Beryllium | 36"-42" | 30 | 9 | Undefined | 0.37 |
| | 48"-54" | 20 | 6 | Undefined | 0.4 |
| Lead | 36"-42" | 28 | 28 | Lognormal | 10.93 |
| | 48"-54" | 19 | 19 | Normal | 8.8 |

Source: CERCLA/RCRA Background Soil Study, November 1992.

* Uranium, Total, was not included in the Background Soil Study and has been calculated from the original background data.

## TABLE G-4

## ESTIMATED SAMPLE SIZES COMPARING LBGR LEVELS, 2x FRL REMOVED:

Type I Error Rate = 5%, Type II Error Rate = 20%

LBGR* = 75%

| | FRL | LBGR | Stand. Dev. | calc N | N | N+20% |
|---|---|---|---|---|---|---|
| Radium 226 | 1.7 | 1.28 | 0.448 | 6.5 | 7 | 9 |
| Radium 228 | 1.8 | 1.35 | 0.376 | 5.2 | 6 | 8 |
| Thorium 228 | 1.7 | 1.28 | 0.498 | 7.2 | 8 | 10 |
| Thorium 232 | 1.5 | 1.13 | 0.364 | 6 | 7 | 9 |
| Uranium, Total | 82 | 61.5 | 12.602 | 3.8 | 4 | 5 |
| Uranium, Total | 50 | 37.5 | 12.602 | 6.2 | 7 | 9 |
| Arsenic | 12 | 9 | 2.962 | 4.5 | 5 | 6 |
| Beryllium | 1.5 | 1.13 | 0.419 | 5 | 6 | 8 |

LBGR* = 80%

| | FRL | LBGR | Stand. Dev. | calc N | N | N+20% |
|---|---|---|---|---|---|---|
| Radium 226 | 1.7 | 1.36 | 0.448 | 8.1 | 9 | 11 |
| Radium 228 | 1.8 | 1.44 | 0.376 | 6.5 | 7 | 9 |
| **Thorium 228** | **1.7** | **1.36** | **0.498** | **9.1** | **10** | **12** |
| Thorium 232 | 1.5 | 1.2 | 0.364 | 7.5 | 8 | 10 |
| Uranium, Total | 82 | 65.6 | 12.602 | 4.8 | 5 | 6 |
| Uranium, Total | 50 | 40 | 12.602 | 7.8 | 8 | 10 |
| Arsenic | 12 | 9.6 | 2.962 | 5.6 | 6 | 8 |
| Beryllium | 1.5 | 1.2 | 0.419 | 6.3 | 7 | 9 |

* as a percent of the FRL

## TABLE G-5

## ESTIMATED SAMPLE SIZES COMPARING LBGR LEVELS, 2x FRL REMOVED:

Type I Error Rate = 5%, Type II Error Rate = 15%

LBGR* = 75%

| | FRL | LBGR | Stand. Dev. | calc N | N | N+20% |
|---|---|---|---|---|---|---|
| Radium 226 | 1.7 | 1.28 | 0.448 | 7.6 | 8 | 10 |
| Radium 228 | 1.8 | 1.35 | 0.376 | 6 | 7 | 9 |
| Thorium 228 | 1.7 | 1.28 | 0.498 | 8.4 | 9 | 11 |
| Thorium 232 | 1.5 | 1.13 | 0.364 | 7 | 7 | 9 |
| Uranium, Total | 82 | 61.5 | 12.602 | 4.4 | 5 | 6 |
| Uranium, Total | 50 | 37.5 | 12.602 | 7.2 | 8 | 10 |
| Arsenic | 12 | 9 | 2.962 | 4.5 | 5 | 6 |
| Beryllium | 1.5 | 1.13 | 0.419 | 5 | 6 | 8 |

LBGR* = 80%

| | FRL | LBGR | Stand. Dev. | calc N | N | N+20% |
|---|---|---|---|---|---|---|
| Radium 226 | 1.7 | 1.36 | 0.448 | 9.5 | 10 | 12 |
| Radium 228 | 1.8 | 1.44 | 0.376 | 7.5 | 8 | 10 |
| Thorium 228 | 1.7 | 1.36 | 0.498 | 10.5 | 11 | 14 |
| Thorium 232 | 1.5 | 1.2 | 0.364 | 8.7 | 9 | 11 |
| Uranium, Total | 82 | 65.6 | 12.602 | 5.5 | 6 | 8 |
| Uranium, Total | 50 | 40 | 12.602 | 9.1 | 10 | 12 |
| Arsenic | 12 | 9.6 | 2.962 | 6.6 | 7 | 9 |
| Beryllium | 1.5 | 1.2 | 0.419 | 7.5 | 8 | 10 |

* as a percent of the FRL

## TABLE G-6

## ESTIMATED SAMPLE SIZES COMPARING LBGR LEVELS, 2x FRL REMOVED:

Type I Error Rate = 5%, Type II Error Rate = 10%

LBGR* = 75%

| | FRL | LBGR | Stand. Dev. | calc N | N | N+20% |
|---|---|---|---|---|---|---|
| Radium 226 | 1.7 | 1.28 | 0.448 | 9 | 10 | 12 |
| Radium 228 | 1.8 | 1.35 | 0.376 | 7.2 | 8 | 10 |
| Thorium 228 | 1.7 | 1.28 | 0.498 | 10 | 11 | 14 |
| Thorium 232 | 1.5 | 1.13 | 0.364 | 8.3 | 9 | 11 |
| Uranium, Total | 82 | 61.5 | 12.602 | 5.3 | 6 | 8 |
| Uranium, Total | 50 | 37.5 | 12.602 | 8.6 | 9 | 11 |
| Arsenic | 12 | 9 | 2.962 | 6.5 | 7 | 9 |
| Beryllium | 1.5 | 1.13 | 0.419 | 7.3 | 8 | 10 |

LBGR* = 80%

| | FRL | LBGR | Stand. Dev. | calc N | N | N+20% |
|---|---|---|---|---|---|---|
| Radium 226 | 1.7 | 1.36 | 0.448 | 11.3 | 12 | 15 |
| Radium 228 | 1.8 | 1.44 | 0.376 | 8.9 | 9 | 11 |
| Thorium 228 | 1.7 | 1.36 | 0.498 | 12.5 | 13 | 16 |
| Thorium 232 | 1.5 | 1.2 | 0.364 | 10.4 | 11 | 14 |
| Uranium, Total | 82 | 65.6 | 12.602 | 6.6 | 7 | 9 |
| Uranium, Total | 50 | 40 | 12.602 | 10.8 | 11 | 14 |
| Arsenic | 12 | 9.6 | 2.962 | 8.1 | 9 | 11 |
| Beryllium | 1.5 | 1.2 | 0.419 | 9.2 | 10 | 12 |

* as a percent of the FRL

## TABLE G-7

## ESTIMATED SAMPLE SIZES COMPARING LBGR LEVELS, 3x FRL REMOVED:

Type I Error Rate = 5%, Type II Error Rate = 20%

LBGR* = 75%

| | FRL | LBGR | Stand. Dev. | calc N | N | N+20% |
|---|---|---|---|---|---|---|
| Radium 226 | 1.7 | 1.28 | 0.492 | 7.2 | 8 | 10 |
| Radium 228 | 1.8 | 1.35 | 0.376 | 5.2 | 6 | 8 |
| Thorium 228 | 1.7 | 1.28 | 0.515 | 7.5 | 8 | 10 |
| Thorium 232 | 1.5 | 1.13 | 0.387 | 6.4 | 7 | 9 |
| Uranium, Total | 82 | 61.5 | 13.895 | 4.2 | 5 | 6 |
| Uranium, Total | 50 | 37.5 | 13.895 | 6.9 | 7 | 9 |
| Arsenic | 12 | 9 | 2.962 | 4.5 | 5 | 6 |
| Beryllium | 1.5 | 1.13 | 0.451 | 5.4 | 6 | 8 |

LBGR* = 80%

| | FRL | LBGR | Stand. Dev | calc N | N | N+20% |
|---|---|---|---|---|---|---|
| Radium 226 | 1.7 | 1.36 | 0.492 | 8.9 | 9 | 11 |
| Radium 228 | 1.8 | 1.44 | 0.376 | 6.5 | 7 | 9 |
| Thorium 228 | 1.7 | 1.36 | 0.515 | 9.4 | 10 | 12 |
| Thorium 232 | 1.5 | 1.2 | 0.387 | 8 | 8 | 10 |
| Uranium, Total | 82 | 65.6 | 13.895 | 5.2 | 6 | 8 |
| Uranium, Total | 50 | 40 | 13.895 | 8.6 | 9 | 11 |
| Arsenic | 12 | 9.6 | 2.962 | 5.6 | 6 | 8 |
| Beryllium | 1.5 | 1.2 | 0.451 | 6.8 | 7 | 9 |

* as a percent of the FRL

## TABLE G-8

## ESTIMATED SAMPLE SIZES COMPARING LBGR LEVELS, 3x FRL REMOVED:

Type I Error Rate = 5%, Type II Error Rate = 15%

LBGR* = 75%

| | FRL | LBGR | Stand. Dev. | calc N | N | N+20% |
|---|---|---|---|---|---|---|
| Radium 226 | 1.7 | 1.28 | 0.492 | 8.3 | 9 | 11 |
| Radium 228 | 1.8 | 1.35 | 0.376 | 6 | 7 | 9 |
| Thorium 228 | 1.7 | 1.28 | 0.515 | 8.7 | 9 | 11 |
| Thorium 232 | 1.5 | 1.13 | 0.387 | 7.4 | 8 | 10 |
| Uranium, Total | 82 | 61.5 | 13.895 | 4.9 | 5 | 6 |
| Uranium, Total | 50 | 37.5 | 13.895 | 8 | 8 | 10 |
| Arsenic | 12 | 9 | 2.962 | 4.5 | 5 | 6 |
| Beryllium | 1.5 | 1.13 | 0.451 | 5.4 | 6 | 8 |

LBGR* = 80%

| | FRL | LBGR | Stand. Dev. | calc N | N | N+20% |
|---|---|---|---|---|---|---|
| Radium 226 | 1.7 | 1.36 | 0.492 | 10.4 | 11 | 14 |
| Radium 228 | 1.8 | 1.44 | 0.376 | 7.5 | 8 | 10 |
| Thorium 228 | 1.7 | 1.36 | 0.515 | 10.9 | 11 | 14 |
| Thorium 232 | 1.5 | 1.2 | 0.387 | 9.3 | 10 | 12 |
| Uranium, Total | 82 | 65.6 | 13.895 | 6.1 | 7 | 9 |
| Uranium, Total | 50 | 40 | 13.895 | 10 | 10 | 12 |
| Arsenic | 12 | 9.6 | 2.962 | 6.6 | 7 | 9 |
| Beryllium | 1.5 | 1.2 | 0.451 | 8.1 | 9 | 11 |

* as a percent of the FRL

## TABLE G-9

## ESTIMATED SAMPLE SIZES COMPARING LBGR LEVELS, 3x FRL REMOVED:

Type I Error Rate = 5%, Type II Error Rate = 10%

LBGR* = 75%

| | FRL | LBGR | Stand. Dev. | calc N | N | N+20% |
|---|---|---|---|---|---|---|
| Radium 226 | 1.7 | 1.28 | 0.492 | 9.9 | 10 | 12 |
| Radium 228 | 1.8 | 1.35 | 0.376 | 7.2 | 8 | 10 |
| Thorium 228 | 1.7 | 1.28 | 0.515 | 10.4 | 11 | 14 |
| Thorium 232 | 1.5 | 1.13 | 0.387 | 8.8 | 9 | 11 |
| Uranium, Total | 82 | 61.5 | 13.895 | 5.8 | 6 | 8 |
| Uranium, Total | 50 | 37.5 | 13.895 | 9.5 | 10 | 12 |
| Arsenic | 12 | 9 | 2.962 | 6.5 | 7 | 9 |
| Beryllium | 1.5 | 1.13 | 0.451 | 7.9 | 8 | 10 |

LBGR* = 80%

| | FRL | LBGR | Stand. Dev. | calc N | N | N+20% |
|---|---|---|---|---|---|---|
| Radium 226 | 1.7 | 1.36 | 0.492 | 12.4 | 13 | 16 |
| Radium 228 | 1.8 | 1.44 | 0.376 | 8.9 | 9 | 11 |
| Thorium 228 | 1.7 | 1.36 | 0.515 | 13 | 13 | 16 |
| Thorium 232 | 1.5 | 1.2 | 0.387 | 11 | 12 | 15 |
| Uranium, Total | 82 | 65.6 | 13.895 | 7.3 | 8 | 10 |
| Uranium, Total | 50 | 40 | 13.895 | 11.9 | 12 | 15 |
| Arsenic | 12 | 9.6 | 2.962 | 8.1 | 9 | 11 |
| Beryllium | 1.5 | 1.2 | 0.451 | 9.9 | 10 | 12 |

* as a percent of the FRL

## TABLE G-10

## ESTIMATED TARGET LEVELS (LBGR) REQUIRED FOR A SAMPLE SIZE OF 12:

Type I Error Rate = 5%

Type II Error rate = 0.20

| | | 2x FRL Removed | | 3x FRL Removed | |
|---|---|---|---|---|---|
| ANALYTE | FRL | LBGR % of FRL | LBGR | LBGR % of FRL | LBGR |
| Radium 226 | 1.7 | 83% | 1.41 | 82% | 1.39 |
| Radium 228 | 1.8 | 87% | 1.57 | 87% | 1.57 |
| Thorium 228 | 1.7 | 81% | 1.38 | 81% | 1.38 |
| Thorium 232 | 1.5 | 84% | 1.26 | 84% | 1.26 |
| Uranium, Total | 82 | 90% | 73.80 | 89% | 72.98 |
| Uranium, Total | 50 | 84% | 42.00 | 82% | 41.00 |
| Arsenic | 12 | 88% | 10.56 | 88% | 10.56 |
| Beryllium | 1.5 | 87% | 1.31 | 86% | 1.29 |

Type II Error rate = 0.15

| | | 2x FRL Removed | | 3x FRL Removed | |
|---|---|---|---|---|---|
| | FRL | LBGR % of FRL | LBGR | LBGR % of FRL | LBGR |
| Radium 226 | 1.7 | 81% | 1.38 | 79% | 1.34 |
| Radium 228 | 1.8 | 84% | 1.51 | 84% | 1.51 |
| Thorium 228 | 1.7 | 78% | 1.33 | 78% | 1.33 |
| Thorium 232 | 1.5 | 82% | 1.23 | 81% | 1.22 |
| Uranium, Total | 82 | 88% | 72.16 | 87% | 71.34 |
| Uranium, Total | 50 | 81% | 40.50 | 80% | 40.00 |
| Arsenic | 12 | 86% | 10.32 | 86% | 10.32 |
| Beryllium | 1.5 | 84% | 1.26 | 83% | 1.25 |

Type II Error rate = 0.10

| | | 2x FRL Removed | | 3x FRL Removed | |
|---|---|---|---|---|---|
| | FRL | LBGR % of FRL | LBGR | LBGR % of FRL | LBGR |
| Radium 226 | 1.7 | 77% | 1.31 | 75% | 1.28 |
| Radium 228 | 1.8 | 82% | 1.48 | 82% | 1.48 |
| Thorium 228 | 1.7 | 74% | 1.26 | 74% | 1.26 |
| Thorium 232 | 1.5 | 79% | 1.19 | 77% | 1.16 |
| Uranium, Total | 82 | 86% | 70.52 | 85% | 69.70 |
| Uranium, Total | 50 | 78% | 39.00 | 76% | 38.00 |
| Arsenic | 12 | 83% | 9.96 | 83% | 9.96 |
| Beryllium | 1.5 | 81% | 1.22 | 80% | 1.2 |

## TABLE G-11

## COMPARISON OF AREA 1 PHASE 1 CERTIFICATION RESULTS TO ESTIMATES USED IN THE DETERMINATION OF SAMPLE SIZE

| Primary COCs | FRL | Avg CU Mean | % FRL | Remnant SD (2xFRL) | Avg CU St.Dev. | % Remnant |
|---|---|---|---|---|---|---|
| Radium-226 | 1.7 | 1.210 | 71.2% | 0.448 | 0.188 | 42.0% |
| Radium-228 | 1.8 | 1.241 | 69.0% | 0.376 | 0.208 | 55.2% |
| Thorium-228 | 1.7 | 1.224 | 72.0% | 0.498 | 0.175 | 35.2% |
| Thorium-232 | 1.5 | 1.117 | 74.5% | 0.364 | 0.150 | 41.1% |
| Uranium, Tot | 82 | 11.712 | 14.3% | 12.602 | 6.625 | 52.6% |
| | | | | | | |
| Arsenic | 12 | 8.310 | 69.2% | 2.962 | 2.258 | 76.2% |
| Beryllium | 1.5 | 0.648 | 43.2% | 0.419 | 0.271 | 64.8% |

**TABLE G-12**

**SUMMARY OF ANALYTICAL METHODS THAT WOULD HAVE BEEN USED FOR AREA 1, PHASE I IF SEP PROCESS WERE IMPLEMENTED**

| COCs | CUs | t-Test | Test for Proportions | Wilcoxon Signed Rank | Median UCL (Percentile Test) |
|---|---|---|---|---|---|
| PRIMARY COCs | | | | | |
| Radium 226 | 41 | 37 (90%) | 0 (0.0%) | 2 (4.9%) | 2 (4.9%) |
| Radium 228 | 41 | 32 (78%) | 0 (0.0%) | 5 (12.2%) | 4 (9.8%) |
| Thorium 228 | 41 | 39 (95%) | 0 (0.0%) | 2 (4.9%) | 0 (0.0%) |
| Thorium 232 | 41 | 37 (90%) | 0 (0.0%) | 1 (2.4%) | 3 (7.3%) |
| Uranium, Total | 41 | 38 (93%) | 3 (7.3%) | 0 (0.0%) | 0 (0.0%) |
| | | | | | |
| ALL PRIMARY | 205 | 183 (89%) | 3 (1.5%) | 10 (4.9%) | 9 (4.4%) |
| | | | | | |
| SECONDARY COCs | | | | | |
| Cesium 137 | 5 | 2 (40%) | 3 (60%) | 0 (0.0%) | 0 (0.0%) |
| Thorium 230 | 5 | 5 (100%) | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) |
| Arsenic | 30 | 28 (93%) | 0 (0.0%) | 0 (0.0%) | 2 (6.7%) |
| Beryllium | 30 | 11 (37%) | 19 (63%) | 0 (0.0%) | 0 (0.0%) |
| Aroclor-1260 | 7 | 0 (0.0%) | 7 (100%) | 0 (0.0%) | 0 (0.0%) |
| | | | | | |
| OVERALL | 282 | 229 (81%) | 32 (11.3%) | 10 (3.5%) | 11 (3.9%) |

## TABLE G-13

## SITE-SPECIFIC VALUES IN RESRAD AREA SIZE ANALYSES

| Parameter Name | ID | Value | Units | Reference |
|---|---|---|---|---|
| Exposure Duration | ED | 38 | y/life | OU5 FS |
| Exposure Frequency | EF | 40 | d/y | OU5 FS |
| Exposure Time | ET | 2 | h/d | OU5 FS |
| Inhalation Rate | IRair | 0.83 | m3/h | OU5 FS (20/24) |
| | IRair | 66.7 | m3/y | 0.8333*2*40 |
| Soil Ingestion Rate | IRsoil | 13 | mg/d | OU5 FS |
| | IRsoil | 0.52 | g/y | 40*13/1000 |
| Soil Porosity | P | 0.457 | unitless | OU5 RI Appendix A.VIII-5 |
| Effective Porosity | | 0.25 | | OU5 FS |
| Density of Contaminated Zone | RHO | 1.44 | g/cm | OU5 RA |
| Radon Emanation Fraction | E | 0.2 | unitless | OU5 RI Appendix A.VIII-5 |
| Radon Diffusion Coefficient | D | -1 | cm2/s | Flag indicating code calcs |
| Thickness of Contaminated Zone | | 0.45 | m | OU5 FS |
| Erosion Rate | | 0.00001 | m/y | OU5 FS |
| Hydraulic Conductivity | | 22 | m/y | OU5 FS |
| Mass Loading in Air | | 2.00E-05 | g/m3 | OU5 FS |

**TABLE G-14**

**RTRAK PERFORMANCE AT THE FRL AND AT THREE TIMES THE FRL (DOE 1997B)**

| Activity Level | Ra-226 (pCi/g) | | | Th-232 (pCi/g) | | | Total U (ppm) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Error (pCi/g) | Averaging Radius (ft) | # of points | Error (pCi/g) | Averaging Radius (ft) | # of points | Error (pCi/g) | Averaging Radius (ft) | # of points |
| FRL | 0.17 | 20 | 25 | 0.15 | 10 | 12 | 8 | 40 | 100 |
| 3 x FRL | 0.51 | 10 | 12 | 0.45 | 8 | 5 | 24 | 25 | 45 |

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**TABLE G-15**

**HOT SPOT CRITERIA**

| | Area Size (ft2) | Concentration |
|---|---|---|
| Ra-226 (pCi/g) | <300 | 5.1 pCi/g |
| Th-232 (pCi/g) | <200 | 4.5 pCi/g |
| Total U (ppm) | <300 | 246 ppm |

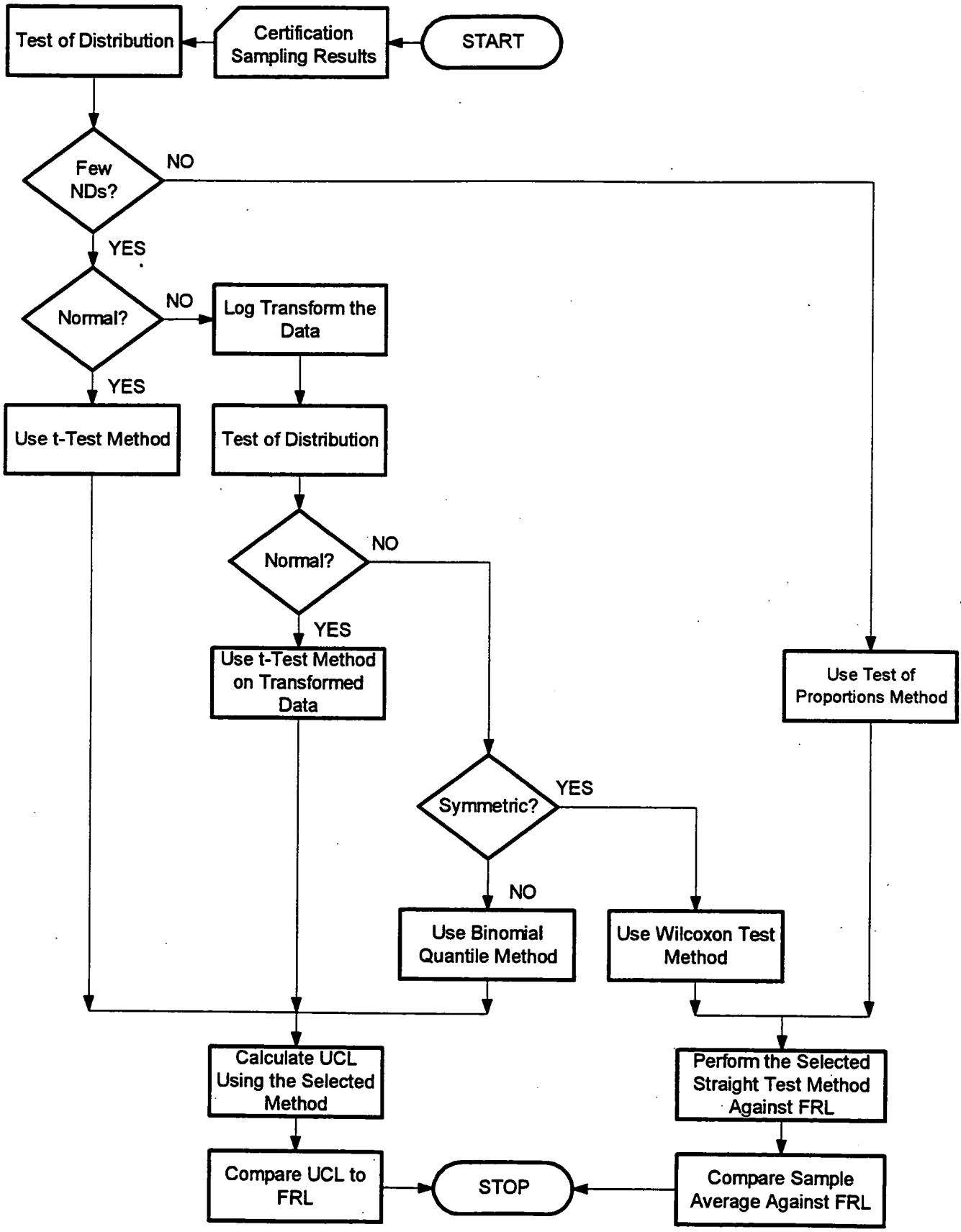


FIGURE G-1 SELECTION PROCEDURE FOR THE CERTIFICATION STATISTICAL ANALYSIS METHOD

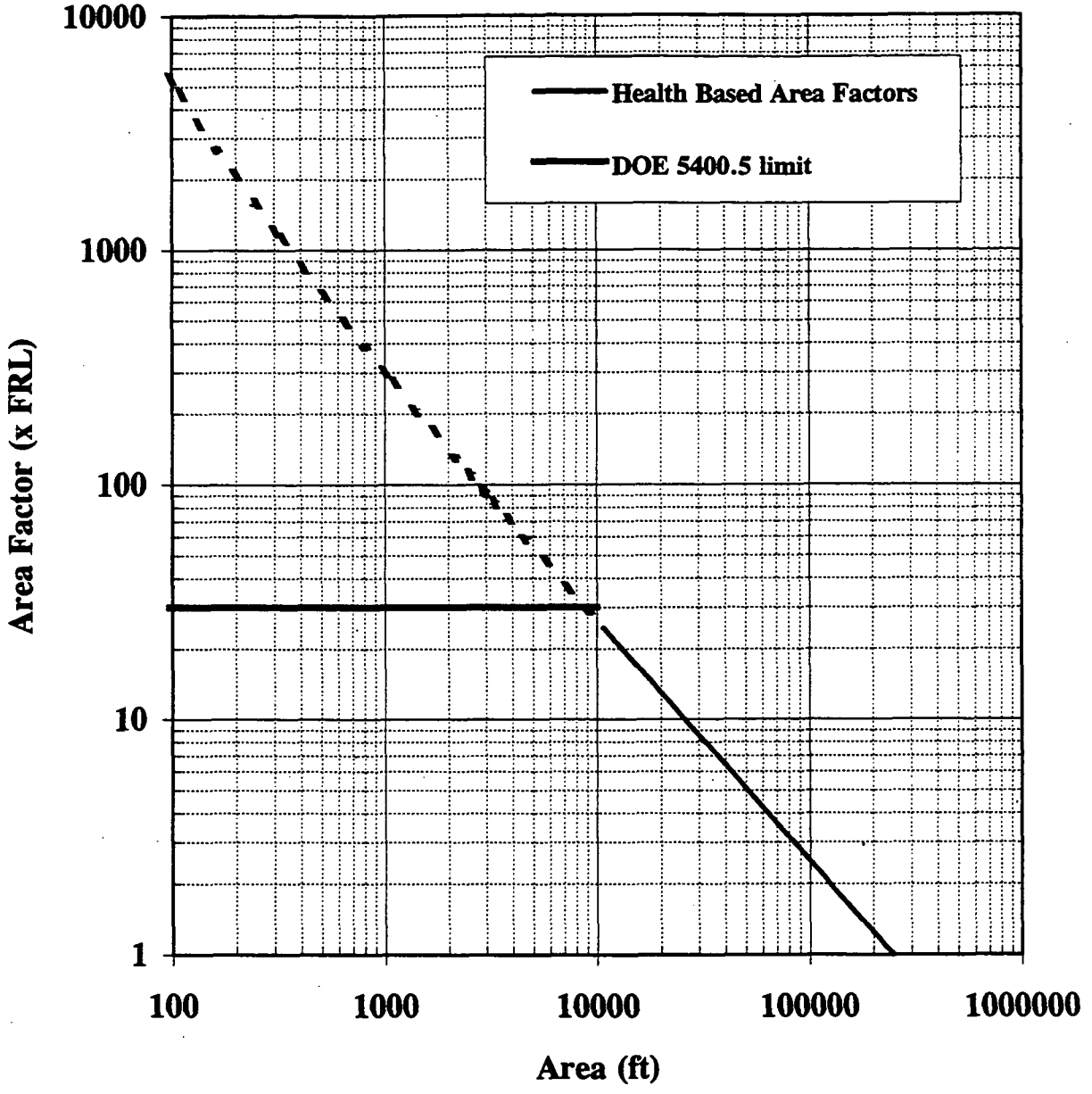


**Figure G-2 Site-Specific Area Factors for a Roving Undeveloped Park User Based on Health Effects and DOE Order 5400.4 Upper Limit of 30 Times the Guideline Limit**

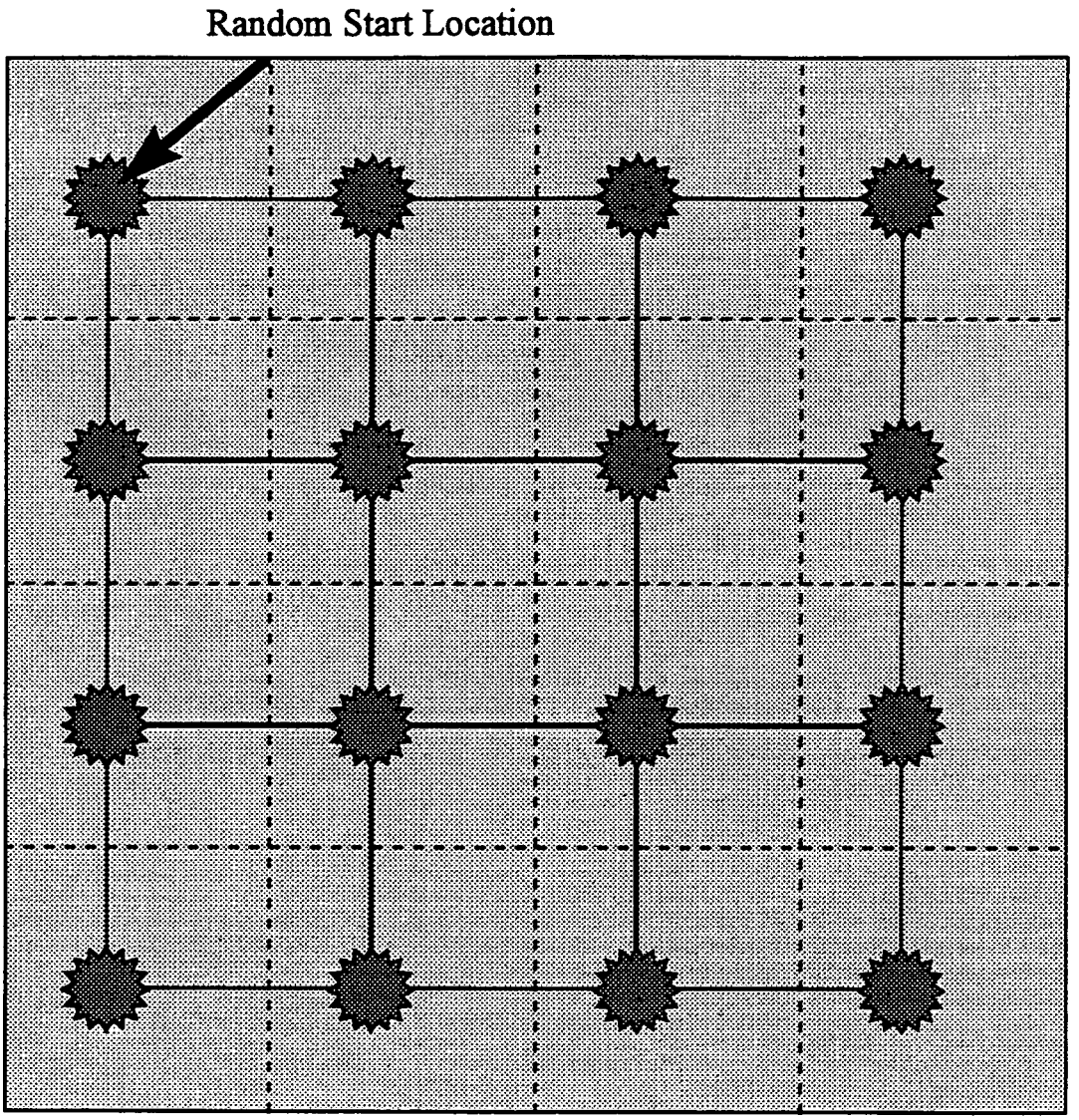


Figure G-3 Example of a CU with a Random Start Systematic Sampling Grid

# APPENDIX H

# FIELD MEASUREMENT METHODS

## INTRODUCTION

This appendix identifies the instruments and analyses to be used by the SCEP. The first portion of the appendix provides a description of the in-situ gamma spectroscopy systems currently being tested at the site. Subsequent sections identify other kinds of instruments that can be used for specialized scanning applications, and equipment suitable for a fields lab. The final portion of the appendix directs the reader to sources of information on the sampling and analytical methods routinely employed by the FEMP to analyze environmental samples.

## H.1 GAMMA SPECTROSCOPY

Two different gamma spectroscopy systems will be used to support the data collection phases defined in Section 2.4. One is build around a large volume sodium iodide (NaI) detector and is intended to provide wide area scanning capabilities which can identify areas of soil containing gamma emitting COCs exceeding 3 times the FRL. The second system is configured around a high purity germanium (HPGe) detector which can characterize concentrations of gamma emitting COCs in soil at or below the FRL level.

### H.1.1 Large Volume NaI Systems

There are two configurations of large volume NaI spectrometers currently deployed at the FEMP. Both are based on are based upon the same hardware and software. The first configuration deployed was a tractor-mounted gamma spectrometry system called the RTRAK. The second configuration, known as the BTRAK, is mounted on a small manually driven three-wheeled platform. Both systems utilize an on-board GPS for precise location of measurements. With heavy tree cover, the three-wheeled system measurements are referenced to known boundaries to interpolate the measurement locations. While usually deployed in the mobile mode, each are capable of stationary measurements.

The detector in each is a 4 x 4 x 16 inch NaI (Tl) gamma scintillator detector mounted within foam packing within a thin aluminum housing. On the RTRAK, the long axis of the detector is positioned perpendicular to the direction of travel. The BTRAK has the long axis mounted in the direction of travel. The detector center in both systems is at a height of 31 cm above the ground level.

The gamma scintillation signals from the detectors are processed through an on-board high speed multi-channel analyzer and laptop computer. The typical accumulate time for each spectrum ranges from 2-seconds to 16-seconds depending on the DQO. The specific location is tagged to each spectrum file by input from the on-board GPS. Another alarm is sounded at the end of the spectrum accumulate if the proper GPS information has not been received (interference or reduced satellite coverage). While the system is usually involved with accumulating spectra, the imbedded software system will also permit for data reduction for individual (or collective) spectra in the field. The files are collected in the computer hard drive.

Typically, the computer is taken to an on-site facility where the hard drive files are downloaded for data reduction. Following data reduction, the files are transferred to the sitewide Oracle database for archiving and potential retrieval and assessment.

A rudimentary screening is enabled by simply summing each spectrum for the total count rate for each accumulate period. The relatively large size of the detector (256 $in^3$) affords a very sensitive level of screening. An alarm can be set to sound when the count rate exceeds a pre-set level.

The software is set up to provide additional diagnostics. Specific regions of interest for integration are set for gamma ray peak energies at 2.615 Mev (Tl-208 daughter of Th-232), 1.765 Mev (Bi-214 daughter of Ra-226), 1.46 Mev (naturally occurring K-40), 1.001 Mev (Pa-234m daughter of U-238), and a region encompassing 62.9 Kev, 63.3 Kev, and 92.6 Kev (Th-234 daughter of U-238). The analyzer automatically compensates for any significant gain shift by re-computing proper gain (channel location for a specific energy) based upon continual re-assessment of designated and abundant gamma energy peaks that are always present in natural background. To account for variations in the associated Compton continuum, additional regions of interest are summed just above and just below the peak energies and normalized to the peak width to allow a net integration of the characteristic peak. The net count rates are used to compute the isotopic concentrations in the scanned soil surface. The basis for that calculation is a cross-reference to the HPGe system as a secondary standard. The HPGe system performance has been characterized in the previously cited Characterization Comparability Study.

While rudimentary scanning based upon total count rate is both sensitive and effective, field experience has been accumulated using the automated spectral stripping and analysis. Characteristic sensitivity demonstrates a mean equivalent to less than one FRL. Statistical confidence shows a UCL equivalent to less than two FRLs. There are a multitude of potential field conditions which could affect performance at the FRL level; however, none have been encountered which have denied performance at the three FRL level. Obviously, performance is more confident for the relatively high levels for the OSDF WAC.

The software used for data reduction also allows for the summing of adjacent or sequential spectra which can improve statistical confidence; for example, summing of two eight second spectra to yield an equivalent 16 second spectrum. This allows averaging over a larger area.

The spectral acquisition time and the speed the detector is moved over the ground determines the detector's viewing area. As the count time increases, the accuracy of the results increases. As the speed increases, the area viewed increases. A proper balance of these two variables will allow the system to meet DQO requirements and cover the most ground in a given time.

From the screening data provided by resolution gamma spectrometry systems, specific locations can be identified as candidates for high resolution HPGe gamma spectrometry. Specifically, these are locations statistically within the range of the hot-spot criteria and WAC concentrations. Again, confirmation at critical levels are ultimately supported by appropriate sampling and analysis for both radiological and non-radiological contaminants. Table H-1 contains a summary of the potential uses and current capabilities of this system. It is anticipated that continued development of this system will expand these capabilities and that new uses will be found for the equipment as its performance is enhanced.

### H.1.2 High Resolution Gamma Spectroscopy

The HPGe gamma spectrometry system is used for stationary measurements with the detector mounted on a tripod. The usual height is one meter above the surface to yield a field of view covering an

approximate 10 meter diameter (78.5 $m^2$). Equivalent parameters have been established for measurements taken with the detector at 30 cm from the surface covering approximately 12.6 $m^2$.

Laboratory analysis of discrete samples tends to minimize measurement error. However, while analyzing only a limited number of discrete samples in the laboratory may be practical, each sample may only be representative of a small point in space. Thus, the sampling error may be large. Conversely, HPGe measurement error may be somewhat larger than laboratory analyses error. However, the advantages of HPGe measurements are that high quality measurements can be made quickly, a number of radionuclides can be analyzed simultaneously, and HPGe has a large field of view which enables it to characterize a sizeable area. Thus, HPGe tends to minimize sampling error and is superior to laboratory measurements of discrete points, particularly in heterogeneous areas.

The HPGe n-type detector is rated at 90 percent efficiency [relative to NaI (Tl)]. The energy resolution is better than two percent at 1.332 Mev. The field package includes a high speed multi-channel analyzer and laptop computer. The usual accumulate time is 15 minutes. The location is identified by a GPS and each data file includes the corresponding coordinates for each recorded spectrum.

The software employed for data reduction identifies gamma energy peaks based upon specific Gaussian shape attributes. Following a series of fitting tests for a peak, the best final shape is determined and the Compton continuum is subtracted to yield the net integrated count for the specific energy peak. This process is repeated over the entire range of energies (40 Kev through 3 Mev), and the area of each peak is calculated. The software includes a number of input parameters in order to compute soil concentrations. For this FEMP application, the computed soil concentrations were compared, for correlation, with analytical data from soil samples collected on a series of test areas. The Characterization Comparability Study compared the soil sample data to the gamma spectrometry data output.

The precision of the gamma spectrometry system was tested by periodic repeat analyses of reference locations to produce control charts. An example of the precision experience is shown below.

| Isotope | Concentration (pCi/g) | One Standard Deviation (Percent) |
|---|---|---|
| Total U | 74.37 | 3.1 |
| Ra-226 | 0.83 | 13.3 |
| K-40 | 10.4 | 3.7 |

For accuracy, the Characterization Comparability Study showed relative agreement between analytical laboratory results and the concentrations reported by the HPGe system. The typical range of relative standard deviation (covering a broad range of concentrations) amounted to 10 to 11 percent for total uranium, approximately 7 percent for thorium-232, and 27 to 31 percent for radium-226.

Another touchstone of performance, from the Comparability Study is an assessment of the Minimum Detectable Concentrations afforded by the HPGe systems compared to the FRLs.

| Analyte | MDC | FRL |
|---|---|---|
| Total U | 4.06 ppm | 50 or 82 ppm |
| Th-232 | 0.061 pCi/g | 1.5 pCi/g |
| Ra-226 | 0.055 pCi/g | 1.7 pCi/g |

The MDCs demonstrate sensitivity and also a sense of the relatively good statistical performance at concentrations equivalent to the respective FRLs.

The relatively large uncertainty associated with the radium-226 determinations is the consequence of the temporal variation in the radon flux which effects the degree of equilibrium of the short half-lived gamma emitters which are bismuth-214 and lead-214. These are daughters of radon-222 (and radium-226). This temporal variability has been identified to depend upon factors such as soil temperature and atmospheric stability. The depth of the radium-226 contamination and the rate of radon-222 escape from the matrix also appear to be variable. Through further studies, it may be possible to relate the influence of various parameters to the degree of equilibrium of the lead and

bismuth-214 relative to the radium-226. The generic experience is an expectation of 80 percent equilibrium. However, as the correlation demonstrates, this is subject to many variables some of which can change significantly within a matter of hours.

On the other hand, because of the good sensitivity to low concentrations of radium-226, the performance may be adequate for the intended application. Additional testing is planned to further explore this issue. The findings of this study will be presented in a later submission.

The strengths of the HPGe are its ability to accurately quantify a variety of isotopes, its high degree of energy resolution (which makes interferences less likely), its ability to average data over either large or small areas, thereby minimizing sampling error and maximizing data representativeness, and its capability to delineate footprints of hot spots or WAC exceedances by lowering the detecter height to focus in on smaller areas. These characteristics dictate the HPGe's use in providing high-quality data for certification/verification activities relative to remediation of soils for hot spots, WAC exceedances, and FRLs. Additionally, HPGe's strength in footprint delineation indicates that it should be used as a confirmatory tool to evaluate potential hot spot and WAC exceedance areas noted by RTRAK surveys. Table H-1 contains a summary of the potential uses and current capabilities of this system.

## H.2 OTHER FIELD SURVEY EQUIPMENT

A large number of technologies suitable for field screening exist. Types of radiological survey equipment include alpha particle detectors, beta particle detectors, gamma particle detectors, and X-ray/low energy gamma ray detectors. This equipment may be used for specific screening tasks during excavation. Because of the number of instruments available and the different tasks that will be undertaken during the remediation of the site, a detailed description of these technologies will not be undertaken here. The Nuclear Regulatory Commission has published two general references on survey equipment that discuss the current types of equipment generally available and its uses and limitations:

- "Proposed Methodologies for Measuring Low Levels of Residual Radioactivity for Decommissioning. NUREG-1506, Draft Report for Comment and

- Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions, NUREG/CR-1507, Draft Report for Comment.

The IRDPs will introduce and discuss the supplemental survey equipment as required.

## H.3 FIELD LABORATORY MEASUREMENTS

The field laboratory is beyond the conceptual stage, however the equipment has not been procured, set up and tested. Potential vendors of the hardware and software have provided information and the following represents preliminary plans which are subject to change.

The low resolution NaI (Tl) detector will be a large well crystal capable of analyzing a soil sample of approximately 500 grams. For a number of obvious reasons, the same analytical software, used for field measurements with the 4 x 4 x 16 NaI (Tl), is planned for use. Of course, independent calibration to gamma emitting calibration standards will be used to compute contaminant concentrations in relation to the counts integrated within the specific energy regions of interest. Based upon typical experience, it is expected that the statistically confident performance, at the FRL level, can be achieved with count times on the order of 15 minutes.

The high resolution HPGe system will consist of an n-type detector similar to that utilized for field spectrometry measurements. Sample aliquots of approximately one kg will be used to fill a 550 ml Marinelli beaker which, when place over the detector, affords in excess of a $3\pi$ solid angle of gamma emissions from the sample, relative to the detector. The experience with count times of 50 minutes at various analytical laboratories, demonstrate statistically confident performance at levels well below FRL concentrations.

As it may be required, or appropriate, the samples can be recounted, over a period of several days, to establish the rate of in-growth of the lead and bismuth-214 daughters of radon-222. This will identify the analytical degree of disequilibrium of these gamma emitting daughters of radium-226 to improve the analytical confidence.

Each detector system will utilize a suitable counting shield to minimize the influence of background gamma rays associated with naturally occurring radioactive materials.

A low background alpha and beta counting system will also be a component of the field laboratory. The primary use will be to count swipe samples for contamination control within the analytical instrument spaces and the separate sample preparation area. Certain other gross screening may be afforded through use of the low background counters. One example could be short gross counts of one gram soil samples slurried with alcohol onto a planchet for counting after drying.

A separate controlled area will include facilities for sample receipt and preparation. As much as reasonably practical, for a field laboratory, procedures and good housekeeping will minimize the potential for cross contamination of samples. Portable radiation detection instruments are not sufficiently sensitive to monitor and control contamination levels significant to analytical controls. That monitoring, along with counting of swipe samples, will be used to maintain rigorous controls.

The functions within the field laboratory will include means to accurately weigh the "wet" and dry weights of sample aliquots, means to dry soil samples (80-100° C), and equipment to homogenize dried soil samples. Only two sample containers will be used: 550 ml Marinelli beakers for HPGe gamma spectrometry and 500 gram containers for the NaI (Tl) well detector. Swipe samples will be placed into planchets for low background alpha and beta counting.

Other analytical capabilities have been considered for the field laboratory, however, neither the need nor suitability for supplemental analyses has been demonstrated. However, current and new technologies will be assessed for potential addition to the field laboratory capabilities. If these additional capabilities are found to be needed and practicable, each will be studied and performance tested for approval prior to implementation in the field.

## H.4 ANALYTICAL LABORATORY SERVICES

Performance requirements for contracted analytical laboratory services are explicit and are contained within bid packages and contracts which constitute the Basic Ordering Agreements. The specifications

have evolved after several years of development. Contributors included experts both within and without the DOE analytical community. Through subsequent experience, including data validation and quality assurance surveillance, the original requirements have been extended to cover greater and more specific details for analytical procedures and performance. This does not guarantee performance. However, it does help assure that data validation at the analytical laboratories, and again within FEMP data validation process, can qualify any non-performance or questionable performance.

Table H-4 lists some of the COCs detected in soil and suitable analytical techniques. It is not intended to be all inclusive, but rather addresses the more common COCs and techniques. The QAPP should be consulted for a complete list of approved methods.

Some of the related quality assurance measures are provided in Appendix E of this report. The blanket Quality Assurance program is provided in the Sitewide CERCLA Quality Assurance Manual. The Basic Ordering Agreements document the specific analytical procedures to be employed, specific features to be followed within these procedures, and the performance required. Data validation and quality assurance is monitored by the analytical laboratory, and by the FEMP. The FEMP also performs periodic on-site QA audits of the laboratory facilities.

## TABLE H-1

## RAPID ANALYTICAL METHODS FOR RADIOLOGIC CONSTITUENTS

| Instrumentation | Application | Constituent | MDC | FRL[b] | TAT[c] |
|---|---|---|---|---|---|
| RTRAK | 1. Designed Excavation<br>- WAC attainment | Total uranium | | | 30 min.- 4 hrs. |
| | | Thorium-228 | | | 30 min.- 4 hrs. |
| | 2. Confirmation of Excavation Limits<br>- Detection of hot spots<br>- WAC attainment<br>- Screening for and biasing samples for Confirmation of Excavation Limits | Thorium-232 | | | 30 min.- 4 hrs. |
| | | Radium-228 | | | 30 min.- 4 hrs. |
| | | Radium-226 | | | 30 min.- 4 hrs. |
| HPGE | | Total uranium | < 5 ppm | 82 ppm ($K_L$=325 L/kg<br>50 ppm (ALARA, $K_L$=325 L/kg)<br>20 ppm ($K_L$=15 L/kg)) | 5-30 min. |
| | | Thorium-228 | < 0.5 pCi/g | 1.7 pCi/g | 5-30 min. |
| | | Thorium-232 | < 0.5 pCi/g | 1.5 pCi/g | 5-30 min. |
| | | Radium-228 | < 0.5 pCi/g | 1.8 pCi/g | 5-30 min. |
| | | Radium-226 | < 0.5 pCi/g | 1.7 pCi/g | 5-30 min. |
| | | Cesium-137 | < 0.1 pCi/g | 1.4 pCi/g | 5-30 min. |
| Alpha Spectrometer | 1. Confirmation of Excavation Limits<br>2. Certification | Neptunium-237 | < 0.4 pCi/g | 3.2 pCi/g | 7-45 days |
| | | Plutonium-238 | < 0.4 pCi/g | 78 pCi/g | 7-45 days |
| | | Thorium-230 | < 0.2 pCi/g | 280 pCi/g | 7-45 days |
| Gamma Spectrometer | 1. Confirmation of Excavation Limits<br>2. Certification | Lead-210 | < 1.0 pCi/g | 38 pCi/g | 7-45 days |
| Gas Proportional Counting | 1. Confirmation of Excavation Limits | Strontium-90 | < 1.0 pCi/g | 14 pCi/g | 5 days |
| | | Technetium-99 | < 2.0 pCi/g | 30 pCi/g | 5 days |

[a]minimum detectable concentration. Calibration studies using the RTRAK are currently being performed to determine an accurate MDC.
[b]final remediation level from the Operable Unit 5 ROD
[c]turnaround time. When a range is provided for the TAT, the quicker time identifies the TAT in emergency situations. The longer time is the normally expected TAT.

## TABLE H-2

## RAPID ANALYTICAL METHODS FOR METALS

| Instrumentation | Application Stage of Sampling | Constituent | MDL[a] | FRL[b] | TAG[c] |
|---|---|---|---|---|---|
| EDXRF[d] | 1. Confirmation of Excavation Control Check for<br>- FRLs<br>- Removal of Hot Spots | Antimony | 32 mg/kg | 96 mg/kg | 5-15 min. |
| | | Arsenic | 25 mg/kg | 12 mg/kg | 5-15 min. |
| | | Cadmium | 86 mg/kg | 82 mg/kg | 5-15 min. |
| | | Lead | 14 mg/kg | 400 mg/kg | 5-15 min. |
| | | Manganese | 203 mg/kg | 4,600 mg/kg | 5-15 min. |
| | | Molybdenum | 4 mg/kg | 2,900 mg/kg | 5-15 min. |
| | | Silver | 100 mg/kg | 29,000 mg/kg | 5-15 min. |
| | | Zinc | 35 mg/kg | 120,000 mg/kg | 5-15 min. |
| Inductivity Coupled Plasma Spectrometer | | Beryllium | 0.03 mg/kg | 1.5 mg/kg | 1-14 days |

[a]method detection limit (mg/kg)
[b]final remediation level (mg/kg) from the Operable Unit 5 ROD
[c]turnaround time. When a range is provided for the TAT, the quicker time identifies the TAT in emergency situations. The longer time is the normally expected TAT.
[d]field portable energy dispersive x-ray fluorescence spectrometer

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## TABLE H-3

## RAPID ANALYTICAL METHODS FOR ORGANICS, PESTICIDES AND DIOXINS

| Instrumentation | Application | Analytical Suite | Constituent | MDL[a] | FRL[b] | TAT[c] |
|---|---|---|---|---|---|---|
| Gas Chromotography/ Mass Spectrometry | 1. Designed Excavation - WAC Attainment | Secondary COCs[d]/Volatiles | 1,1-Dichloroethene | < 5 ug/kg[e] | 410 ug/kg | 24 hrs. |
| | | | Tetrachloroethene | < 5 ug/kg[e] | 3,600 ug/kg | 24 hrs. |
| | | | Trichloroethene | < 5 ug/kg[e] | 25,000 ug/kg | 24 hrs. |
| | | Secondary COC/Semivolatiles | Carbazole | < 5 ug/kg[e] | 12,000 ug/kg | 8 hrs. - 30 days |
| | | Secondary COC/Pesticides | Dieldrin | < 3.3 ug/kg[e] | 15 ug/kg | 8 hrs. - 30 days |
| Immunoassay Test Kit | 1. Designed Excavation - WAC Attainment<br>2. Confirmation of Excavation Limits -Hot Spot Detection -FRL Attainment | Secondary COCs/PAHs[f] | Benzo(a)anthracene | 1,000 ug/kg | 20,000 ug/kg | 30 min. |
| | | | Benzo(b)fluoranthene | 1,000 ug/kg | 20,000 ug/kg | 30 min. |
| | | | Benzo(a)pyrene | 1,000 ug/kg | 2,000 ug/kg | 30 min. |
| | | | Benzo(k)fluoranthene | 1,000 ug/kg | 200,000 ug/kg | 30 min. |
| | | | Chrysene | 1,000 ug/kg | 2,000,000 ug/kg | 30 min. |
| | | | Dibenzo(a,h)anthracene | 1,000 ug/kg | 2,000 ug/kg | 30 min. |
| | | | Indeno(1,2,3-cd)pyrene | 1,000 ug/kg | 20,000 ug/kg | 30 min. |
| | | Secondary COCs/Dioxins | Heptachlorodibenzo-p-dioxin | 0.001 ug/kg | 0.88 ug/kg | 70 min. |
| | | | Octachlorodibenzo-p-dioxin | 0.001 ug/kg | 8.8 ug/kg | 70 min. |
| | | Secondary COCs/PCBs[g] | Aroclor-1260 | 1,000 ug/kg | 130 ug/kg | 30 min. |

[a]method detection limit (parts per billion)
[b]final remediation level (parts per billion) from the Operable Unit 5 ROD
[c]turnaround time. When a range is provided for the TAT, the quicker time identifies the TAT in emergency situations. The longer time is the normally expected TAT.
[d]constituents of concern
[e]practical quantitation limit (PQL) is provided instead of the MDL for laboratory analyses. The PQL equals five times the MDL.
[f]polynuclear aromatic hydrocarbons
[g]polychlorinated biphenyls

## TABLE H-4

## LABORATORY METHODS FOR RADIONUCLIDES, METALS, AND ORGANIC CHEMICALS

| Constituent | Parameter | FRL (pCi/g) | Analytical Options | Lowest DL/Method/TAT | Fastest TAT/ Method /DL |
|---|---|---|---|---|---|
| Cesium-137 | Radiological | 1.4 | gamma/ HPGe | 0.5 / gamma / 7 days | 0.1 / HPGe / 5-30 min. |
| Lead-210 | Radiological | 38 | gamma, GPC | 0.5 / GPC / 7 days | 0.5 / GPC / 7 days |
| Neptunium-237 | Radiological | 3.2 | alpha | 0.2 / alpha / 7 days | 0.2 / alpha / 7 days |
| Plutonium-238 | Radiological | 78 | alpha | 0.2 / alpha / 7 days | 0.2 / alpha / 7 days |
| Plutonium-239/240 | Radiological | 77 | alpha | 0.2 / alpha / 7 days | 0.2 / alpha / 7 days |
| Radium-226 | Radiological | 1.7 | gamma, RTRAK, HPGe | 0.25 / gamma / 25 days | 0.5 / HPGe / 5-30 min. |
| Radium-228 | Radiological | 1.8 | alpha, gamma, RTRAK, HPGe | 0.5 / gamma / 5 days | 0.5 / HPGe / 5-30 min. |
| Strontium-90 | Radiological | 14 | GPC | 0.5 / GPC / 5 days | 0.5 / GPC / 5 days |
| Technitium-99 | Radiological | 30 | GPC | 1.0 / GPC / 5 days | 1.0 / GPC / 5 days |
| Thorium-228 | Radiological | 1.7 | alpha, gamma, RTRAK, HPGe | 0.1 / alpha / 5 days | 0.5 / HPGe / 5-30 min. |
| Thorium-230 | Radiological | 280 | alpha | 0.1 / alpha / 5 days | 0.1 / alpha / 5 days |
| Thorium-232 | Radiological | 1.5 | alpha, gamma, RTRAK, HPGe | 0.1 / alpha / 5 days | 0.5 / HPGe / 5-30 min. |
| Uranium (total) | Radiological | 82 ppm | KPA, alpha, gamma, RTRAK, HPGe | 0.1 ppm / gamma / 5 days | 5 ppm / HPGe / 5-30 min. |

| Constituent | Parameter | RL (mg/kg) | Analytical Options | Lowest DL TAT - 5=3-0 days |
|---|---|---|---|---|
| Pentachlorodibenzofuran | Dioxin / Furan | N/A | GC/MS | 0.000006 |
| Heptachlorodibenzofuran | Dioxin / Furan | 0.0088 | GC/MS | 0.000006 |
| Hexachlorodibenzofuran | Dioxin / Furan | N/A | GC/MS | 0.000006 |
| Hexachlorodibenzo-p-dioxin | Dioxin / Furan | 0.0088 | GC/MS | 0.000013 |
| Octachlorodibenzofuran | Dioxin / Furan | 0.0088 | GC/MS | 0.000013 |
| Octochlorodibenzo-p-dioxin | Dioxin / Furan | 0.0088 | GC/MS | 0.000013 |
| Tetrachlorodibenzofuran | Dioxin / Furan | N/A | GC/MS | 0.000001 |
| Tetrachlorodibenzo-p-dioxin | Dioxin / Furan | N/A | GC/MS | 0.000001 |

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## TABLE H-4

(Continued)

| Constituent | Parameter | RL (mg/kg) | Analytical Options | Lowest DL TAT - 5-30 days |
|---|---|---|---|---|
| Antimony | Inorganics | 96 | ICP / AA | 0.5 |
| Arsenic | Inorganics | 12 | ICP / AA | 1.3 |
| Barium | Inorganics | 68,000 | ICP / AA | 1 |
| Beryllium | Inorganics | 1.5 | ICP / AA | 0.05 |
| Boron | Inorganics | 7400 | ICP / AA | 4 |
| Cadmium | Inorganics | 82 | ICP / AA | 0.1 |
| Chromium (total) | Inorganics | N/A | ICP / AA | 1.30 |
| Cobalt | Inorganics | 740 | ICP / AA | 0.3 |
| Copper | Inorganics | 220,000 | ICP / AA | 0.5 |
| Lead | Inorganics | 400 | ICP / AA | 0.05 |
| Manganese | Inorganics | 4,600 | ICP / AA | 1 |
| Mercury | Inorganics | 8 | ICP / AA | 0.13 |
| Molybdenum | Inorganics | 2,900 | ICP / AA | 13 |
| Nickel | Inorganics | 15,000 | ICP / AA | 4 |
| Selenium | Inorganics | 5,400 | ICP / AA | 1.3 |
| Silver | Inorganics | 29,000 | ICP / AA | 1.3 |
| Thallium | Inorganics | 91 | ICP / AA | 1.0 |
| Vanadium | Inorganics | 5,100 | ICP / AA | 1.0 |
| Zinc | Inorganics | 120,000 | ICP / AA | 1.0 |

## TABLE H-4

(Continued)

| Constituent | Parameter | RL (mg/kg) | Analytical Options | Lowest DL TAT = 5=30 days |
|---|---|---|---|---|
| Aroclor 1254 | Organics - PCB | 0.13 | GC/ECD | 0.04 |
| Aroclor 1260 | Organics - PCB | 0.13 | GC/ECD | 0.04 |
| Chlordane | Organics - Pesticide | 0.19 | GC/ECD | 0.002 |
| Dieldrin | Organics - Pesticide | 0.015 | GC/ECD | 0.004 |
| Heptachlor epoxide | Organics - Pesticide | N/A | GC/ECD | 0.002 |

| Constituent | Parameter | RL (mg/kg) | Analytical Options | Lowest DL TAT = 5- 30 days |
|---|---|---|---|---|
| Benzo(a)anthracene | Organics - Semivolatile | 20 | GC/MS SW846 8270 | 0.0007 |
| Benzo(b)fluoranthene | Organics - Semivolatile | 20 | GC/MS SW846 8271 | 0.0007 |
| Benzo(k)fluoranthene | Organics - Semivolatile | 200 | GC/MS SW846 8272 | 0.0007 |
| Benzo(a)pyrene | Organics - Semivolatile | 2 | GC/MS SW846 8273 | 0.0007 |
| bis(2-Ethylhexyl)phthalate | Organics - Semivolatile | 820 | GC/MS SW846 8274 | 0.22 |
| bis(2-chloroisopropyl)ether | Organics - Semivolatile | 420 | GC/MS SW846 8275 | 0.22 |
| Carbazole | Organics - Semivolatile | 12 | GC/MS SW846 8276 | 0.04 |
| Di-n-octylphthalate | Organics - Semivolatile | 1,100 | GC/MS SW846 8277 | 0.2 |
| Dibenzo(a,h)anthracene | Organics - Semivolatile | 2 | GC/MS SW846 8278 | 0.0005 |
| Indeno(1,2,3-cd)pyrene | Organics - Semivolatile | 20 | GC/MS SW846 8279 | 0.0007 |
| 4-Methylphenol | Organics - Semivolatile | 250 | GC/MS SW846 8280 | 0.2 |
| N-nitroso-di-n-propylamine | Organics - Semivolatile | 0.20 | GC/MS SW846 8281 | 0.20 |
| N-nitroso-diphenylamine | Organics - Semivolatile | 51 | GC/MS SW846 8282 | 0.20 |
| 4-Nitroaniline | Organics - Semivolatile | 150 | GC/MS SW846 8283 | 1 |
| 4-Nitrophenol | Organics - Semivolatile | N/A | GC/MS SW846 8284 | 0.90 |
| Pentachlorophenol | Organics - Semivolatile | 2.30 | GC/MS SW846 8285 | 0.90 |

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## TABLE H-4

(Continued)

| | | | | |
|---|---|---|---|---|
| Phenanthrene | Organics - Semivolatile | N/A | GC/MS SW846 8286 | 0.001 |
| Tributyl phosphate | Organics - Semivolatile | 250 | GC/MS SW846 8287 | 0.04 |
| Chrysene | Organics - Semivolatile | 2,000 | GC/MS SW846 8288 | 0.002 |

| Constituent | Parameter | RL (mg/kg) | Analytical Options | Lowest DL - TAT= 5-30 days |
|---|---|---|---|---|
| Acetone | Organics - Volatile | 43,000 | GC/MS SW846 8260, CLP | 0.0007 |
| Benzene | Organics - Volatile | 850 | GC/MS SW846 8260, CLP | 0.001 |
| Bromodichloromethane | Organics - Volatile | 4 | GC/MS SW846 8260, CLP | 0.001 |
| Bromoform | Organics - Volatile | 31 | GC/MS SW846 8260, CLP | 0.001 |
| Bromomethane | Organics - Volatile | 8,200 | GC/MS SW846 8260, CLP | 0.001 |
| 2-Butanone | Organics - Volatile | N/A | GC/MS SW846 8260, CLP | 0.01 |
| Carbon tetrachloride | Organics - Volatile | 2.1 | GC/MS SW846 8260, CLP | 0.001 |
| Carbon disulfide | Organics - Volatile | 5,000 | GC/MS SW846 8260, CLP | 0.001 |
| Chlorobenzene | Organics - Volatile | 340 | GC/MS SW846 8260, CLP | 0.001 |
| Chloroethane | Organics - Volatile | N/A | GC/MS SW846 8260, CLP | 0.001 |
| Chloroform | Organics - Volatile | 45 | GC/MS SW846 8260, CLP | 0.001 |
| 2-Chlorophenol | Organics - Volatile | N/A | GC/MS SW846 8260, CLP | 0.20 |
| 3,3-Dichlorobenzidene | Organics - Volatile | 0.55 | GC/MS SW846 8260, CLP | .055* |
| 1,1-Dichloroethane | Organics - Volatile | N/A | GC/MS SW846 8260, CLP | N/A |
| 1,2-Dichloroethane | Organics - Volatile | 0.16 | GC/MS SW846 8260, CLP | 0.016 |
| 1,1-Dichloroethene | Organics - Volatile | 0.41 | GC/MS SW846 8260, CLP | 0.041 |
| 1,2-Dichloroethene | Organics - Volatile | N/A | GC/MS SW846 8260, CLP | 0.001 |
| Ethyl ether | Organics - Volatile | N/A | GC/MS SW846 8260, CLP | 0.001 |
| Ethylbenzene | Organics - Volatile | 5,100 | GC/MS SW846 8260, CLP | 0.01 |

## TABLE H-4

(Continued)

| | | | | |
|---|---|---|---|---|
| Methanol | Organics - Volatile | N/A | GC/MS SW846 8260, CLP | 0.20 |
| 4-Methyl-2-pentanone | Organics - Volatile | 2,500 | GC/MS SW846 8260, CLP | 0.007 |
| Methylene Chloride | Organics - Volatile | 37 | GC/MS SW846 8260, CLP | 0.003 |
| Styrene | Organics - Volatile | N/A | GC/MS SW846 8260, CLP | 0.001 |
| 1,1,2,2-Tetrachloroethane | Organics - Volatile | N/A | GC/MS SW846 8260, CLP | 0.001 |
| Tetrachloroethene | Organics - Volatile | 3.6 | GC/MS SW846 8260, CLP | 0.36 |
| Toluene | Organics - Volatile | 100,000 | GC/MS SW846 8260, CLP | 0.001 |
| 1,1,1-Trichloroethane | Organics - Volatile | N/A | GC/MS SW846 8260, CLP | 0.001 |
| 1,1,2-Trichloroethane | Organics - Volatile | 4.30 | GC/MS SW846 8260, CLP | 0.001 |
| Trichloroethene | Organics - Volatile | 25 | GC/MS SW846 8260, CLP | 0.0010 |
| Vinyl chloride | Organics - Volatile | 0.13 | GC/MS SW846 8260, CLP | 0.013 |
| Xylenes | Organics - Volatile | 920,000 | GC/MS SW846 8260, CLP | 0.001 |

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# APPENDIX I

## SITEWIDE EXTENT OF CONTAMINATION BY CONSTITUENT

As described in Section 2.1.3.3 of the Sitewide Excavation Plan (SEP), spatial extent of area-specific constituents of concern (ASCOCs) was determined by comparing their relationship to Final Remediation Levels (FRLs), Benchmark Toxicity Values (BTVs), and Waste Acceptance Criteria (WAC) for the On-Site Disposal Facility (OSDF). To do this, the series of maps contained in this appendix was assembled to display the actual distribution of contamination sitewide and identify the extent of contamination within the eight Remediation Areas described in Section 1.2.2 and shown on Figure 1-3. These maps also indicate if a COC distribution is confined to a limited area or if it impacts larger areas. The ASCOCs for each of the remediation areas were identified based on the sample results represented by these maps, augmented by process knowledge. The results of this analysis are shown in Table 2-9.

# LIST OF FIGURES

## Primary ASCOCs

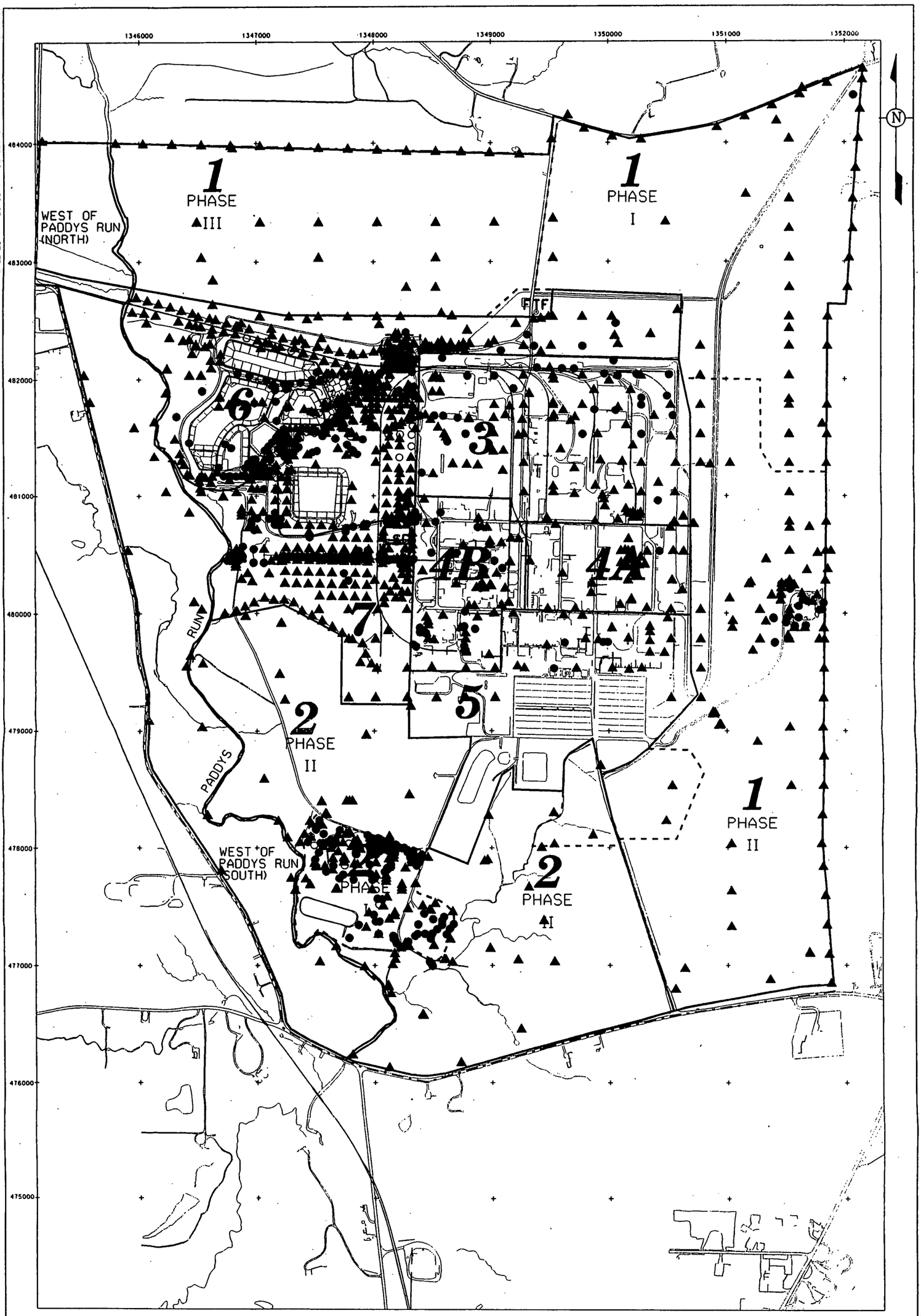

| | |
|---|---|
| Uranium, total | I-1 |
| Radium-226 | I-2 |
| Radium-228 | I-3 |
| Thorium-228 | I-4 |
| Thorium-232 | I-5 |


## Secondary ASCOCs


| | | | |
|---|---|---|---|
| Aroclor-1254 | I-6 | Heptachlorodibenzo-p-dioxin | I-18 |
| Aroclor-1260 | I-7 | Indeno(1,2,3-cd)pyrene | I-19 |
| Arsenic | I-8 | Lead | I-20 |
| Benzo(a)anthracene | I-9 | Lead-210 | I-21 |
| Benzo(a)pyrene | I-10 | Manganese | I-22 |
| Benzo(b)fluoranthene | I-11 | Neptunium-237 | I-23 |
| Beryllium | I-12 | 4-Nitroaniline | I-24 |
| Bis(2-chloroisopropyl)ether | I-13 | Octachlorodibenzo-p-dioxin | I-25 |
| Cesium-137 | I-14 | Plutonium-238 | I-26 |
| Dibenzo(a,h)anthracene | I-15 | Strontium-90 | I-27 |
| 1,1-Dichloroethene | I-16 | Technetium-99 | I-28 |
| Dieldrin | I-17 | Tetrachloroethene | I-29 |
| Fluoride | (a) | Thorium-230 | I-30 |
| | | Trichloroethene | I-31 |


Note: (a) No data for soil in the SED.

FIGURE I-1. SITEWIDE DISTRIBUTION OF TOTAL URANIUM BASED ON RI/FS DATA




LEGEND:

- FEMP BOUNDARY
- EXCEEDS FRL
- NON DETECTED, BUT METHOD DETECTION LIMIT EXCEEDS THE FRL
- BELOW FRL
- REMEDIATION BOUNDARIES

SCALE

800 400 0 800 FEET

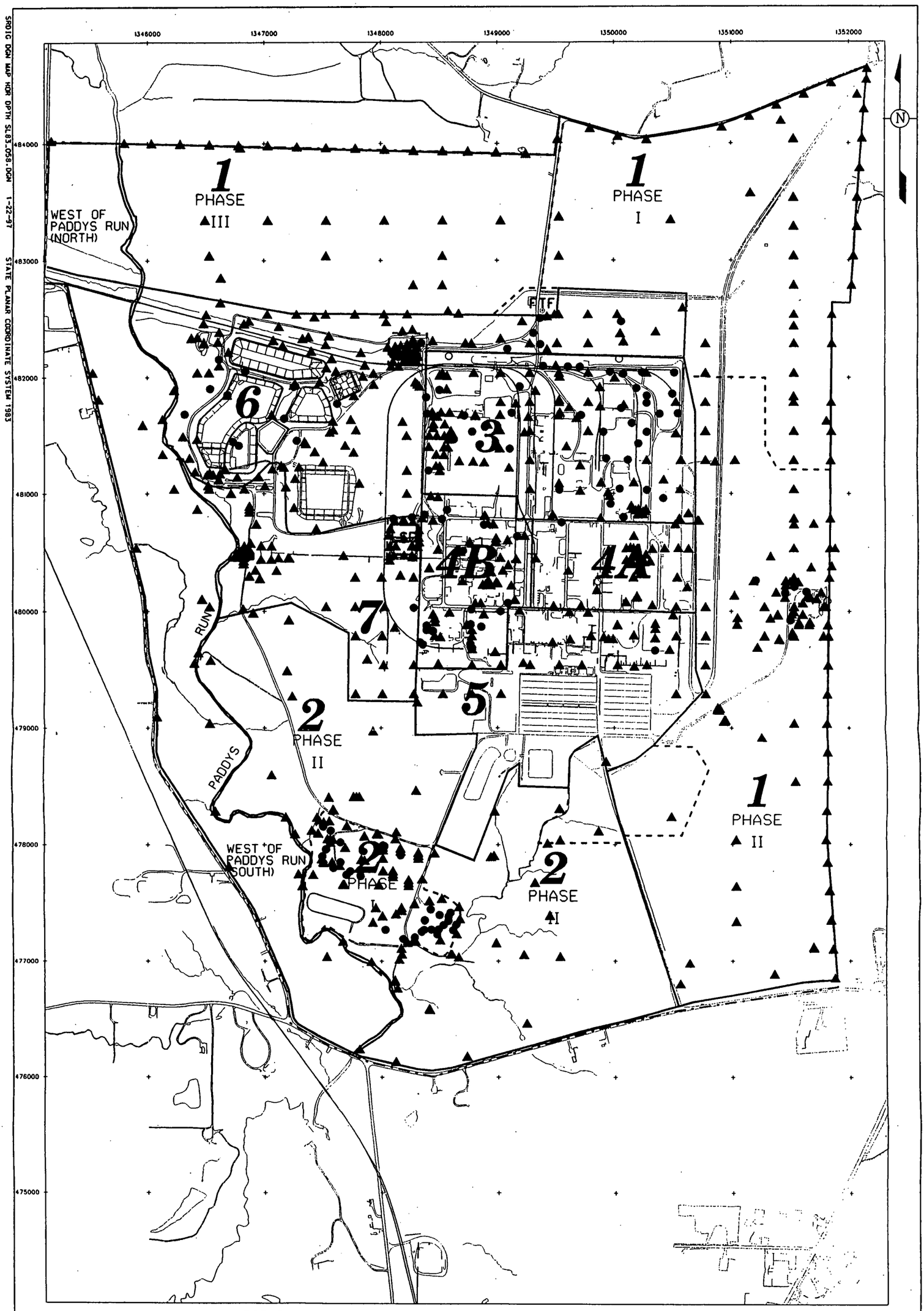
DRAFT

FIGURE 1-2. SITEWIDE DISTRIBUTION OF RADIUM-226 BASED ON RI/FS DATA

SR01G DGN MAP MDR DPTN SL83_057.DGN 1-22-97 STATE PLANAR COORDINATE SYSTEM 1983

000729

925




LEGEND:

- FEMP BOUNDARY
- ● EXCEEDS FRL
- ○ NON DETECTED, BUT METHOD DETECTION LIMIT EXCEEDS THE FRL
- ▲ BELOW FRL
- REMEDIATION BOUNDARIES

SCALE

800 400 0 800 FEET

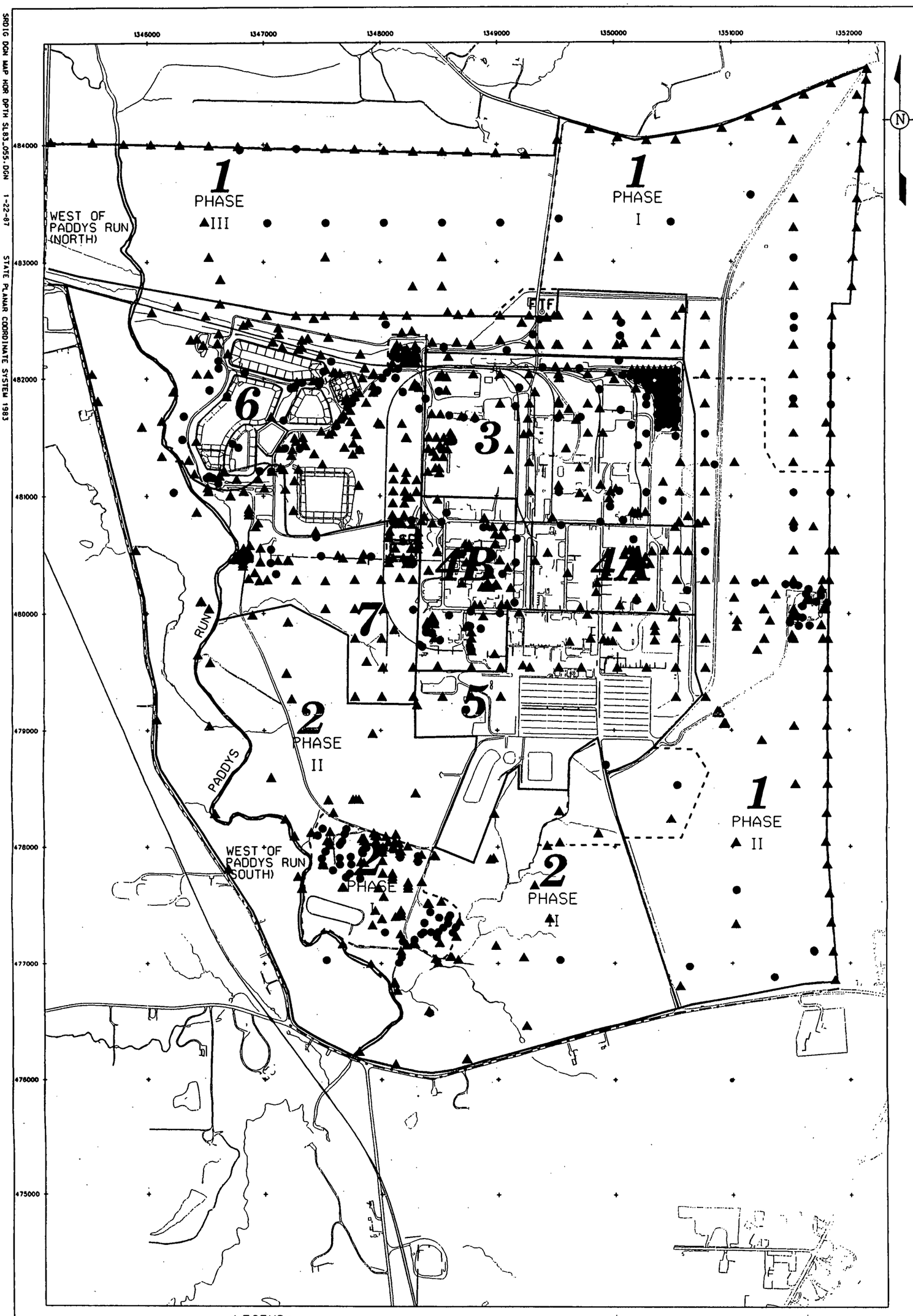
DRAFT

FIGURE I-3. SITEWIDE DISTRIBUTION OF RADIUM-228 BASED ON RI/FS DATA

SRDIG DGN MAP MDN DPTH SL83.056.DGN 1-22-97 STATE PLANAR COORDINATE SYSTEM 1983

000730

925




LEGEND:

- FEMP BOUNDARY
- EXCEEDS FR
- NON DETECTED, BUT METHOD DETECTION LIMIT EXCEEDS THE FRL
- BELOW FRL
- REMEDIATION BOUNDARIES

SCALE

800 400 0 800 FEET

DRAFT

SRDIG DGN MAP HOR DPTH SL83_055.DGN 1-22-97 STATE PLANAR COORDINATE SYSTEM 1983

FIGURE I-4. SITEWIDE DISTRIBUTION OF THORIUM-228 BASED ON RI/FS DATA

000731

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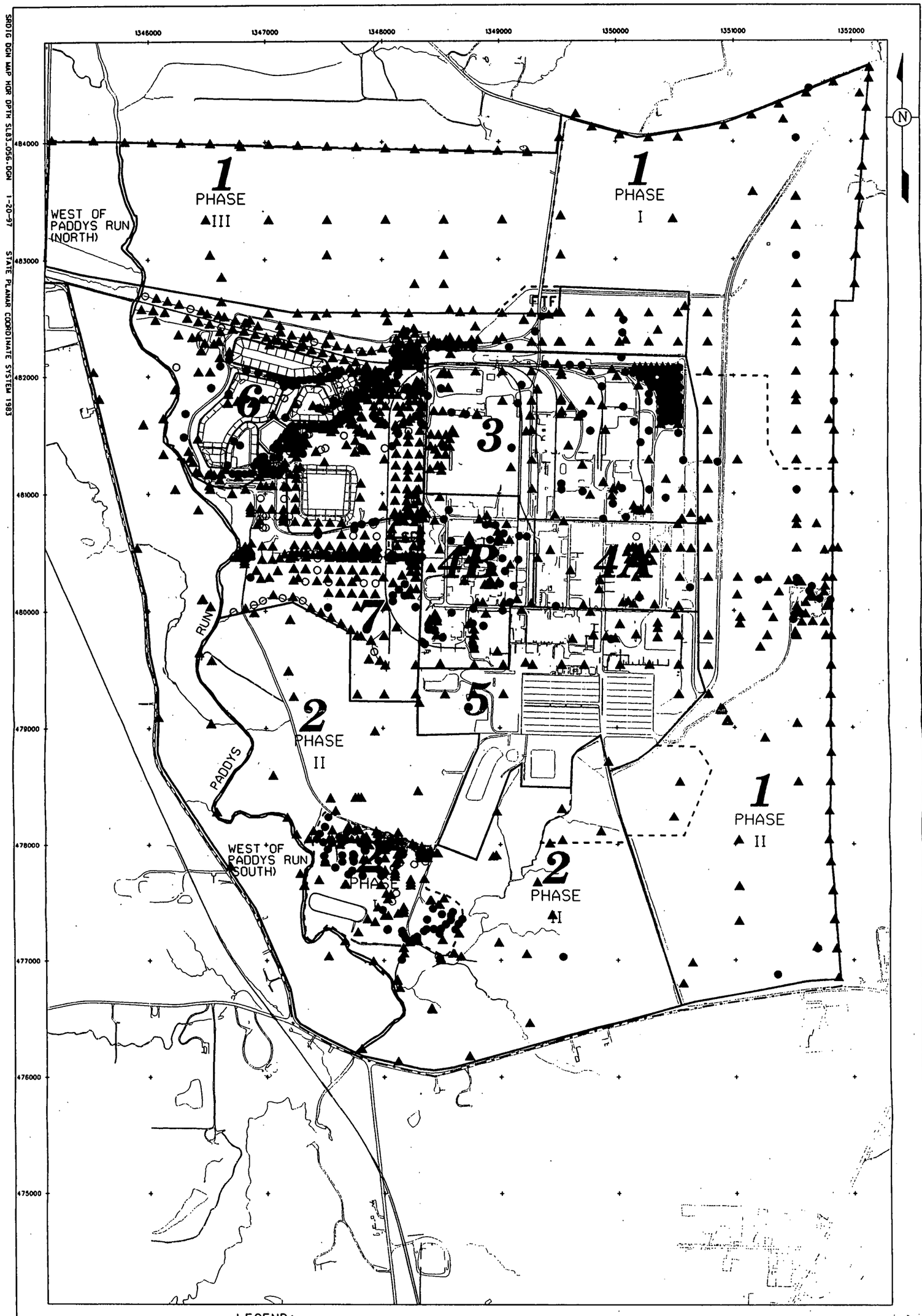


LEGEND:

- FEMP BOUNDARY
- ● EXCEEDS FRL
- ○ NON DETECTED, BUT METHOD DETECTION EXCEEDS THE FRL
- ▲ BELOW FRL
- REMEDIATION BOUNDARIES

SCALE

800 400 0 800 FEET

DRAFT

FIGURE I-5. SITEWIDE DISTRIBUTION OF THORIUM-232 BASED ON RI/FS DATA

SRDIG DGN MAP HOR DPTH SL83_056.DGN 1-20-97 STATE PLANAR COORDINATE SYSTEM 1983

000232

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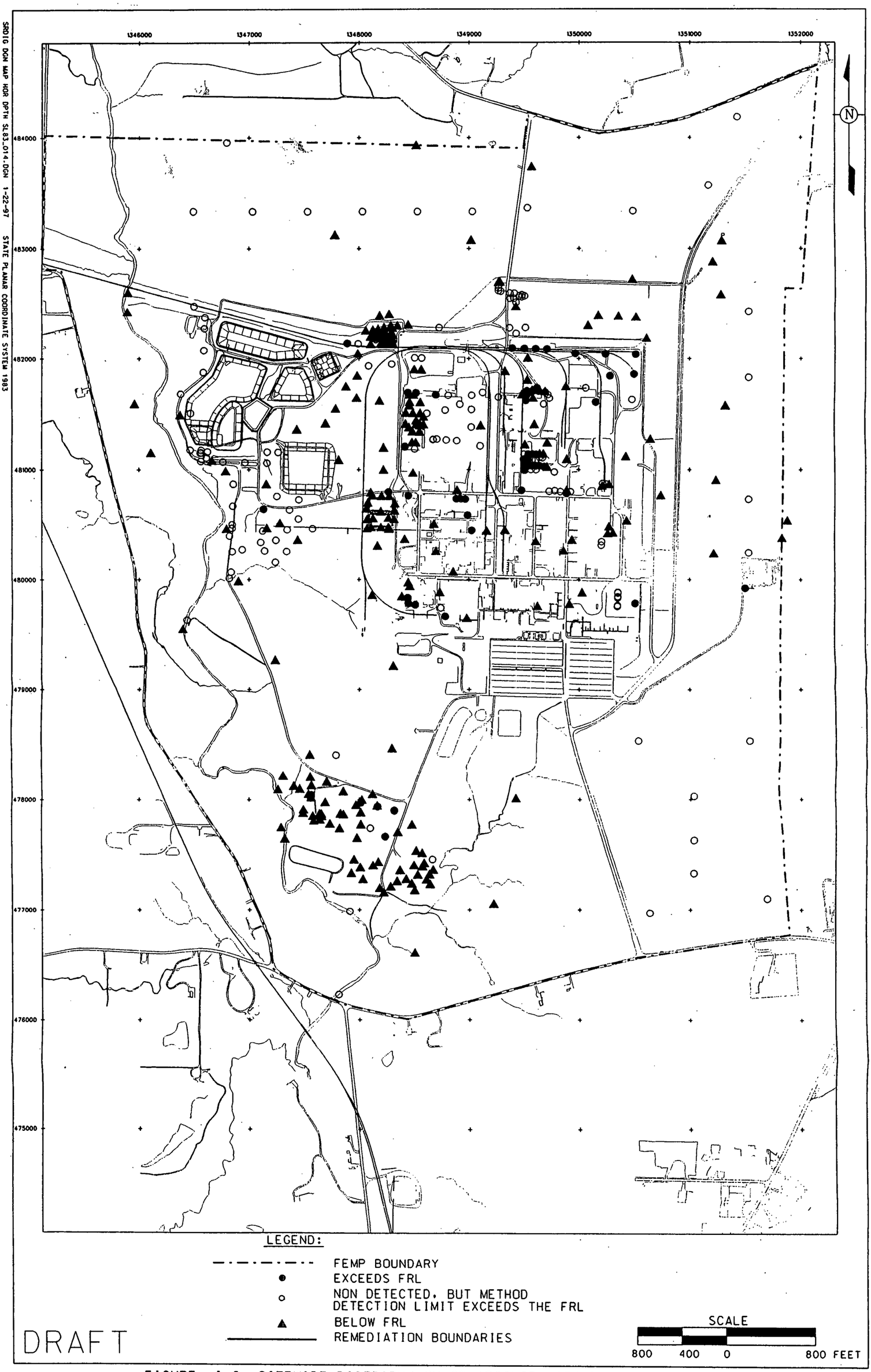
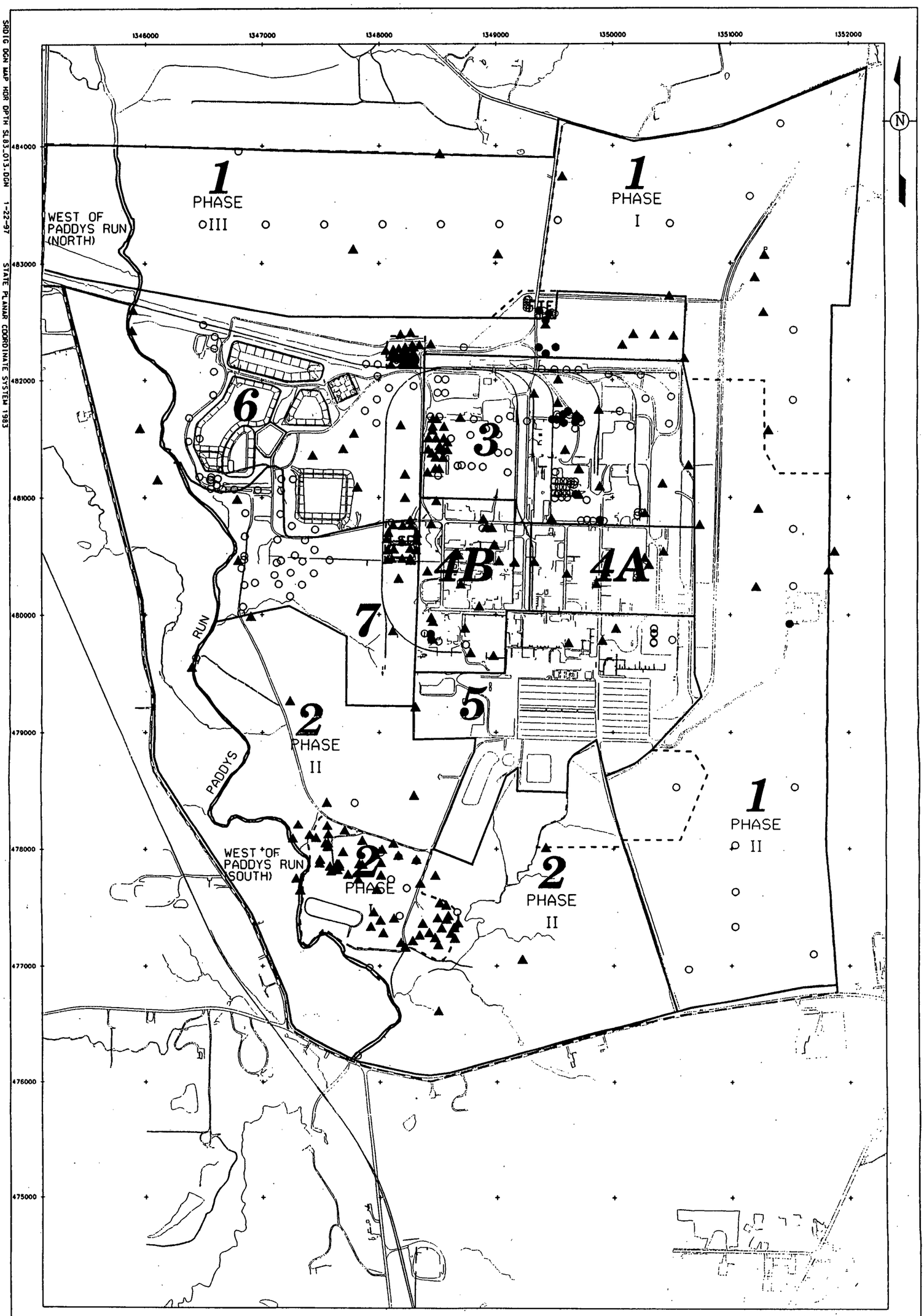



FIGURE I-6. SITEWIDE DISTRIBUTION OF AROCLOR-1254 BASED ON RI/FS DATA.




LEGEND:

- FEMP BOUNDARY
- ● EXCEEDS FRL
- ○ NON DETECTED, BUT METHOD DETECTION LIMIT EXCEEDS THE FRL
- ▲ BELOW FRL
- REMEDIATION BOUNDARIES

SCALE

800 400 0 800 FEET

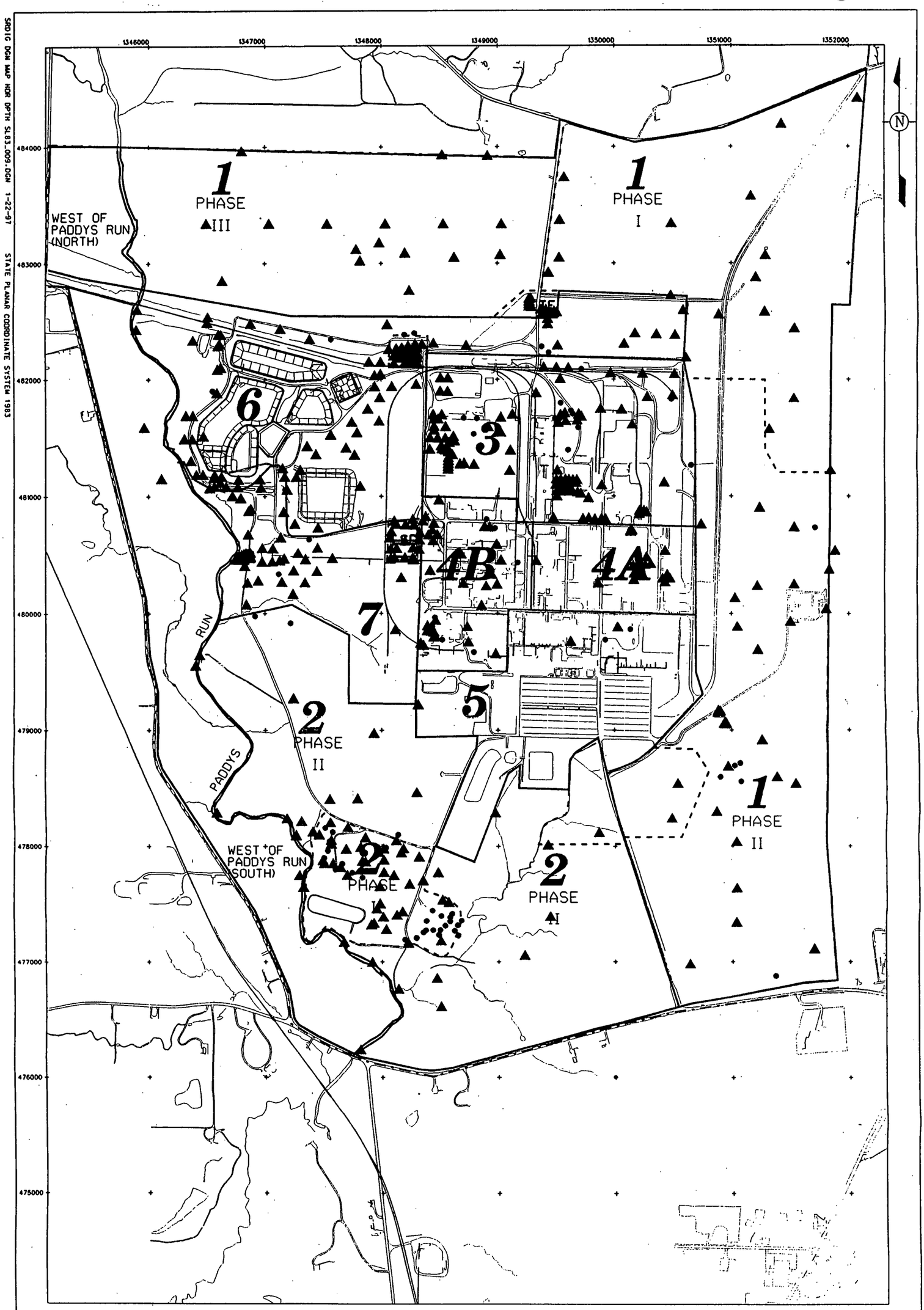
DRAFT

FIGURE I-7. SITEWIDE DISTRIBUTION OF AROCLOR-1260 BASED ON RI/FS DATA.

SRDIG DGN MAP HDR OPTH SL83_013.DGN 1-22-97 STATE PLANAR COORDINATE SYSTEM 1983

000734

925




LEGEND:

- FEMP BOUNDARY
- ● EXCEEDS FRL
- ○ NON DETECTED, BUT METHOD DETECTION LIMIT EXCEEDS THE FRL
- ▲ BELOW FRL
- REMEDIATION BOUNDARIES

SCALE

800 400 0 800 FEET

DRAFT

SRDIG DGN MAP HDR DPTH SL83_009.DGN 1-22-97 STATE PLANAR COORDINATE SYSTEM 1983

FIGURE I-8. SITEWIDE DISTRIBUTION OF ARSENIC BASED ON RI/FS DATA.

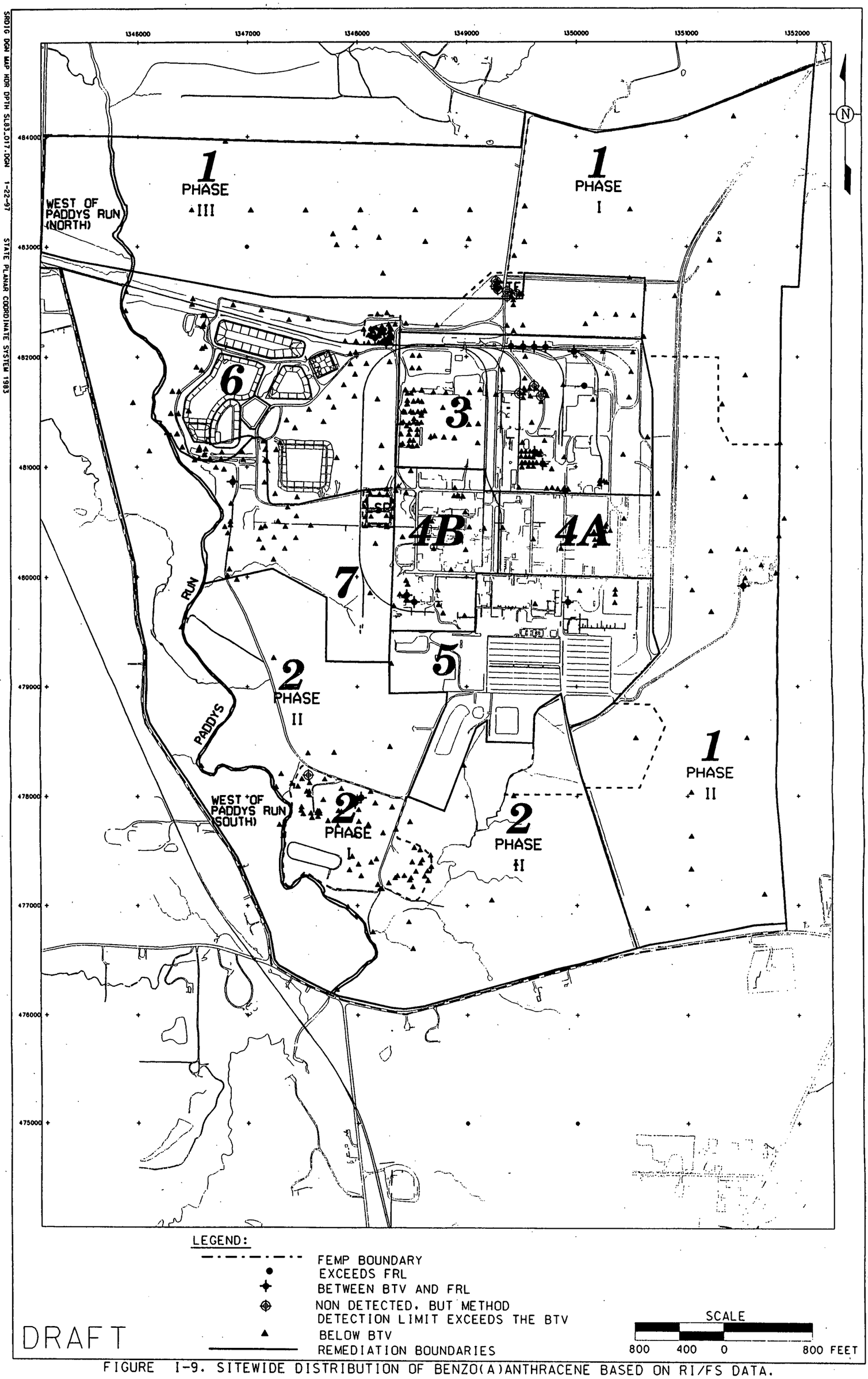
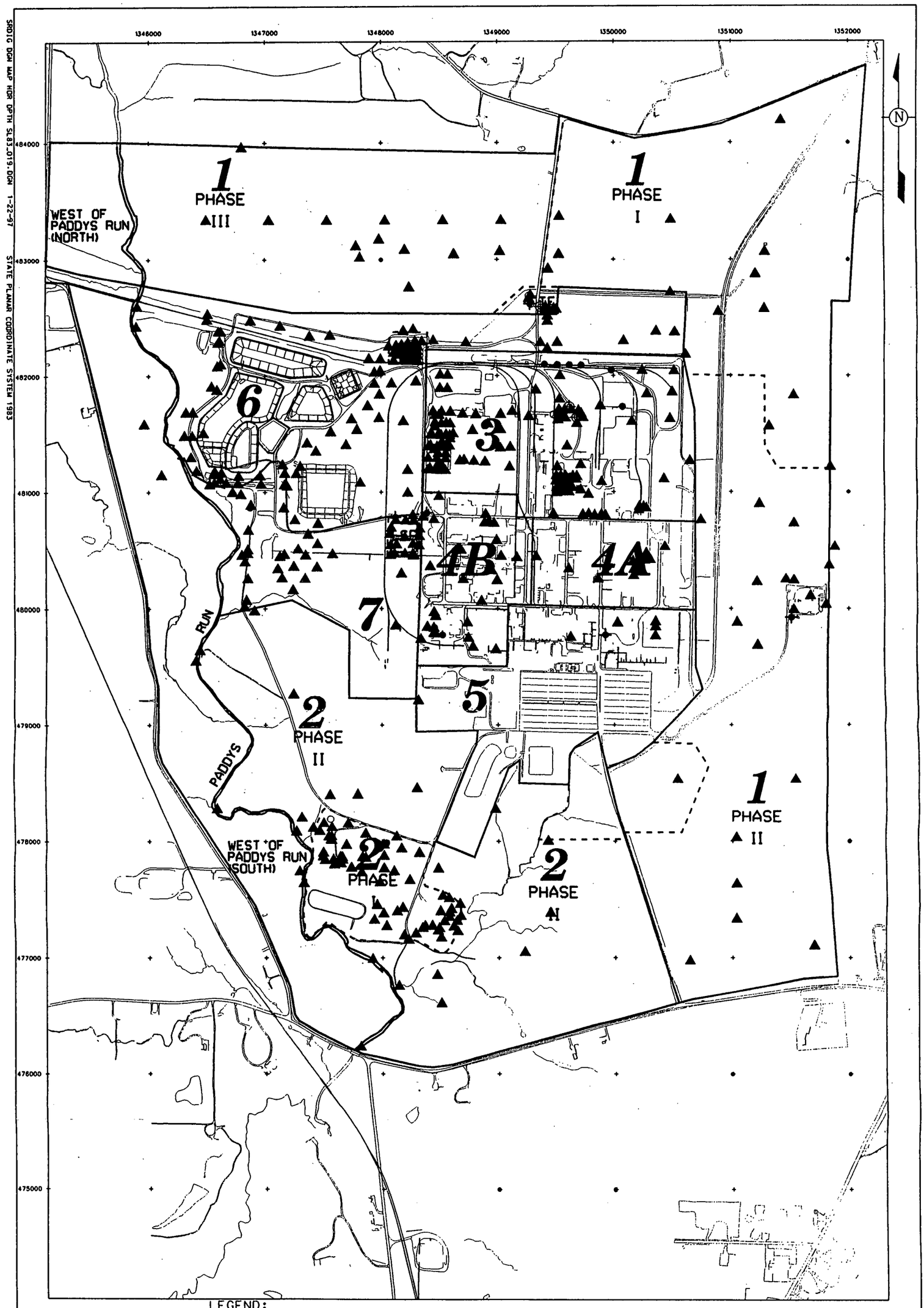



FIGURE I-9. SITEWIDE DISTRIBUTION OF BENZO(A)ANTHRACENE BASED ON RI/FS DATA.




LEGEND:

- FEMP BOUNDARY
- ● EXCEEDS FRL
- ○ NON DETECTED, BUT METHOD DETECTION LIMIT EXCEEDS THE FRL
- ✦ BETWEEN BTV AND FRL
- ⊕ NON DETECTED, BUT METHOD DETECTION LIMIT, EXCEEDS THE BTV
- ▲ BELOW BTV
- REMEDIATION BOUNDARIES

DRAFT

SRDIG DGN MAP HDR OPTN SL83-019.DGN 1-22-97 STATE PLANAR COORDINATE SYSTEM 1983

FIGURE I-10. SITEWIDE DISTRIBUTION OF BENZO(A)PYRENE BASED ON RI/FS DATA

000737

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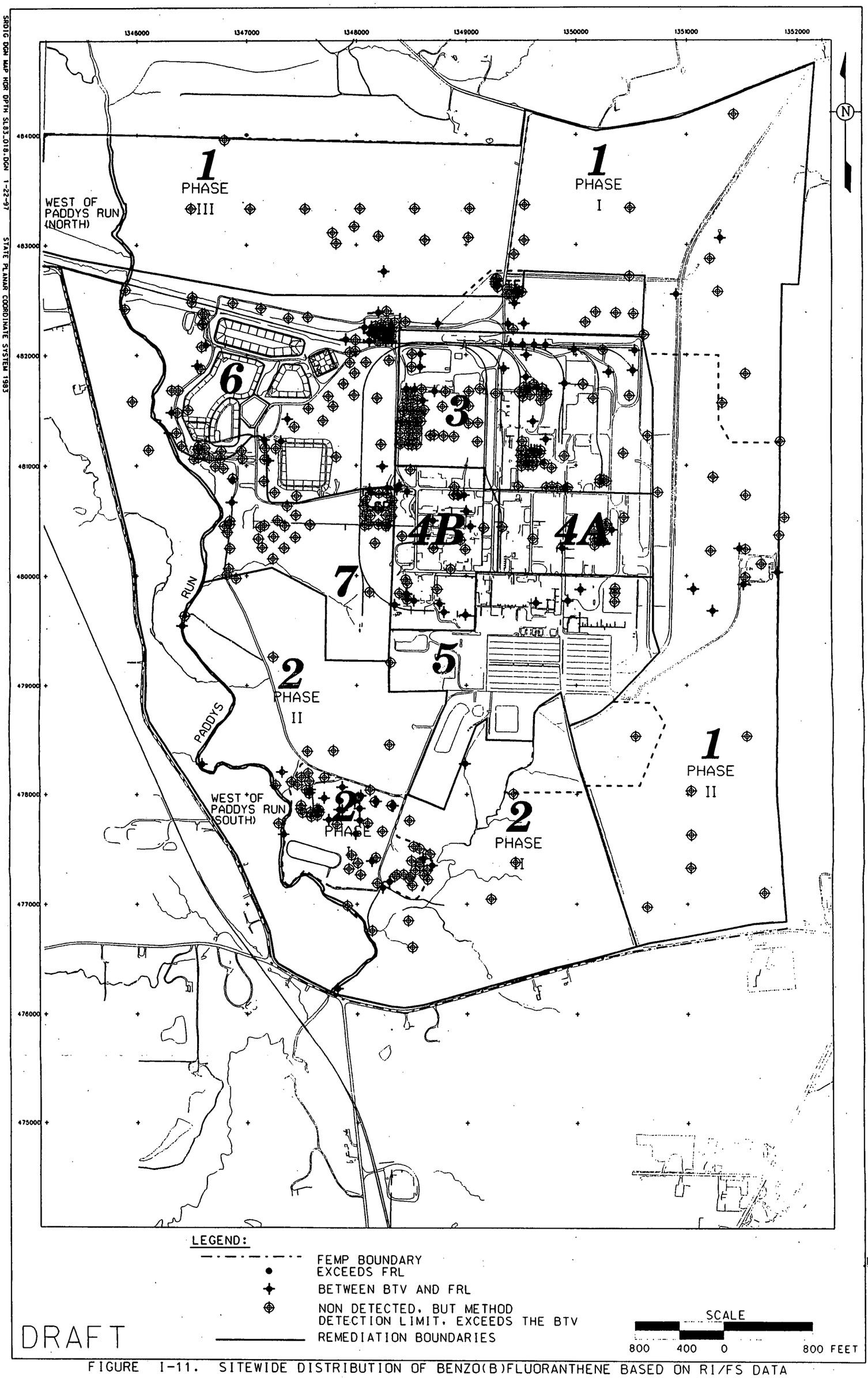
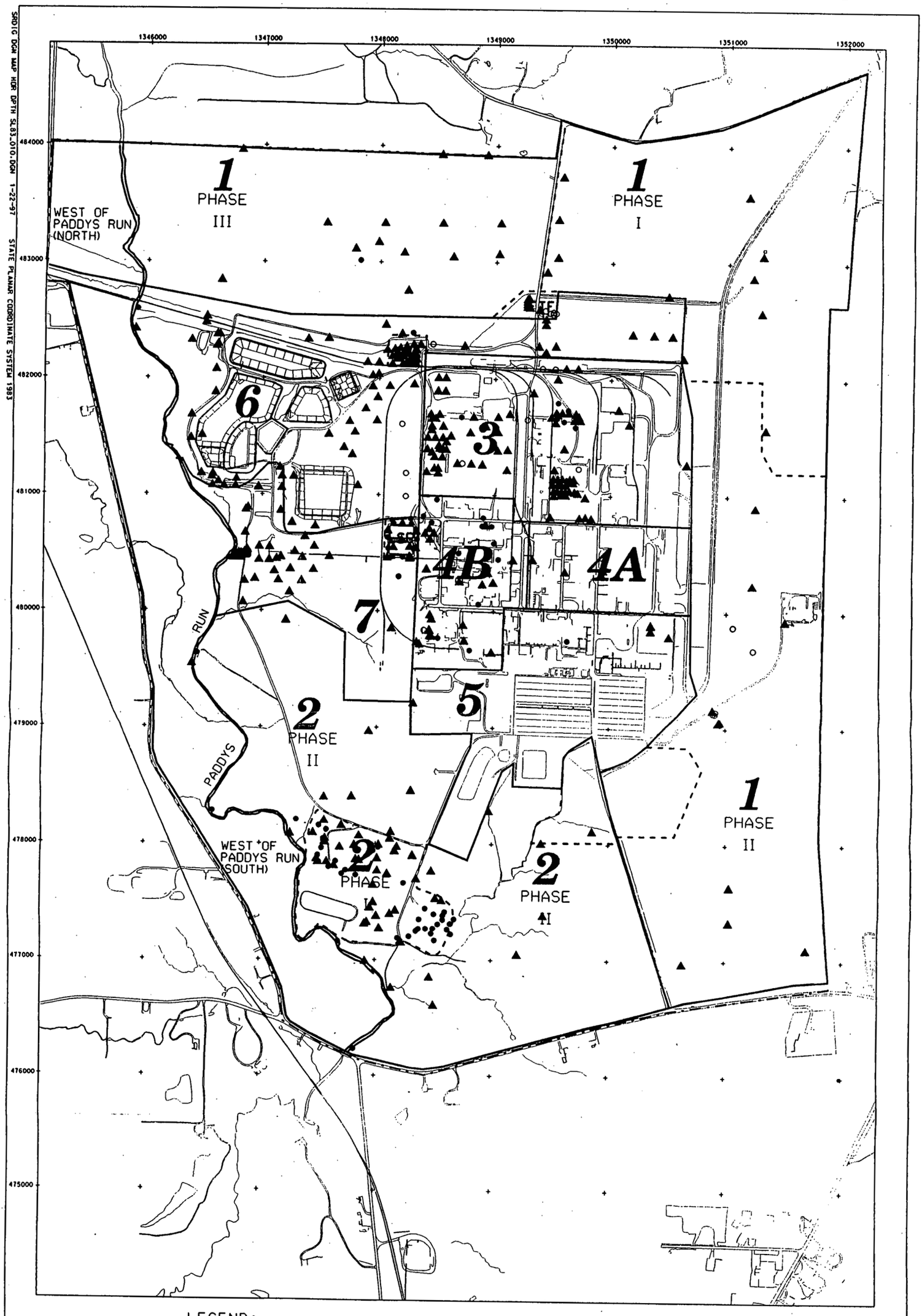



FIGURE I-11. SITEWIDE DISTRIBUTION OF BENZO(B)FLUORANTHENE BASED ON RI/FS DATA

SRDIG DGN MAP HDR OPTN SL83_018.DGN 1-22-97 STATE PLANAR COORDINATE SYSTEM 1983

000738

925



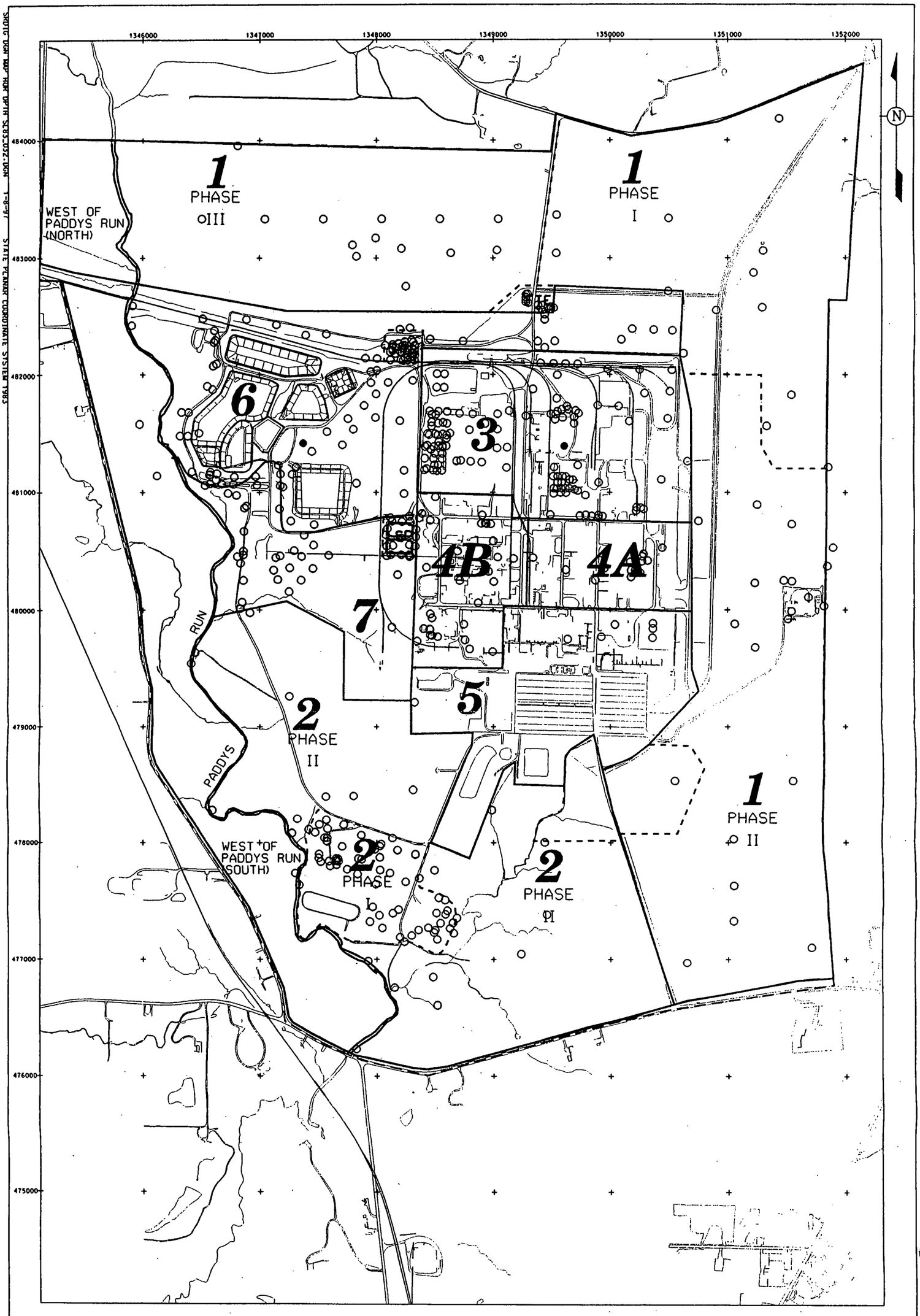

LEGEND:

- FEMP BOUNDARY
- EXCEEDS FRL
- NON DETECTED, BUT METHOD DETECTION LIMIT EXCEEDS THE FRL
- BELOW FRL
- REMEDIATION BOUNDARIES

SCALE

800 400 0 800 FEET

FIGURE I-12. SITEWIDE DISTRIBUTION OF BERYLLIUM BASED ON RI/FS DATA




LEGEND:

- FEMP BOUNDARY
- ● EXCEEDS WAC
- ○ NON DETECTED, BUT METHOD DETECTION LIMIT EXCEEDS THE WAC
- REMEDIATION BOUNDARIES

SCALE

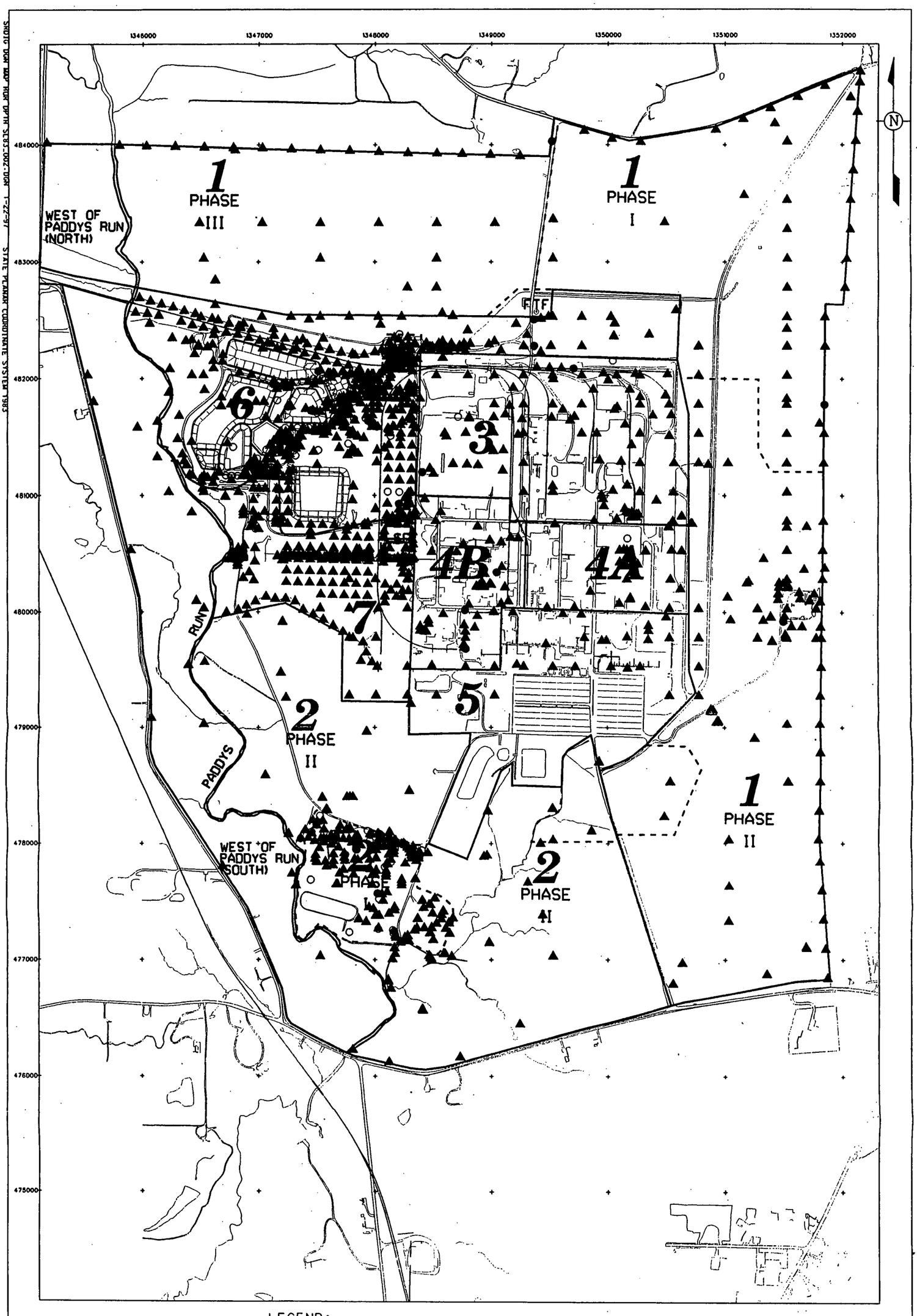
800 400 0 800 FEET

DRAFT

FIGURE I-13. SITEWIDE DISTRIBUTION OF BIS(2-CHLOROISOPROPYL) ETHER BASED ON RI/FS DATA

000740

925




LEGEND:

- FEMP BOUNDARY
- EXCEEDS FRL
- NON DETECTED, BUT METHOD DETECTION LIMIT EXCEEDS THE FRL
- BELOW FRL
- REMEDIATION BOUNDARIES

SCALE

800 400 0 800 FEET

DRAFT

FIGURE I-14. SITEWIDE DISTRIBUTION OF CESIUM-137 BASED ON RI/FS DATA

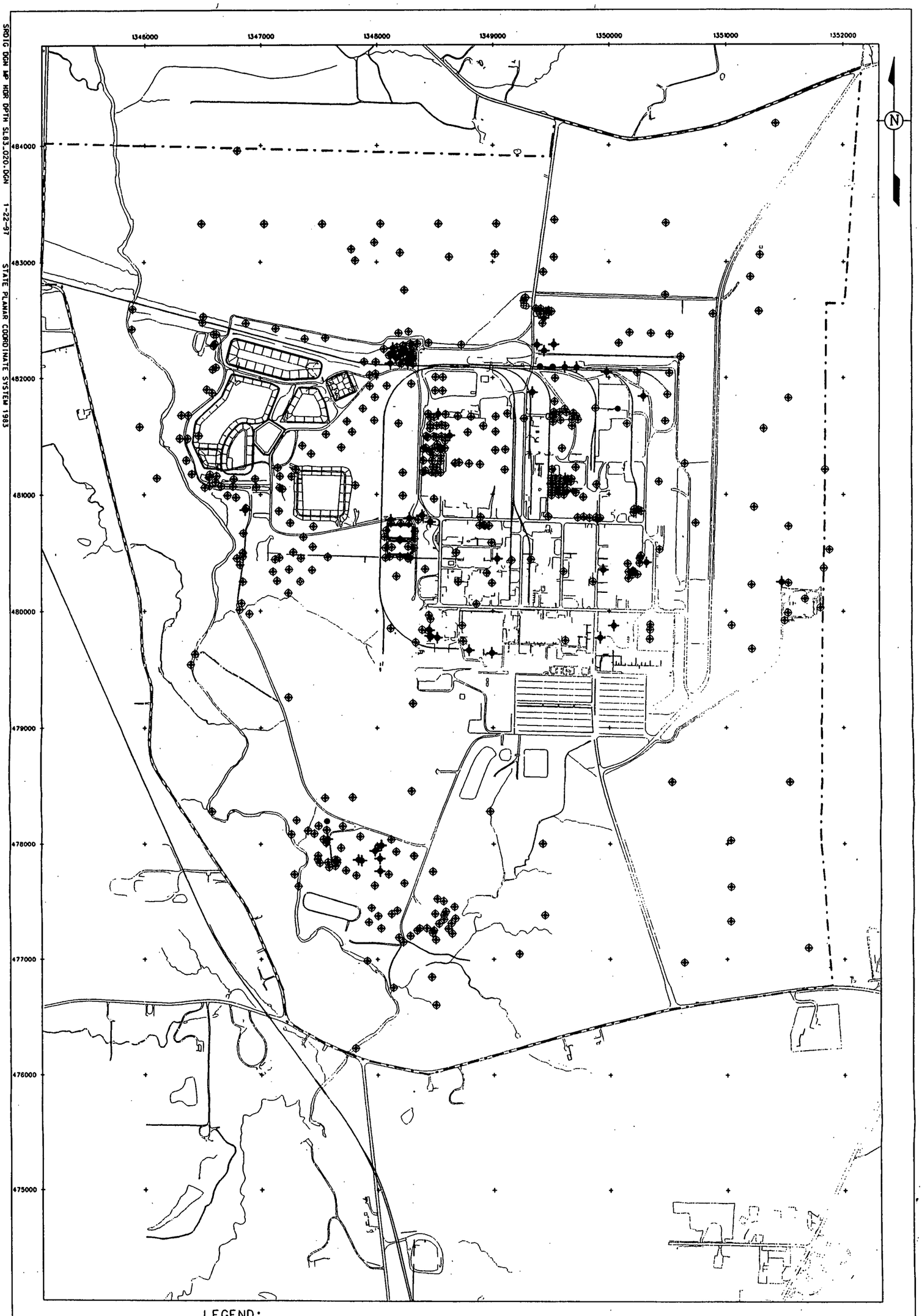



FIGURE I-15. SITEWIDE DISTRIBUTION OF DIBENZO(A,H)ANTHRACENE BASED ON RI/FS DATA



000742

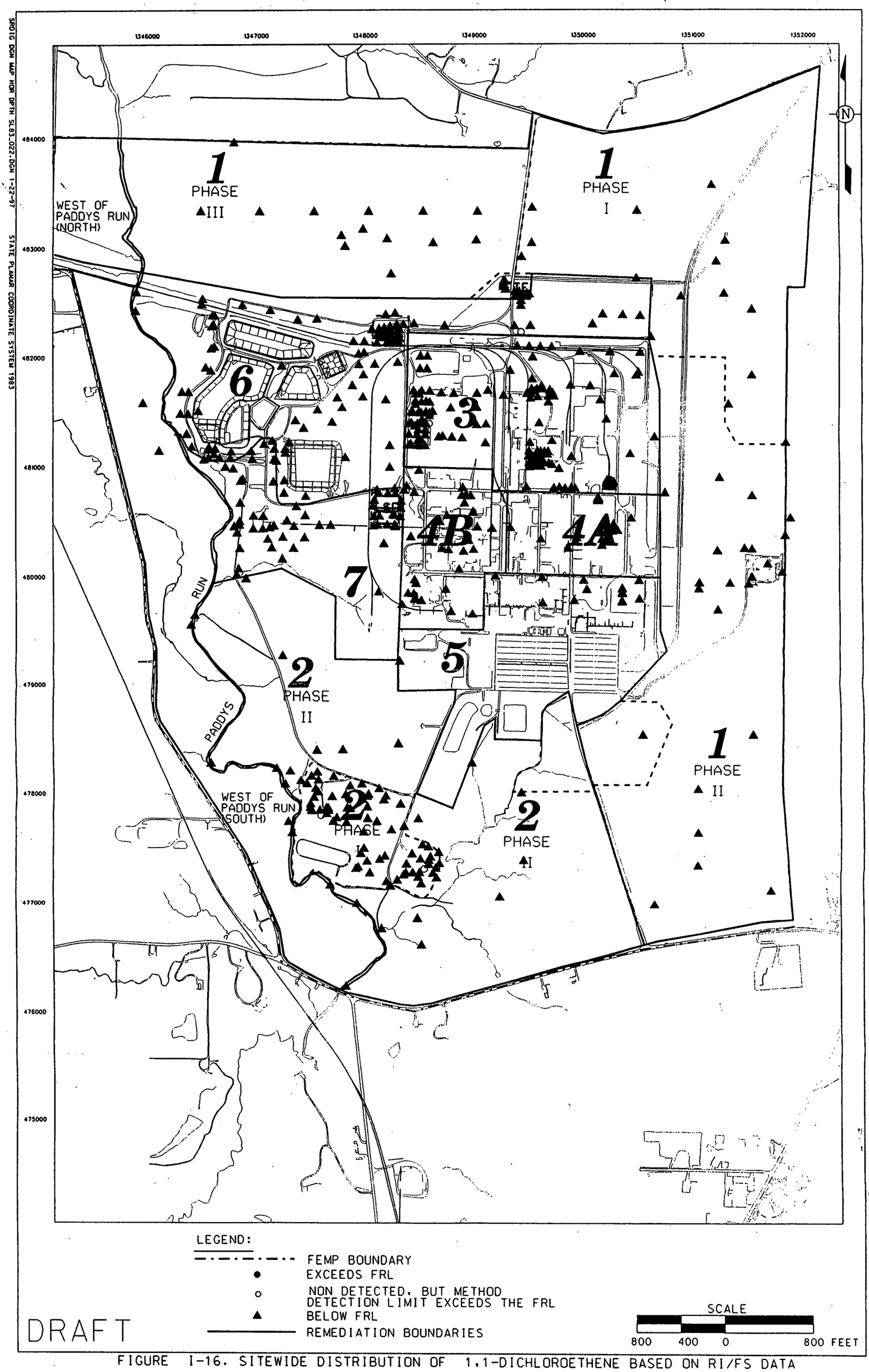
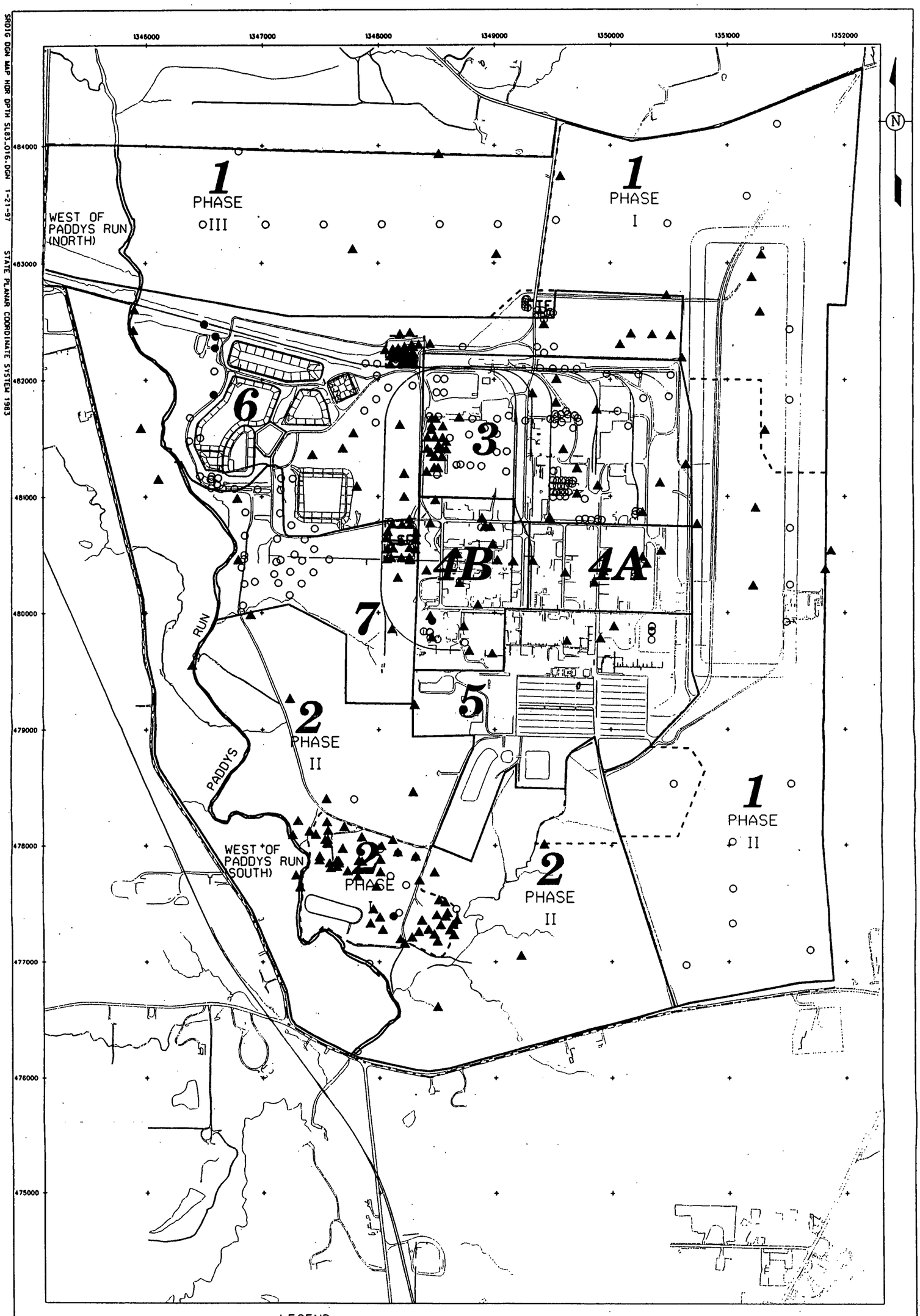



FIGURE I-16. SITEWIDE DISTRIBUTION OF 1,1-DICHLOROETHENE BASED ON RI/FS DATA



000743




LEGEND:

- FEMP BOUNDARY
- ● EXCEEDS FRL
- ○ NON DETECTED, BUT METHOD DETECTION LIMIT EXCEEDS THE FRL
- ▲ BELOW FRL
- REMEDIATION BOUNDARIES

SCALE

800 400 0 800 FEET

DRAFT

FIGURE I-17. SITEWIDE DISTRIBUTION OF DIELDRIN BASED ON RI/FS DATA

SRDIG DGN MAP HDR DPTH SL83_016.DGN 1-21-97 STATE PLANAR COORDINATE SYSTEM 1983

000744

FE 995

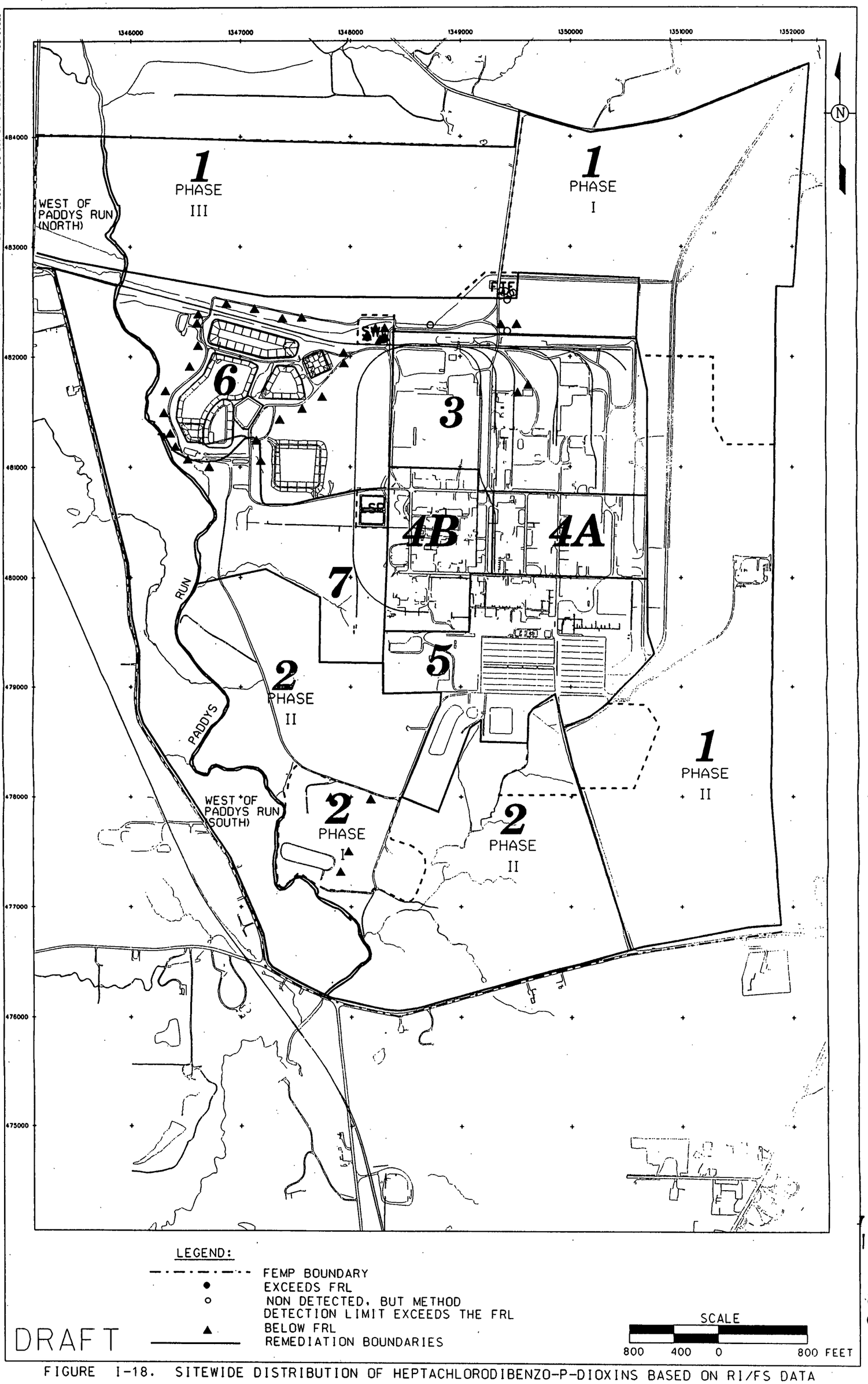



FIGURE I-18. SITEWIDE DISTRIBUTION OF HEPTACHLORODIBENZO-P-DIOXINS BASED ON RI/FS DATA

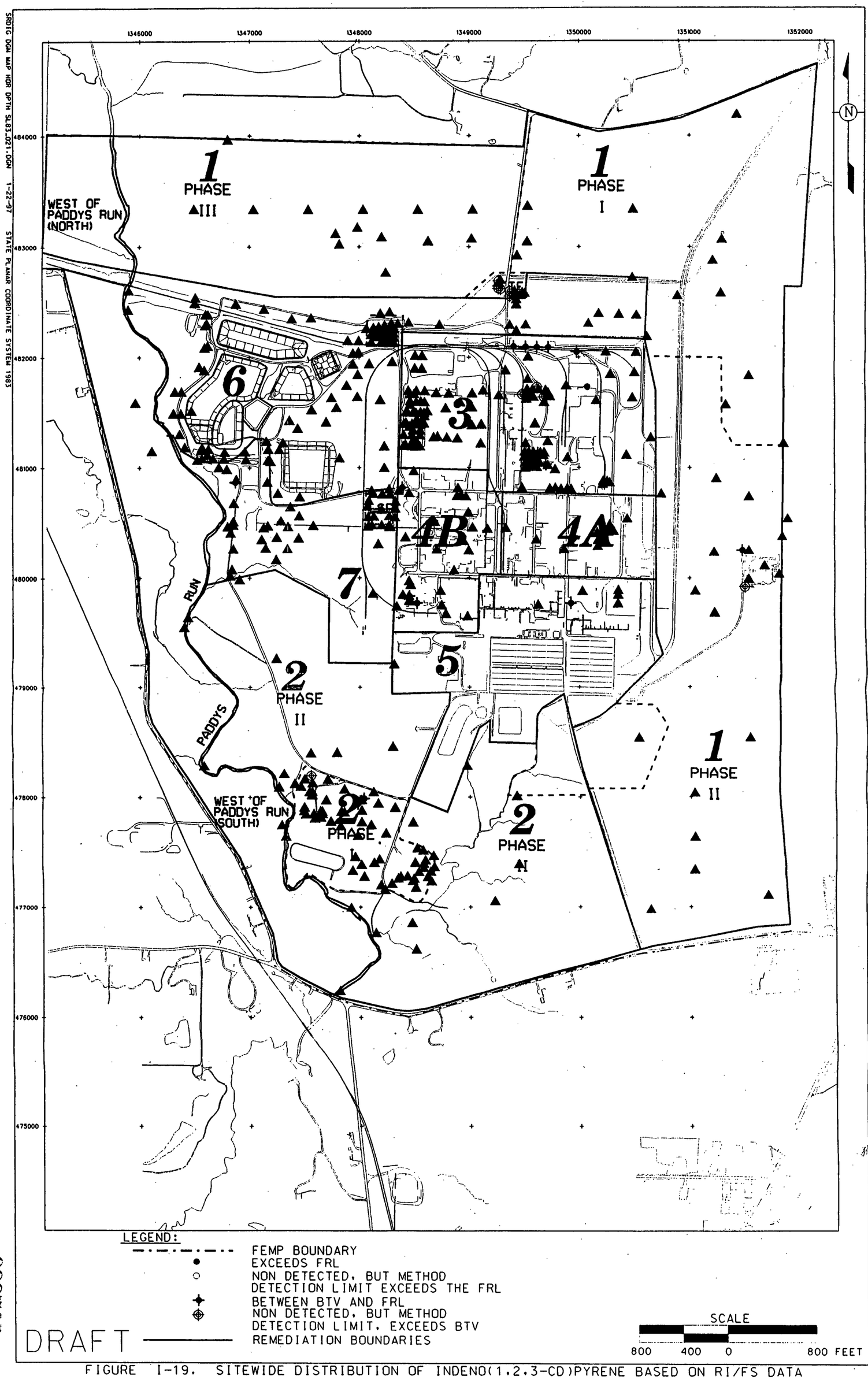



FIGURE I-19. SITEWIDE DISTRIBUTION OF INDENO(1,2,3-CD)PYRENE BASED ON RI/FS DATA

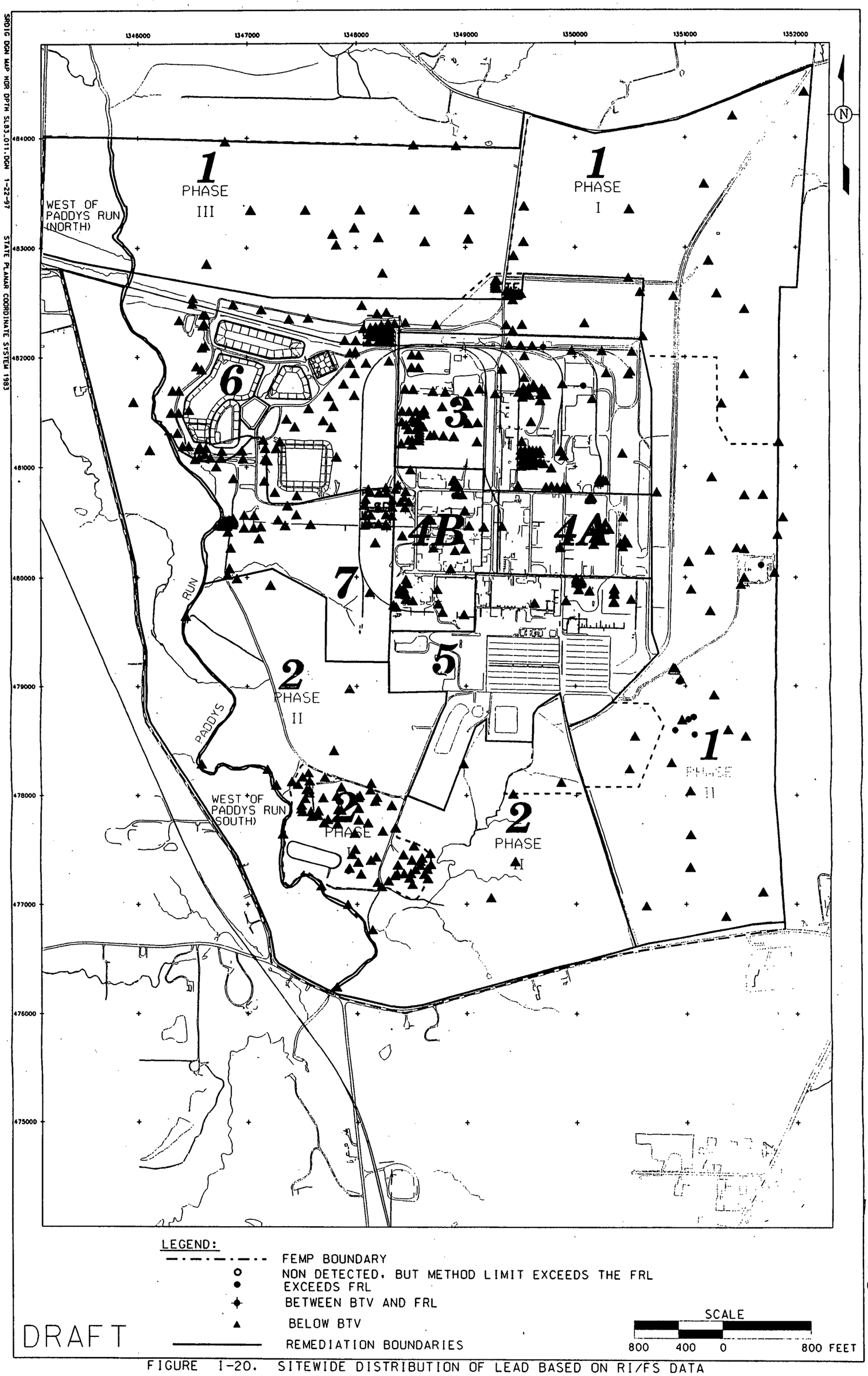



FIGURE I-20. SITEWIDE DISTRIBUTION OF LEAD BASED ON RI/FS DATA



000743

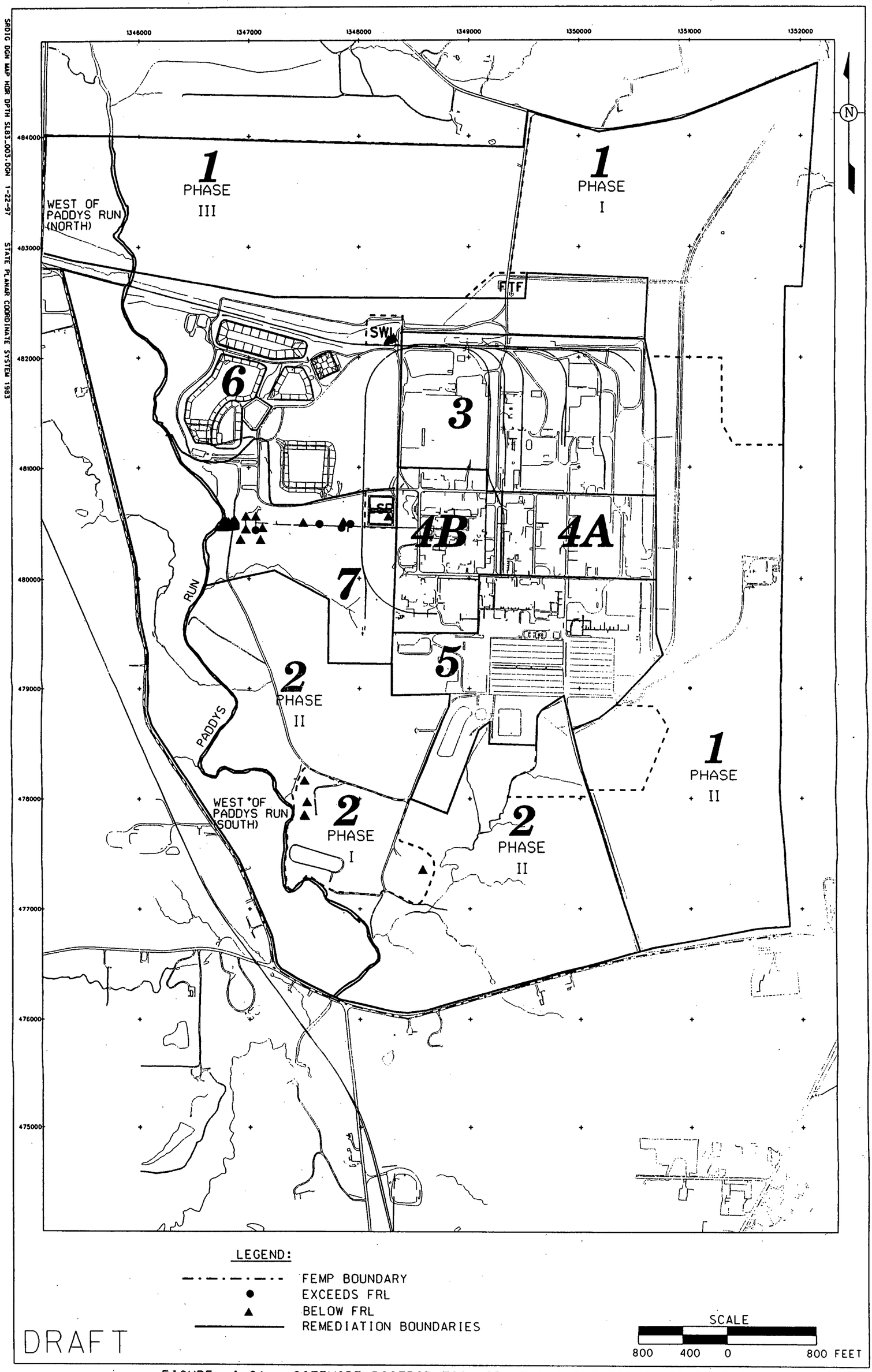
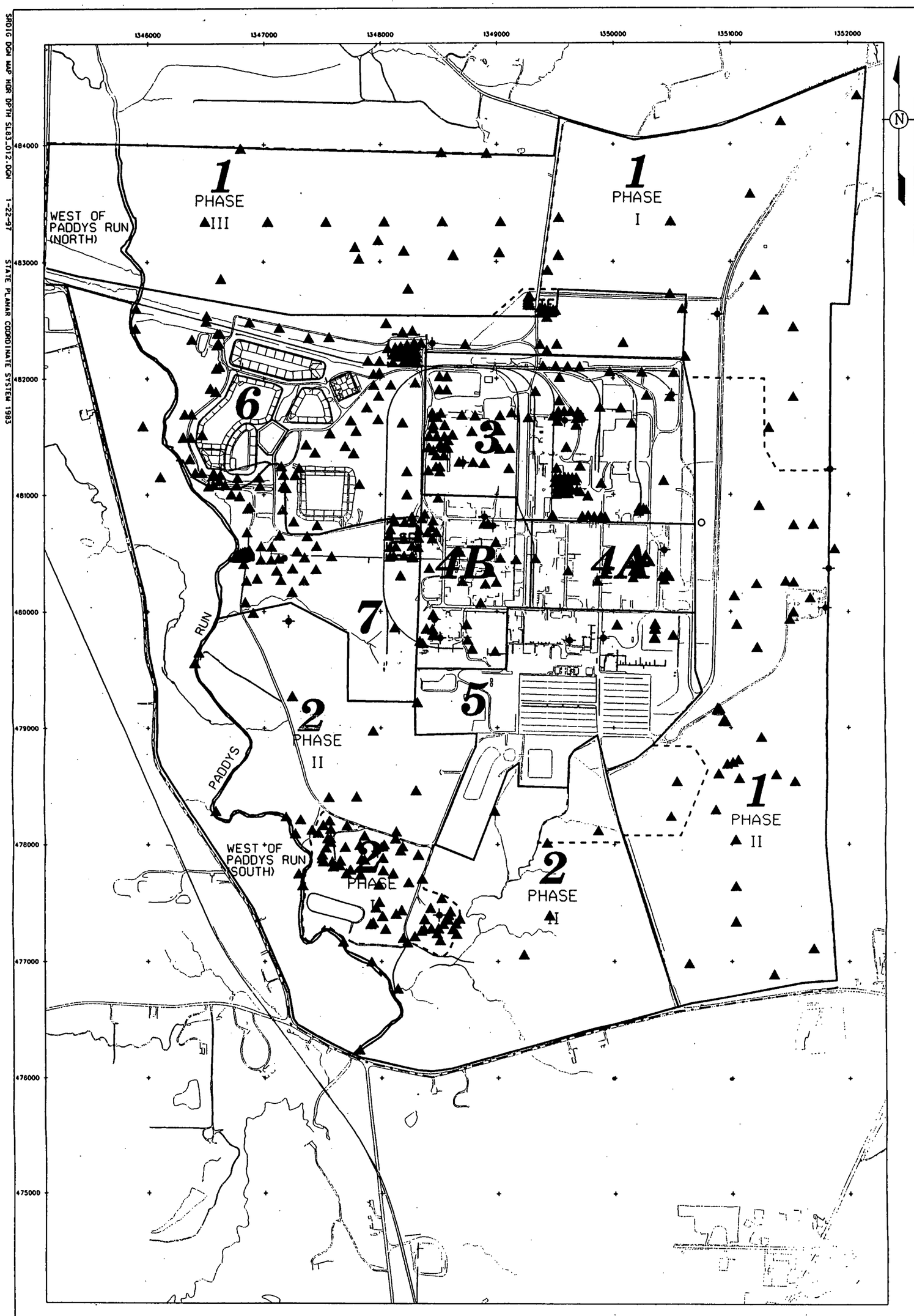



FIGURE I-21. SITEWIDE DISTRIBUTION OF LEAD-210 BASED ON RI/FS DATA




LEGEND:

- FEMP BOUNDARY
- EXCEEDS FRL
- BETWEEN BTV AND FRL
- BELOW BTV
- REMEDIATION BOUNDARIES

SCALE

800 400 0 800 FEET

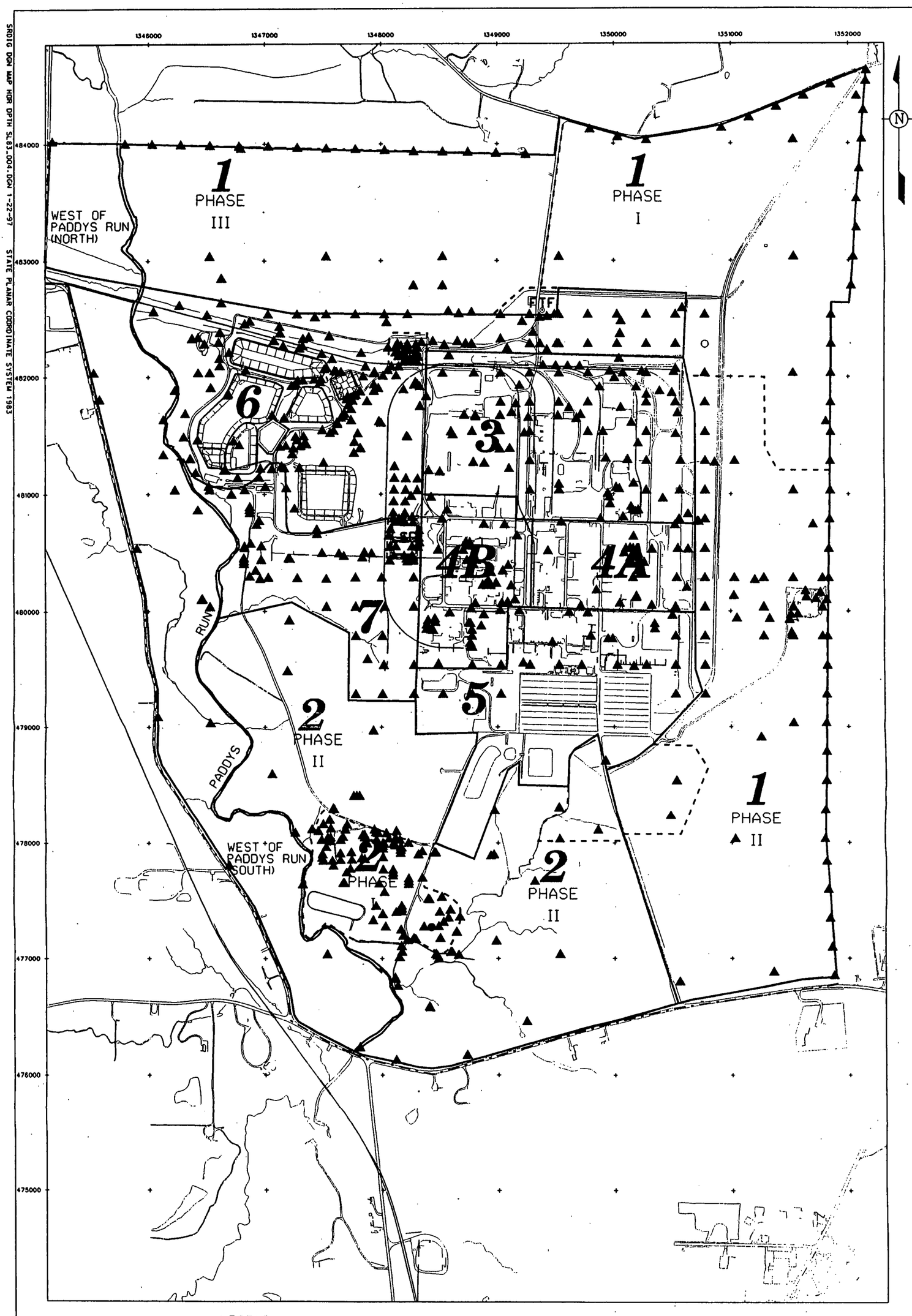
DRAFT

FIGURE I-22. SITEWIDE DISTRIBUTION OF MANGANESE BASED ON RI/FS DATA

SR01G DGN MAP HDR DPTH SL83_012.DGN 1-22-97 STATE PLANAR COORDINATE SYSTEM 1983

000749

925




LEGEND:

- FEMP BOUNDARY
- ● EXCEEDS FRL
- ○ NON DETECTED, BUT METHOD DETECTION LIMIT EXCEEDS THE FRL
- ▲ BELOW FRL
- REMEDIATION BOUNDARIES

SCALE

800 400 0 800 FEET

DRAFT

FIGURE I-23. SITEWIDE DISTRIBUTION OF NEPTUNIUM-237 BASED ON RI/FS DATA

SR01G DGN MAP HOR OPTN SL83.004.DGN 1-22-97 STATE PLANAR COORDINATE SYSTEM 1983

000250

925

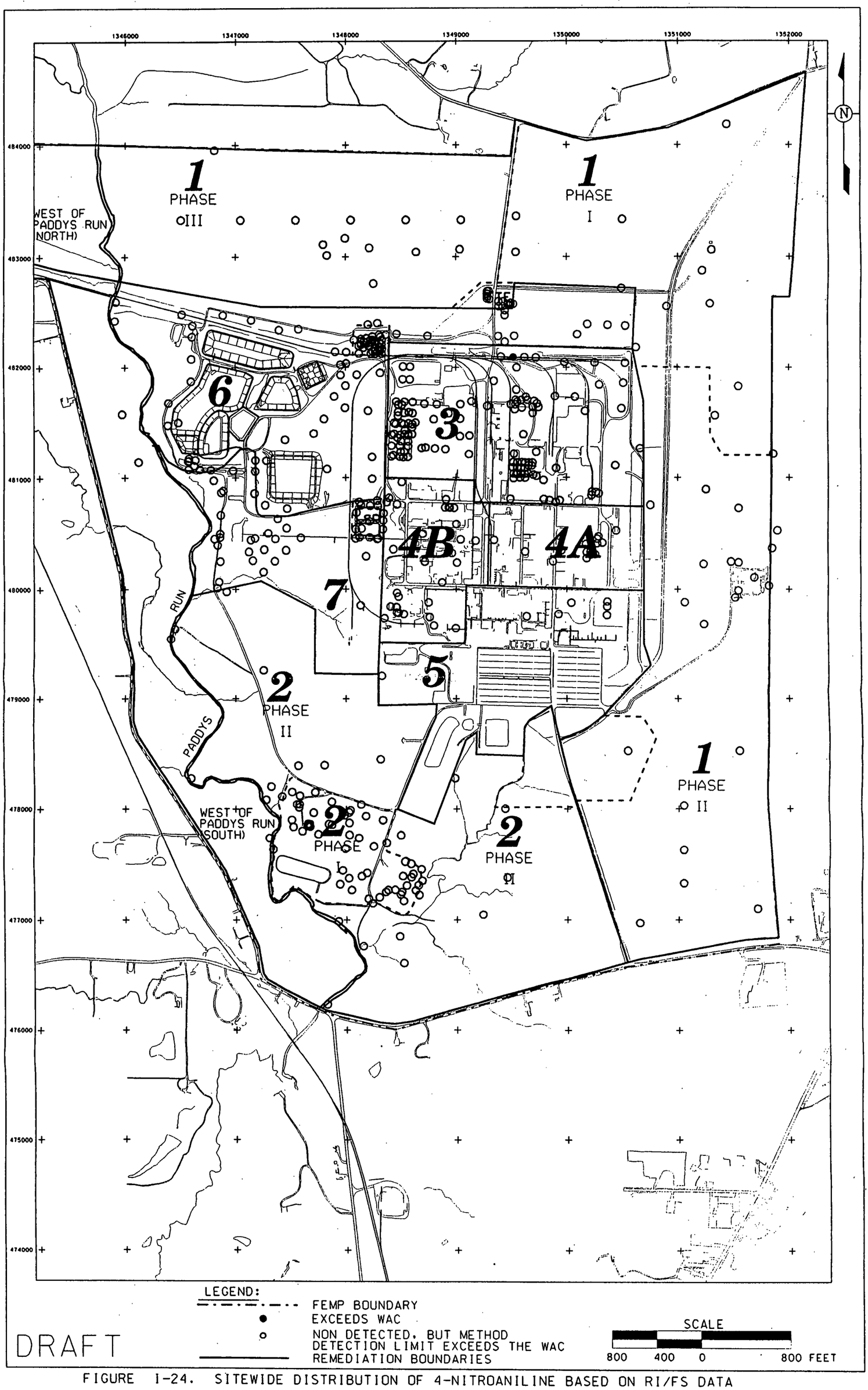



FIGURE I-24. SITEWIDE DISTRIBUTION OF 4-NITROANILINE BASED ON RI/FS DATA

SR01G DGN MAP NOR OPTN SL83_034.DGN 1-22-97 STATE PLANAR COORDINATE SYSTEM 1983

000751

925

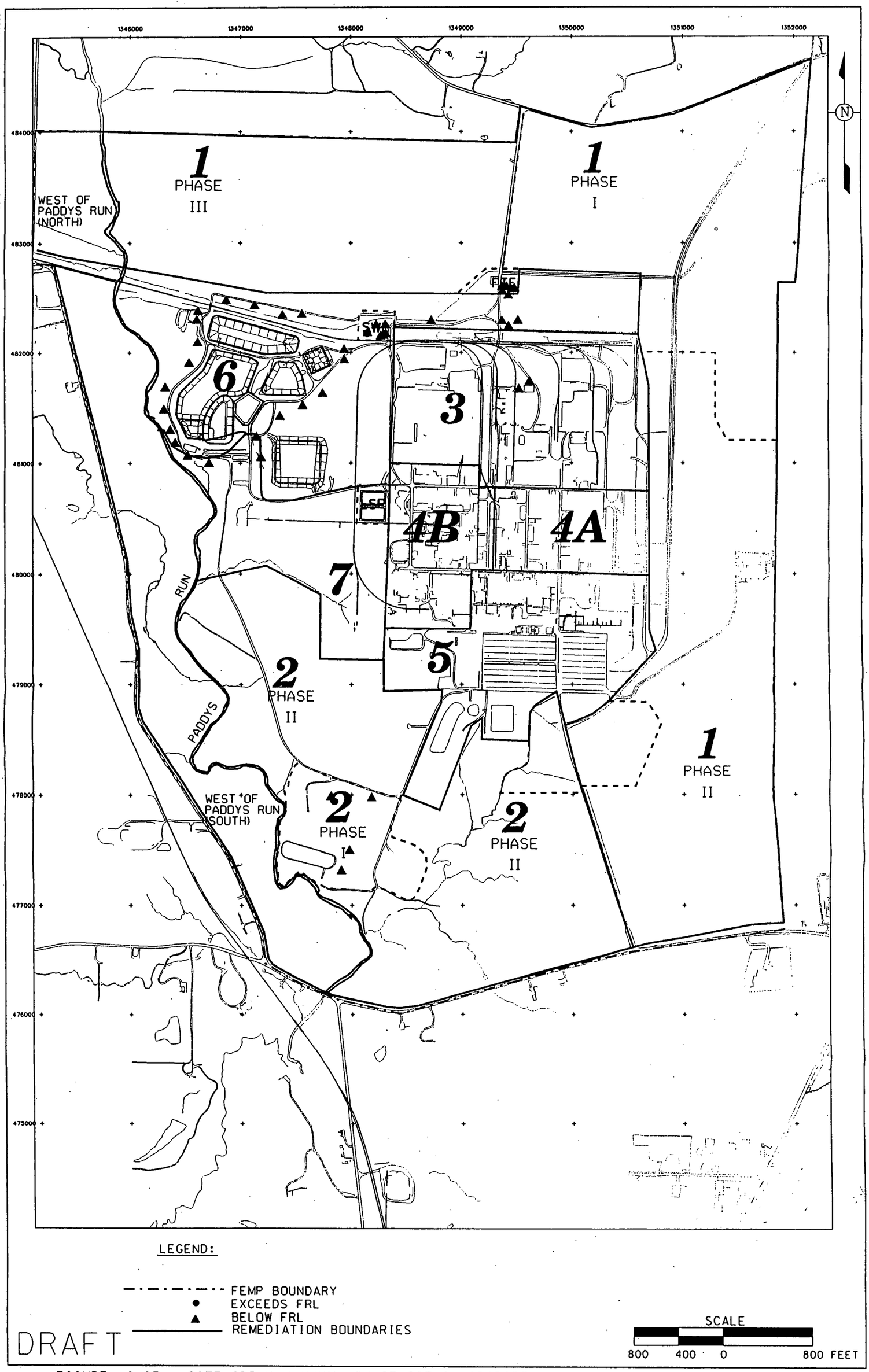
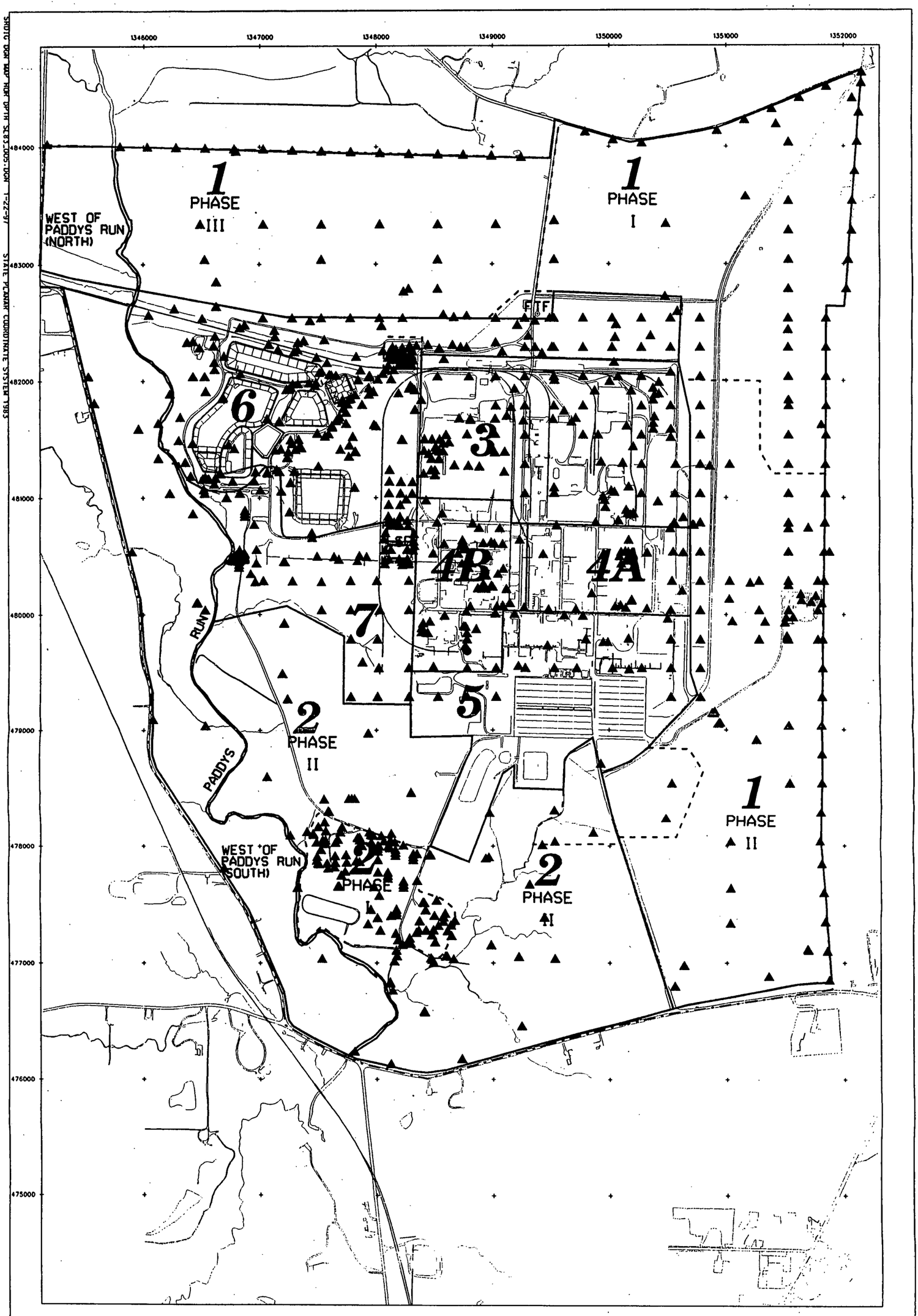



FIGURE I-25. SITEWIDE DISTRIBUTION OF OCTACHLORODIBENZO-P-DIOXIN BASED ON RI/FS DATA

SR01G DGN MAP HOR DPTH SL83-026.DGN 1-8-97 STATE PLANAR COORDINATE SYSTEM 1983




LEGEND:

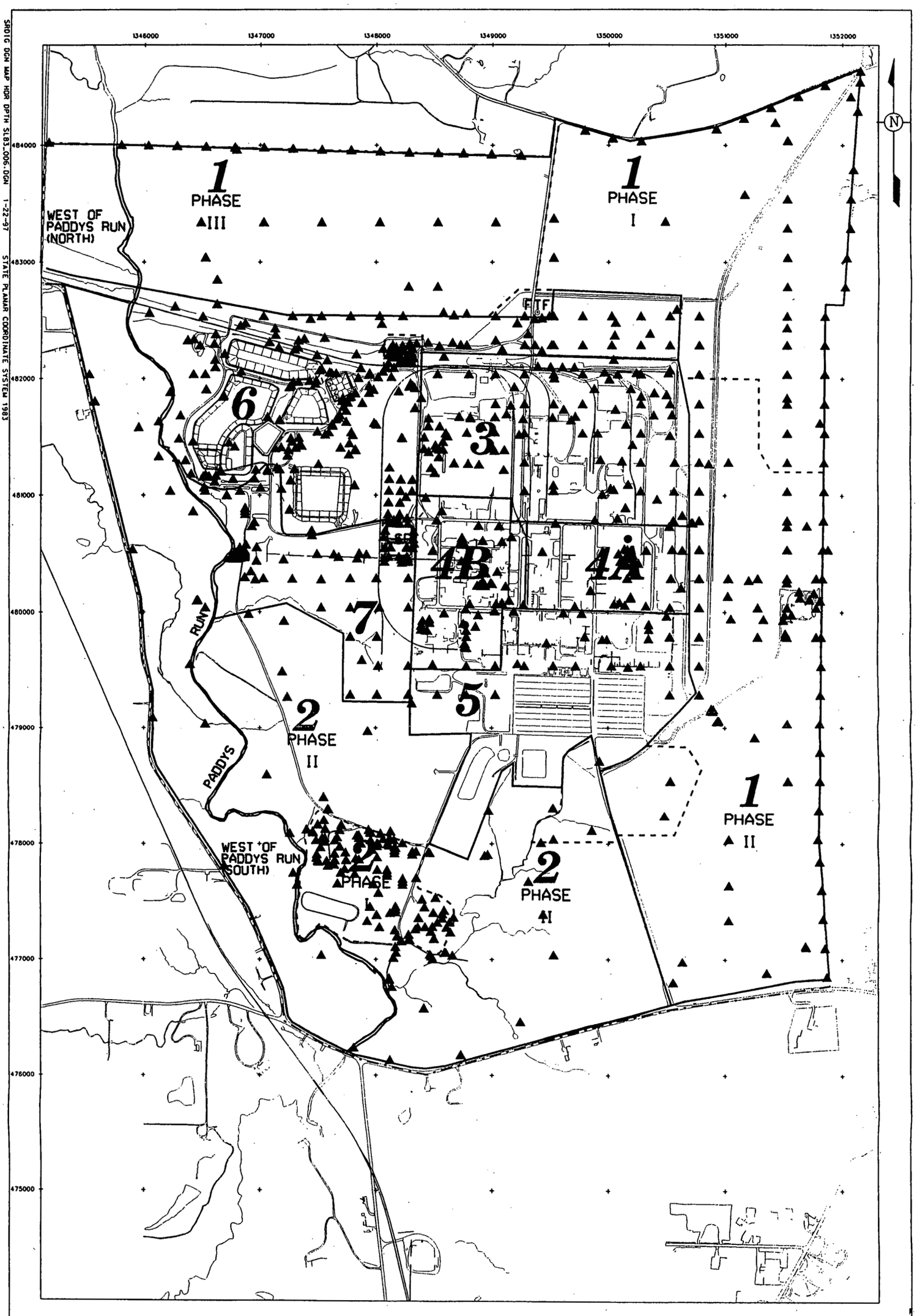
- FEMP BOUNDARY
- EXCEEDS FRL
- BELOW FRL
- REMEDIATION BOUNDARIES

SCALE

800 400 0 800 FEET

DRAFT

FIGURE I-26. SITEWIDE DISTRIBUTION OF PLUTONIUM-238 BASED ON RI/FS DATA




LEGEND:

- FEMP BOUNDARY
- EXCEEDS FRL
- BELOW FRL
- REMEDIATION BOUNDARIES

SCALE

800 400 0 800 FEET

DRAFT

FIGURE I-27. SITEWIDE DISTRIBUTION OF STRONTIUM-90 BASED ON RI/FS DATA

000754

923

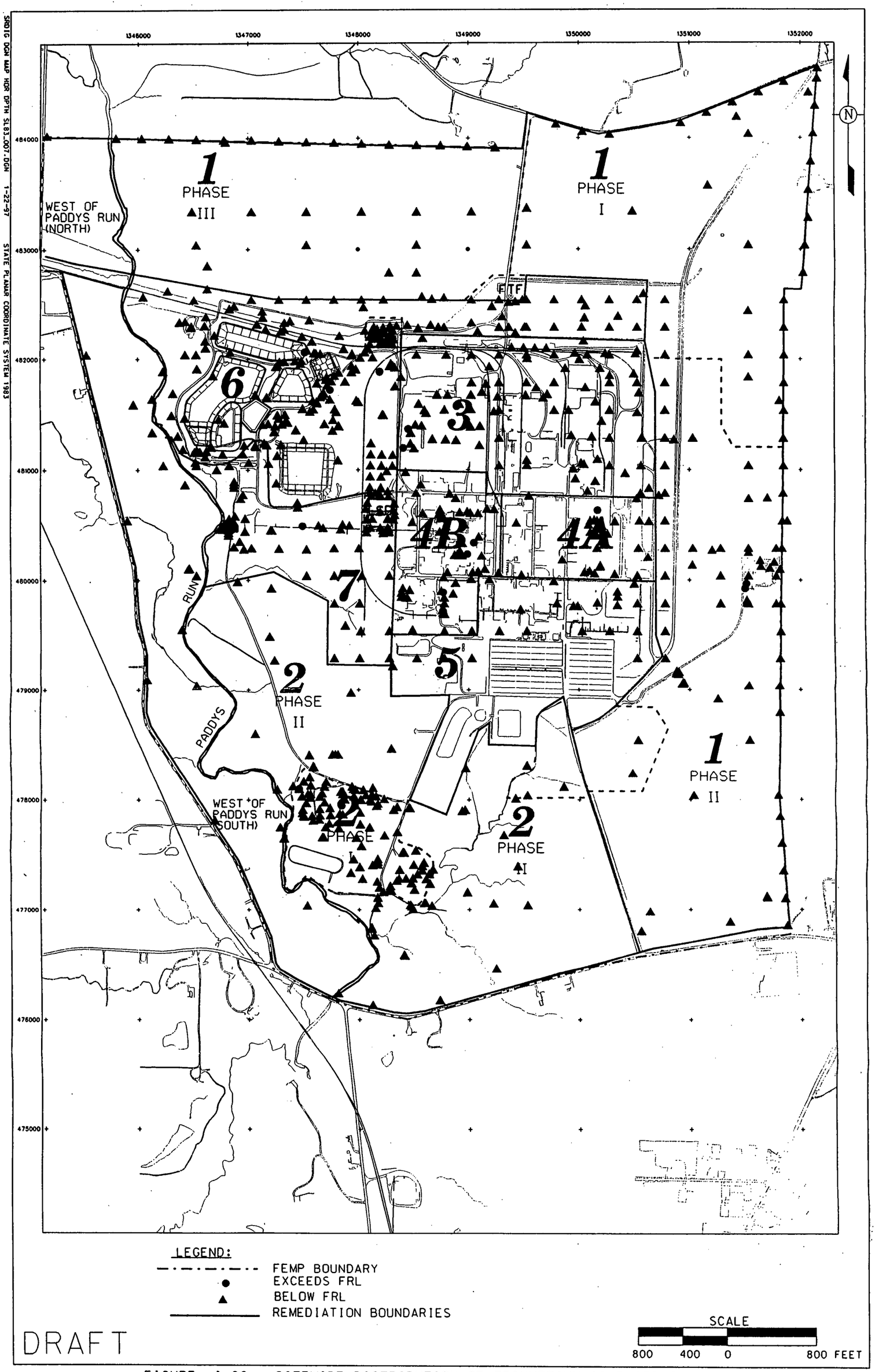
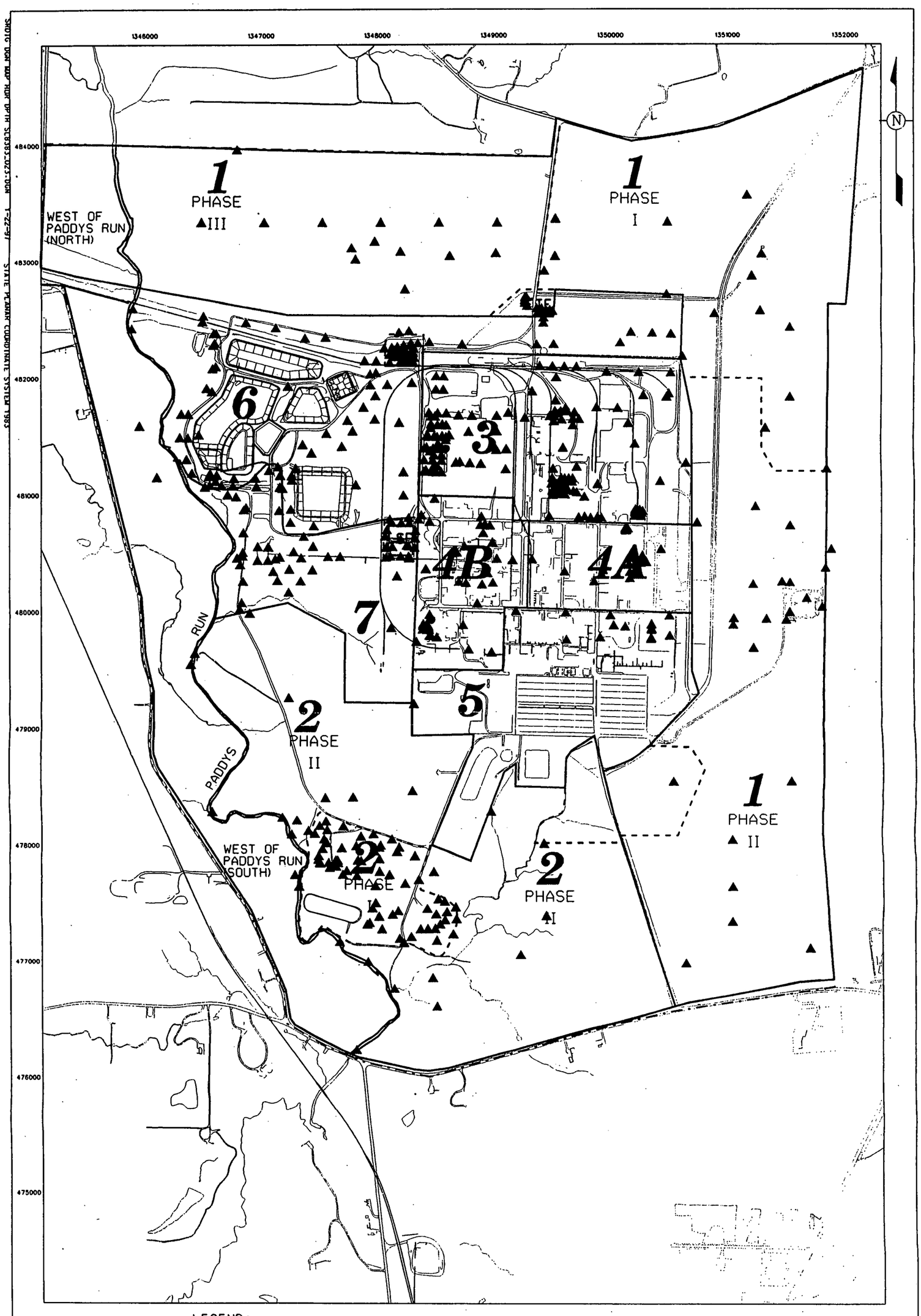



FIGURE I-28. SITEWIDE DISTRIBUTION OF TECHNETIUM-99 BASED ON RI/FS DATA




LEGEND:

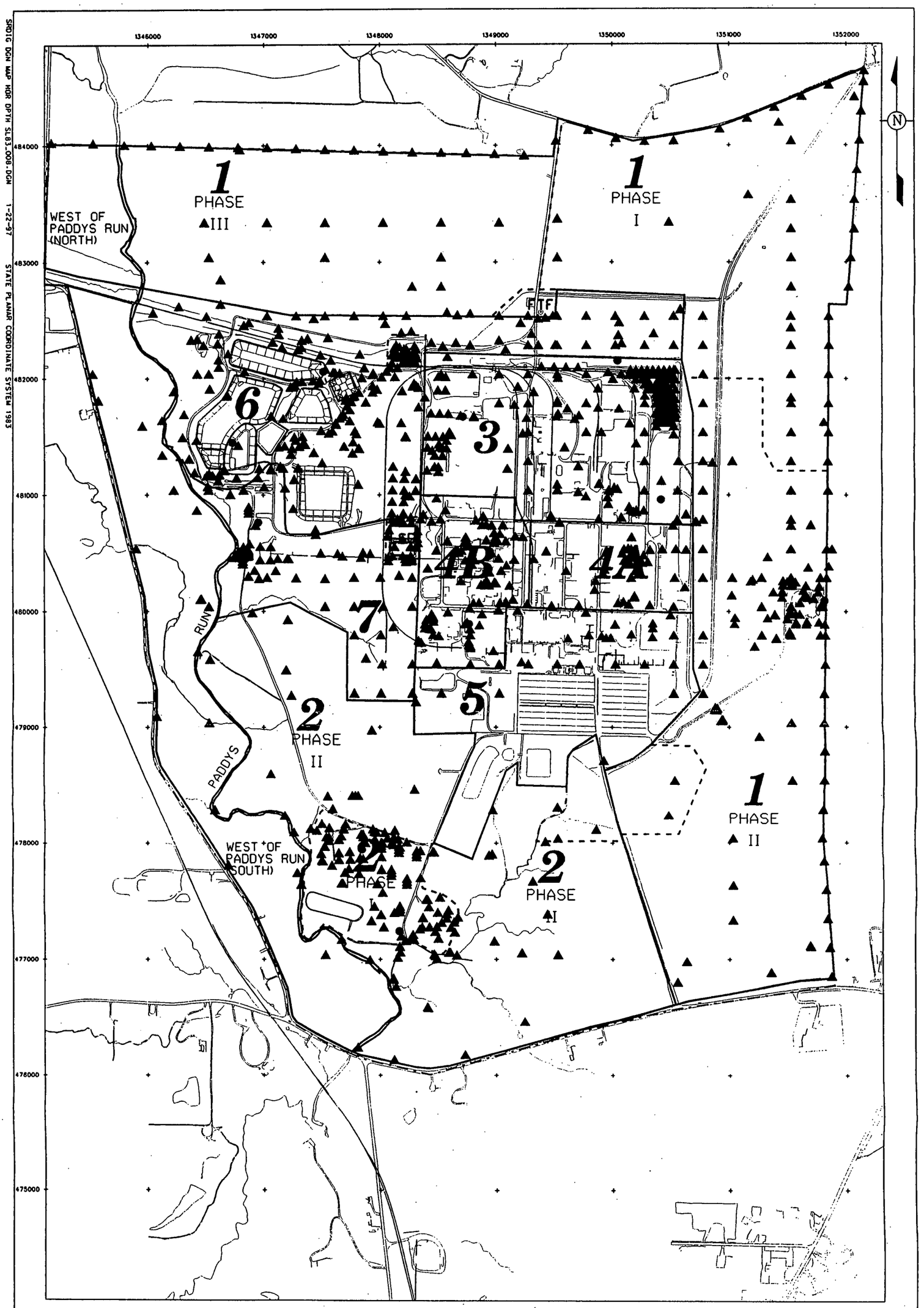
- FEMP BOUNDARY
- ● EXCEEDS FRL
- ○ NON DETECTED, BUT METHOD DETECTION LIMIT EXCEEDS THE FRL
- ▲ BELOW FRL
- REMEDIATION BOUNDARIES

SCALE

800 400 0 800 FEET

DRAFT

FIGURE I-29. SITEWIDE DISTRIBUTION OF TETRACHLOROETHENE BASED ON RI/FS DATA




LEGEND:

- FEMP BOUNDARY
- EXCEEDS FRL
- BELOW FRL
- REMEDIATION BOUNDARIES

SCALE

800 400 0 800 FEET

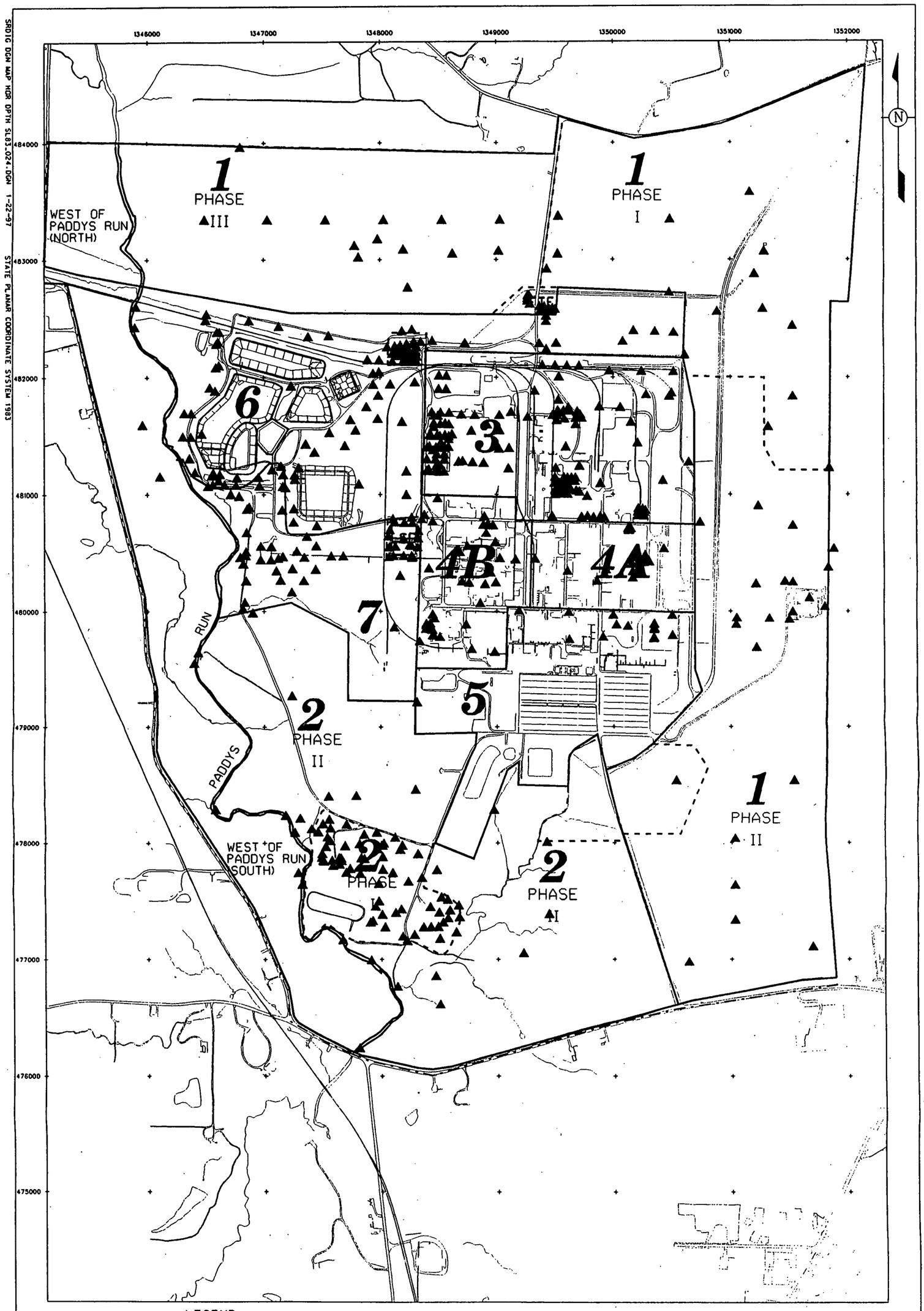
DRAFT

FIGURE I-30. SITEWIDE DISTRIBUTION OF THORIUM-230 BASED ON RI/FS DATA

SRDIG DGN MAP HOR DPTH SL83-008.DGN 1-22-97 STATE PLANAR COORDINATE SYSTEM 1983

000752

925




LEGEND:

- FEMP BOUNDARY
- EXCEEDS FRL
- BELOW FRL
- REMEDIATION BOUNDARIES

SCALE

800 400 0 800 FEET

DRAFT

FIGURE I-31. SITEWIDE DISTRIBUTION OF TRICHLOROETHENE BASED ON RI/FS DATA

SR01G DGN MAP HOR DPTH SL83.024.DGN 1-22-97 STATE PLANAR COORDINATE SYSTEM 1983

000758

925